Management of Arthropod Pests in Organic Strawberry

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Principle of organic agriculture:

Diversity increases stability

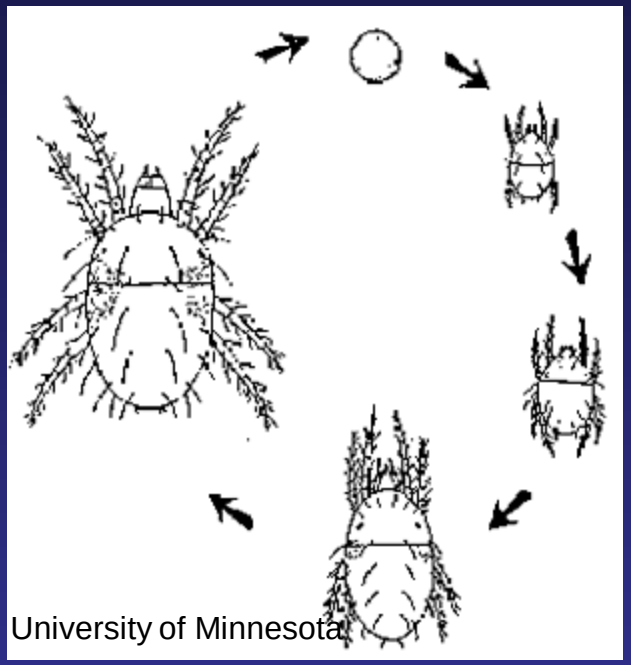
- Is crop diversity important for pest suppression in organic strawberry?
- Can we use crop combinations to put strawberry pests at a disadvantage?
- Can we use insectary plants to enhance biological control of pests in organic strawberry?

Strawberry pests

- twospotted spider mite, strawberry cyclamen mite
- Lygus
- corn earworm, beet armyworm
- whiteflies
- thrips
- light brown apple moth

Twospotted spider mite,
Tetranychus urticae

Life cycle



Host range: many vegetable, field and tree crops

Factors favoring spider mites

- Dust
- Hot/Dry
- Wind

Importance of wind breaks, dust barriers.

→ Vigorous strawberry plants are better able to withstand mite damage.

Damage – spider mites puncture plant cells to drink sap.

INRA, France

Monitoring spider mites

Examine leaves in the middle of the plant, underside.

10 plants/acre in small fields; 5 plants/acre large fields.
Thresholds according to UC:

4-5 months after transplanting: average of 5 mites/leaf
Summer transplants: average 10 mites/leaf

60% *Persimilis?*

Carmine spider mite – rarely causes damage

Predatory mite *Persimilis* (right)

Predatory mite *Galendromus*

Suppliers of mite predators:

- **Biotactics**
- **Rincon Vitova**
- **Syngenta**
- **Kuida Ag (distributors)**

Others…

Rates? Thousands per acre…

Frequency?

There are many approaches to managing spider mites with predatory mites.

Different predatory mites have different characteristics:

best for strawberry?

Other predators

Good Bug Blend for mite management?

Organic acaricides:

Rosemary oil (no residual)

Organic stylet oils

Efficacy?

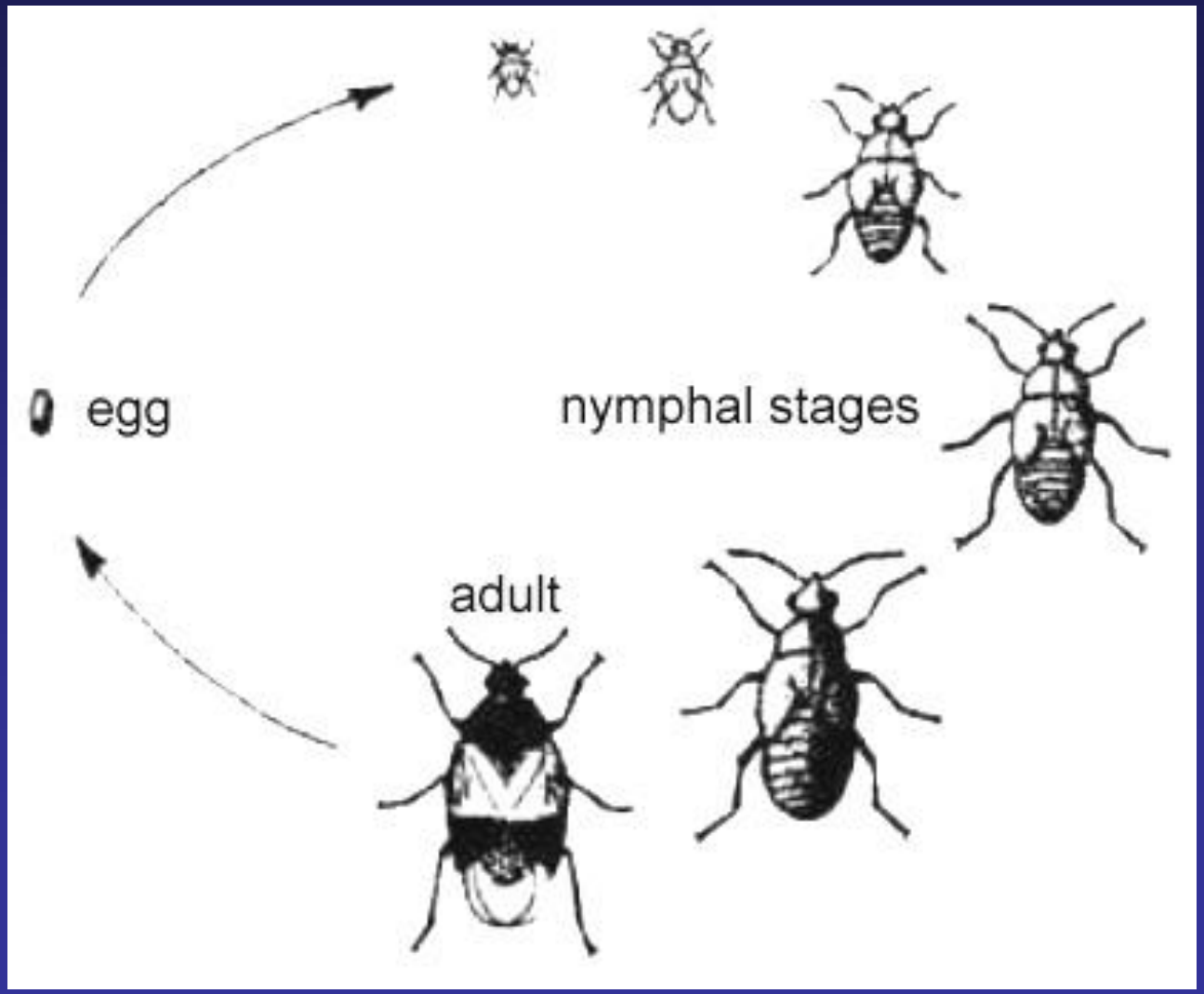
Lygus

(*Lygus hesperus*)

Courtesy Frank Zalom

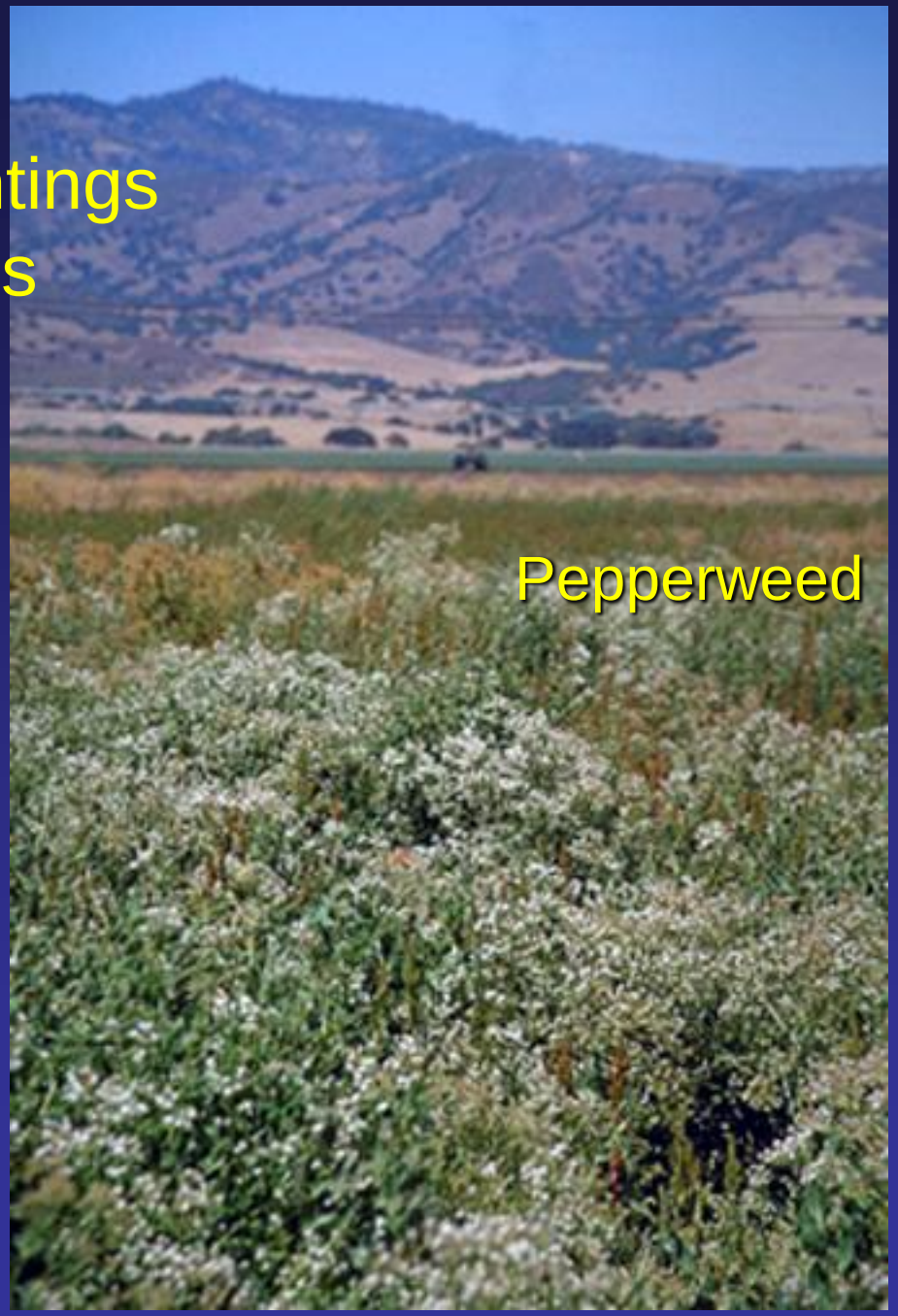
Lygus

Incomplete metamorphosis



Lygus Sources

- Infested second year plantings
- Weedy hosts around fields
- Alternate host crops



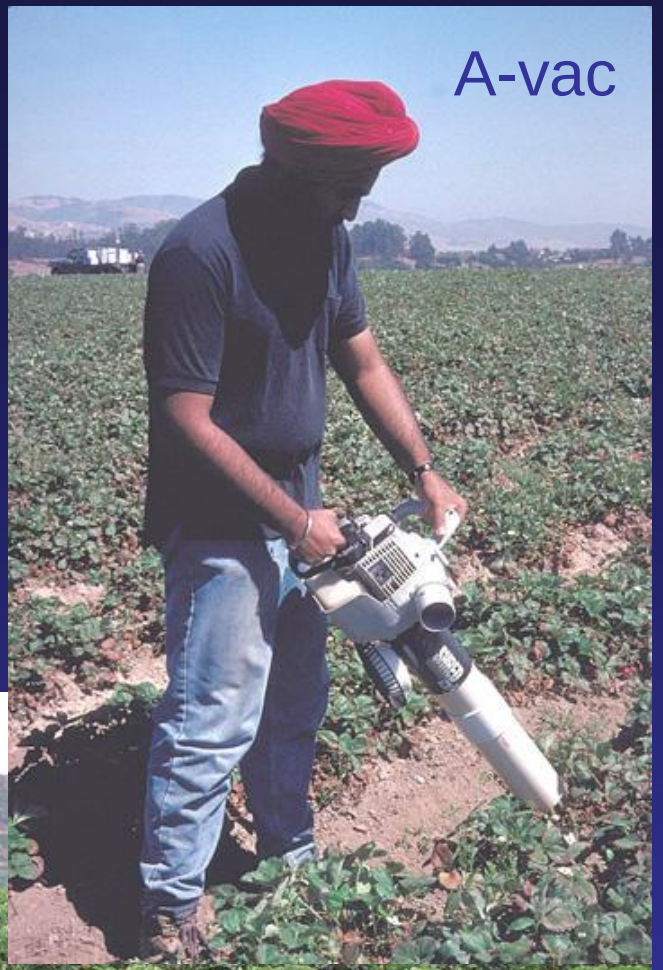
Courtesy Frank Zalom

Monitoring guidelines

Sweep net - for weeds, trap crops, and other crops

Beating hoop or tray - strawberries

A-vac (or other suction devices) - strawberries



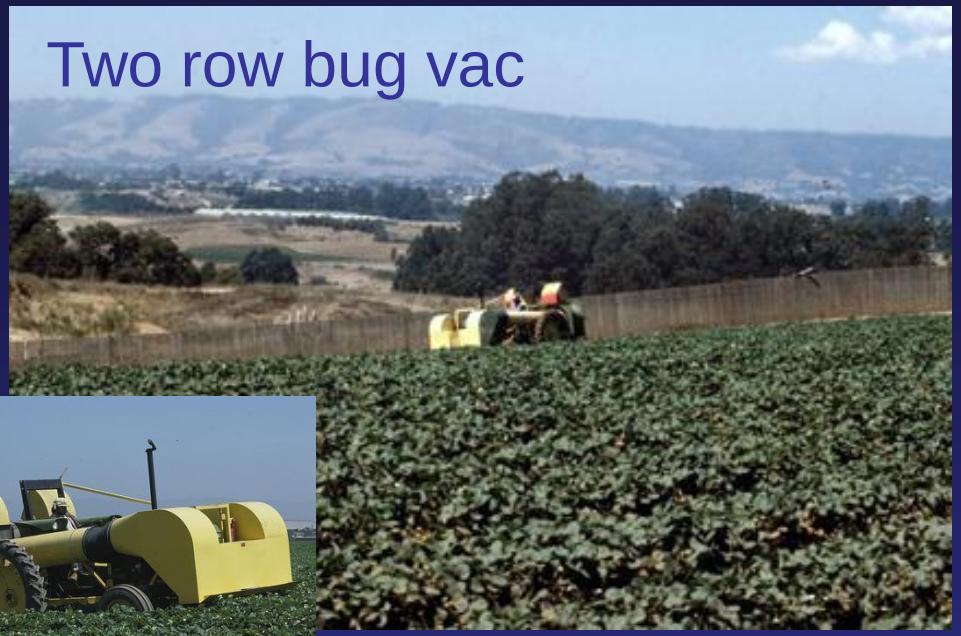
Courtesy Frank Zalom

Alfalfa Interplants in Cotton - Studied since the late 1960s

Courtesy Frank Zalom

Bug Vacs

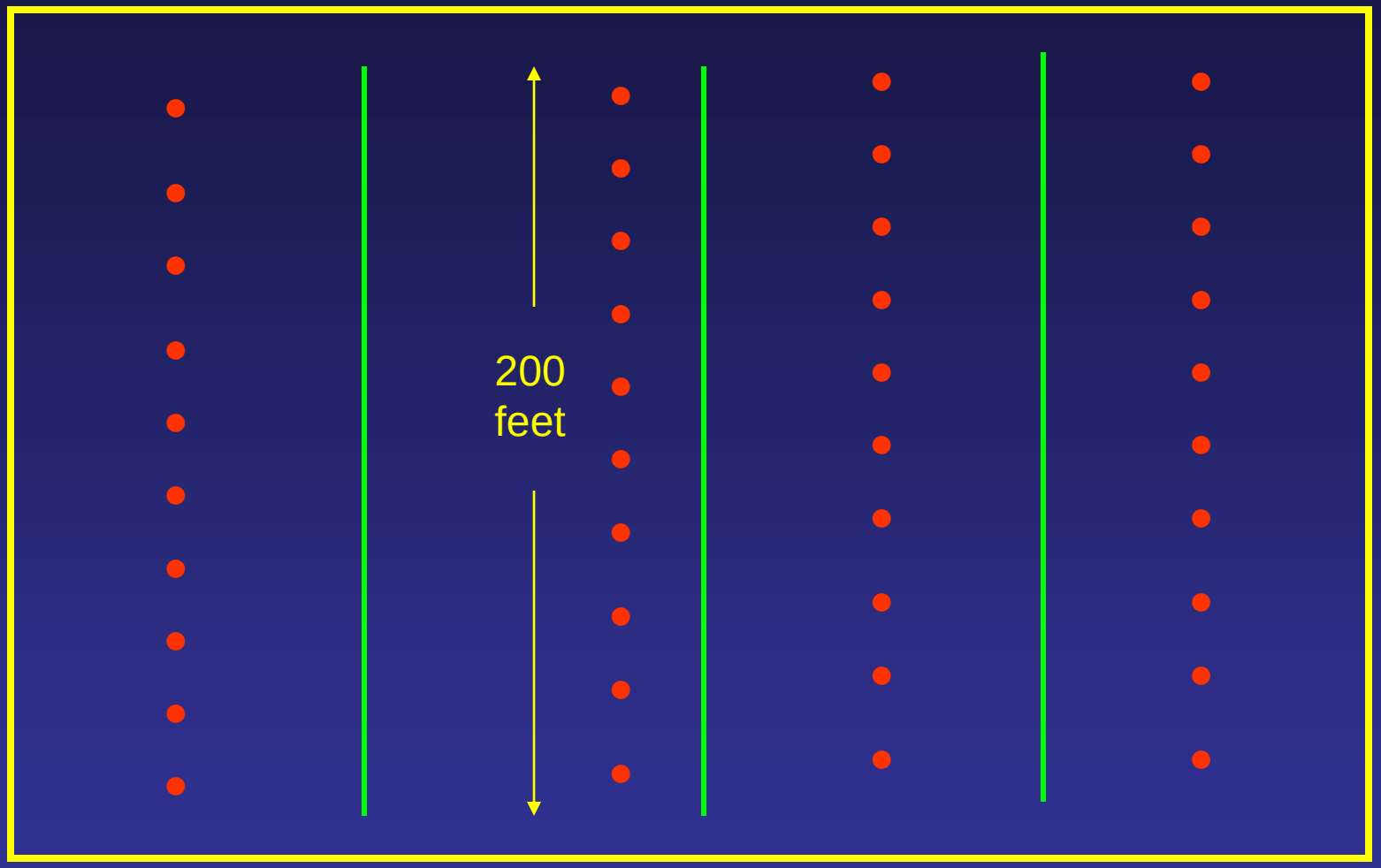
Courtesy Frank Zalom



Swezey et al. 2007. Environmental Entomology

- **3 year Lygus study**
- **Twice-weekly vacuuming of alfalfa trap crop in strawberry**
- **Adults reduced by 72%**
- **Nymphs reduced by 90%**
- **Less damage**
- **Cheaper than vacuuming entire field**

Sampling Lygus in Strawberry, UC Management Guidelines



UC threshold: 1 nymph/10 plants (beating)

Degree Days: combining scouting and temperature information to predict Lygus development

Lower temperature threshold for Lygus: 54° F

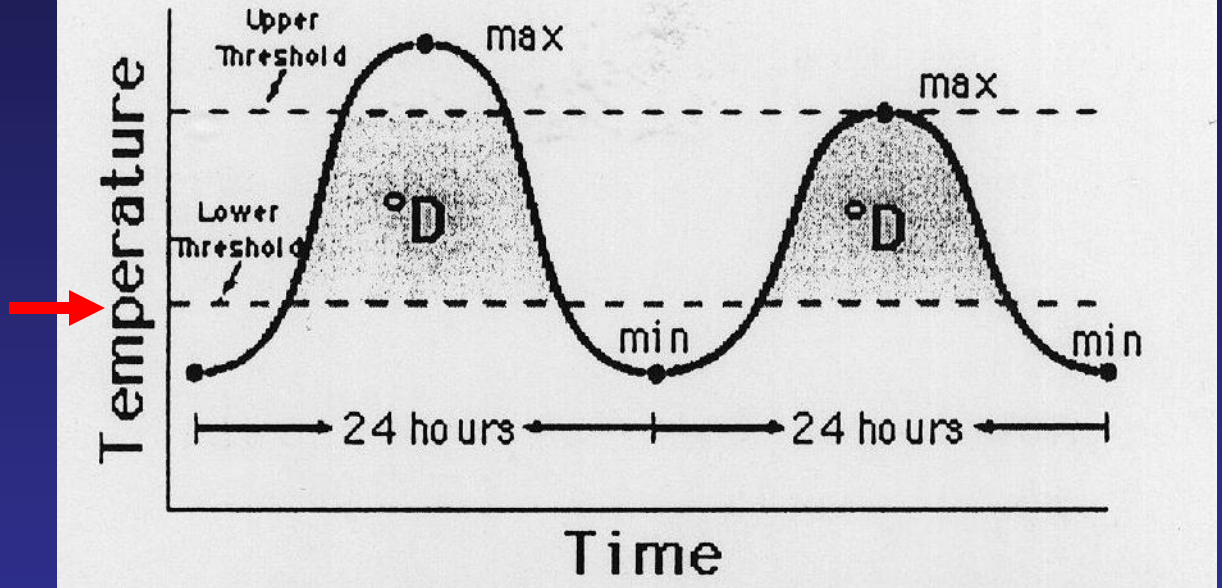


Figure 1. Thresholds and accumulated degree-days

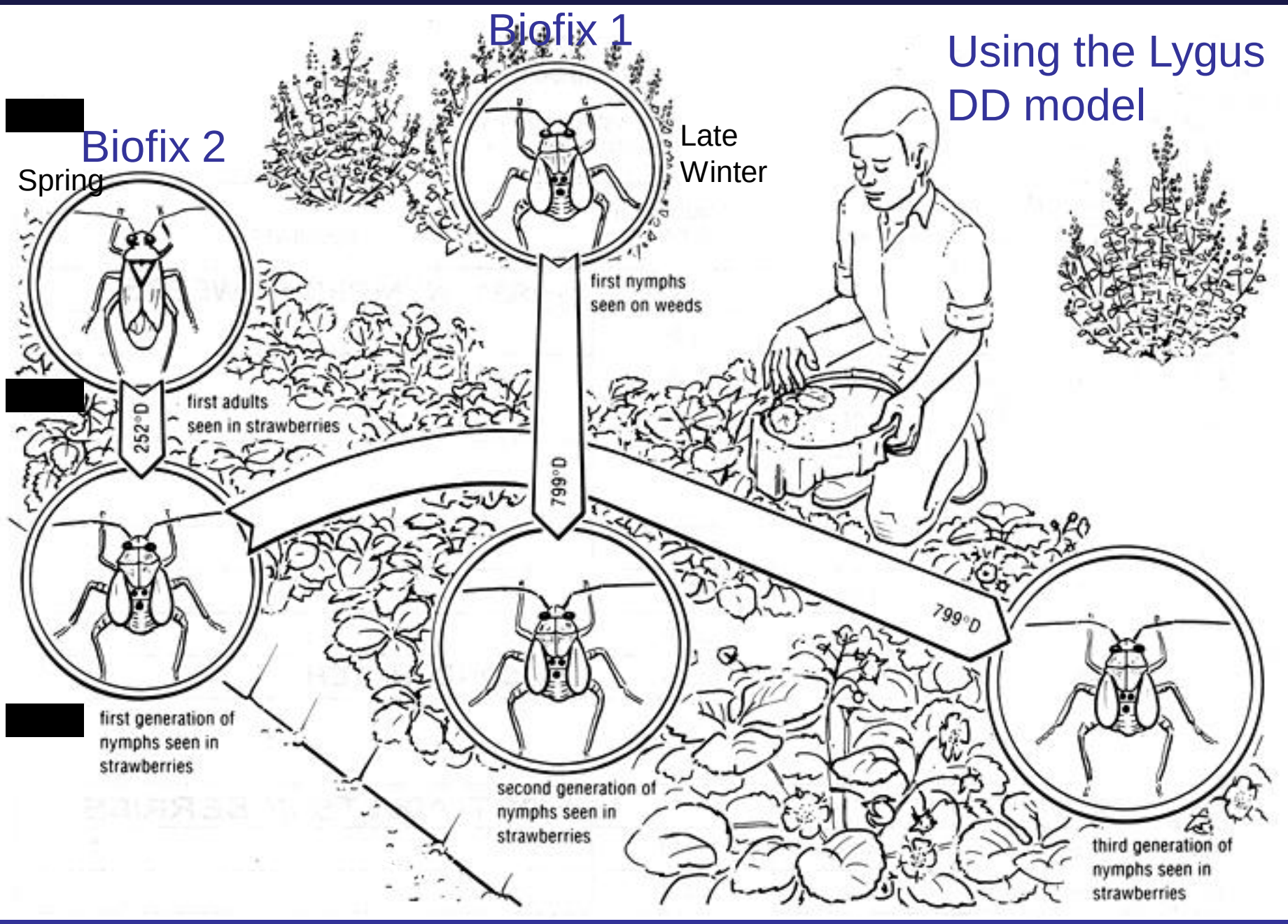
Degree-day Accumulations (> 54°F) Required for Each Stage of Lygus Development

Developmental stage	DD (°F)	DD (°C)
Eggs:	252.0	140.0
Nymphs:	371.0	206.1
Egg to Adult:	623.0	346.1
Pre-Oviposition:	176.0	97.8
(Egg to Egg):	799.0	443.9

Lygus Phenology Model after *Sevacherian et al.*

URL - http://ipm.ucdavis.edu/WEATHER/ddretrieve.html

Using the Lygus DD model



Vacuuming:

- **Destroys beneficials**
- **Spreads powdery mildew**

Alfalfa:

Can be a source of thrips

Egg parasitoid is commercially available – efficacy?

Anaphes iole, **laying egg in Lygus egg.**

Organic insecticides for Lygus:

M-Pede, insecticidal soap.

May kill up to 50% nymphs.

Will not impact adults.

Lygus builds up in second year berries.

Good Bug Blend for Lygus management?

Beet armyworm (*Spodoptera frugiperda*),

Corn earworm (*Helicoverpa zea*)

Each has a broad host range.

Beet armyworm egg mass

Corn earworm: eggs laid singly

Beet army worm

Smooth; black spot above second leg

Corn earworm

Dark tubercles and bristles, color variable

Beet armyworm and corn earworm

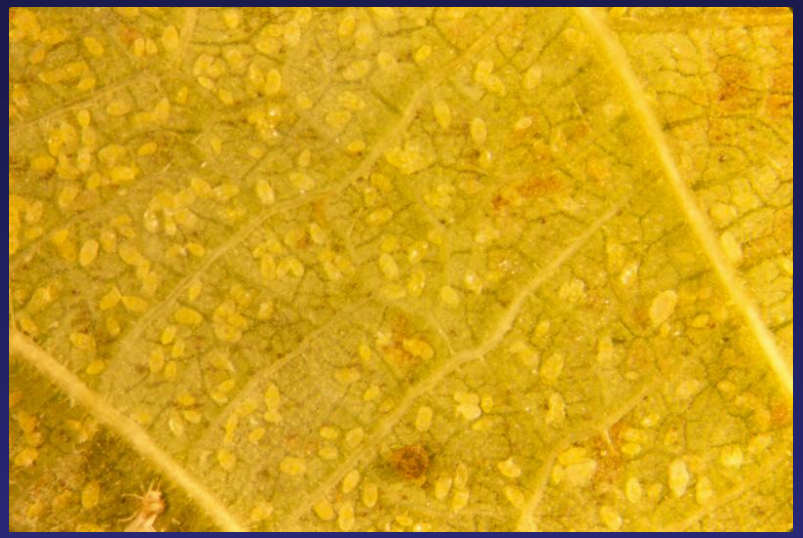
Eggs, larvae: attacked by several parasitoids and predators.

Attacked by pathogens.

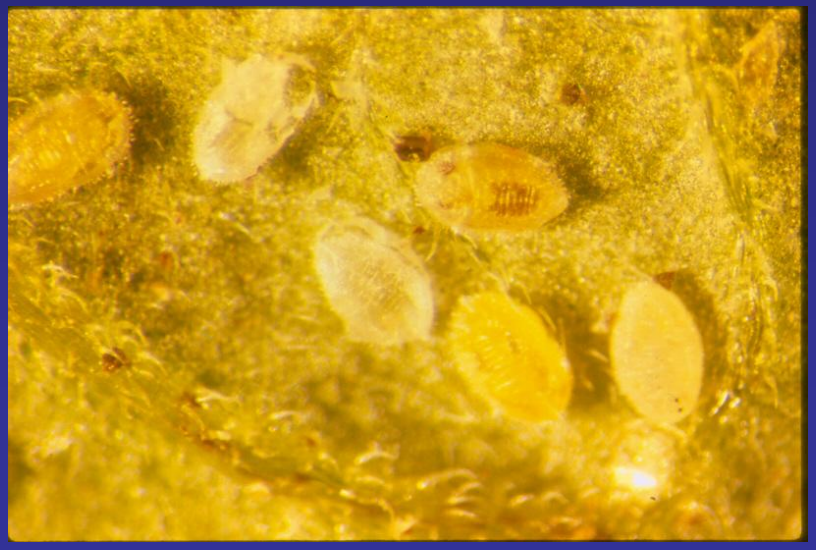
Bt and Entrust (spinosad) can be used in organic production.
Young larvae must be targeted.

Greenhouse whitefly (*Trialeurodes vaporariorum*)

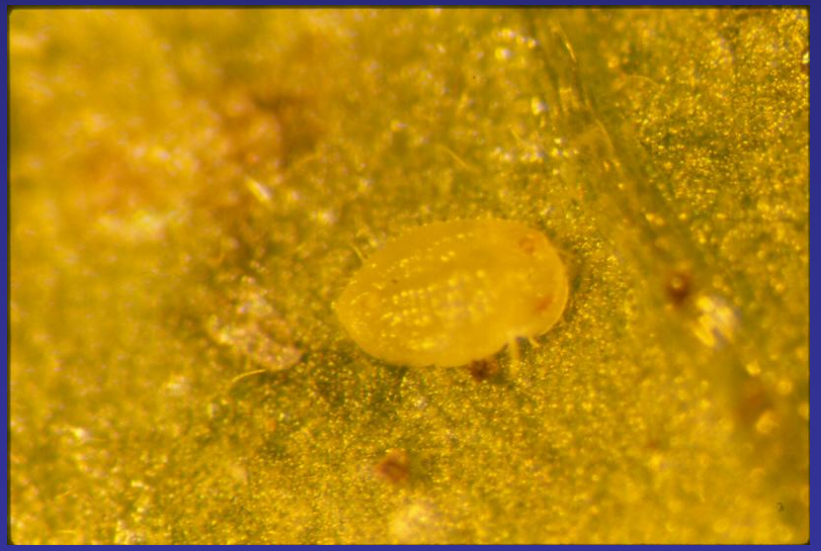
Adults and eggs



Nymphs



Parasitized nymphs



Red-eyed nymphs or pupae

Whitefly damage:

crop debilitation

Sooty mold

Whiteflies build up on second year berries.

pallidosis related decline

Whitefly control in organic strawberry:

"Preserving naturally occurring biological control agents, cultural controls,

sprays of narrow range oil, azadirachtin (Neemix), and insecticidal soaps,

and releases of *Encarsia formosa* into hot spots against low-to-moderate populations of greenhouse whitefly

are acceptable for use on organically certified strawberries."

Western flower thrips (*Frankliniella occidentalis*)

Control:

Spinosad, predators

Type 1 bronzing

Thrips can build up in alfalfa.

Light brown apple moth (*Epiphyas vittata*)

Female

Male

Fotos: David Williams, Principal Scientist, Perennial Horticulture, Department of Primary Industries, Victoria, Australia

Egg cluster Hortnet, New Zealand

Pupa Hortnet, New Zealand

Larva Macleay Museum, University of Sydney

Insectaries with strawberry?

Lygus

Beet armyworm

Spider mites

Whiteflies