Managing & Controlling Insect Pests in Leafy Greens

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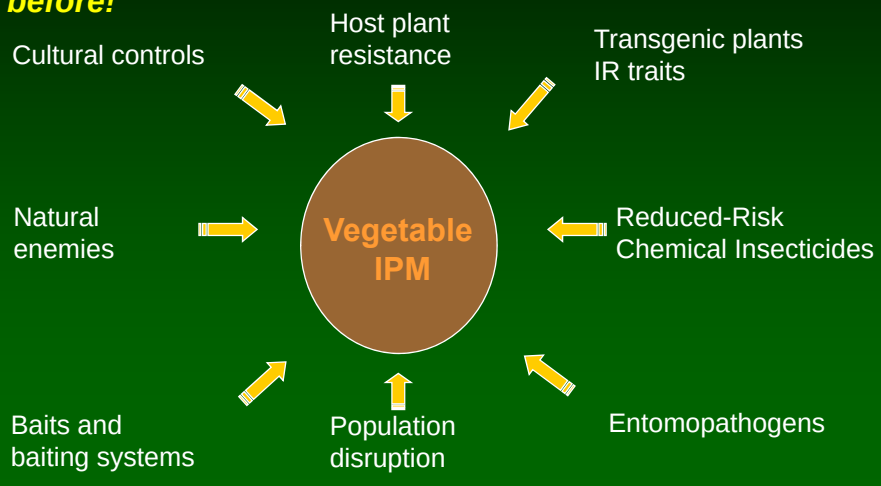
Hoop houses can be ideal for the build-up of pest populations

Insects are difficult to manage

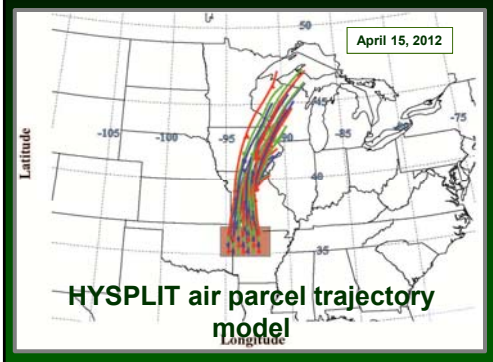
- **Multiple generations - up to 12-15 / year**
- **Limited natural enemies to reduce populations**
- **Almost unlimited food**
- **More consistent / constant environmental conditions**
- **Some life stages are not susceptible to treatment**
- **Major insecticide and miticide** resistance

Wisconsin Vegetable Pest Management

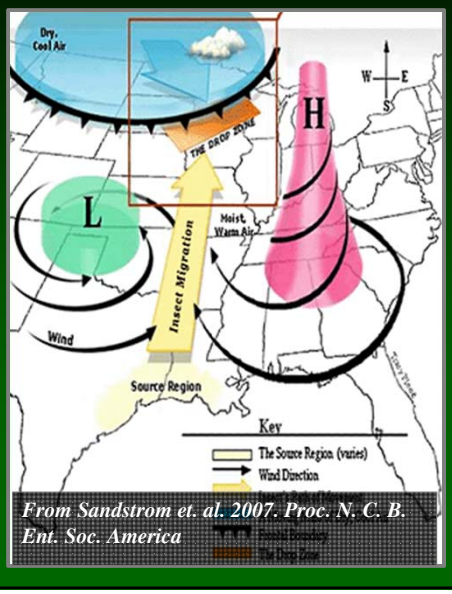
Options for Insect Pest Management – *More than ever before!*



Long Distance Migrations - 2012



Where did all these bugs come from and where might they be going?



From Sandstrom et. al. 2007. Proc. N. C. B. Ent. Soc. America

Variegated cutworm, black cutworm, yellow-striped armyworm, fall armyworm, and Loopers.

- Tomatoes, soybeans, alfalfa, potato
- Hostas, petunias, and lots & lots of other things

Reduced-Risk Foliar Registrations (2008-12)

- **Radiant®SC (spinetoram)**
  - Macrocyclic lactone (spinosad: MoA group 5)
    Use rate 4 - 12 oz / ac (Lepidoptera)
  - 10-14 days persistence (improved photostability)
  - Very low impact on beneficials

- **Coragen™ (chlorantraniliprole)**
  - Anthranilic diamide (MoA group 28)
    Use rate 3 - 5 oz (Lepidoptera) +MSO 5% v/v
  - 14+ days persistence
  - Very low impact on beneficials and low toxicity
  - Ovicidal activity

Corn earworm larvae 'dead'

Reduced Risk Foliar Options Registration 2006 - OMRI

- **Entrust® SC (spinosad)**
  - Macrocyclic lactone (spinosad: MoA group 5)
    - Use rate 1.25 - 2 oz / A
    - Control of onion thrips
  - 7-10 days persistence (photostability)
  - Very low impact on beneficials
  - Low mammalian toxicity

Aster yellows

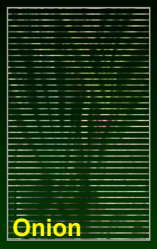
Disease incidence:
1%-15% in intensively managed carrot fields

Variable symptoms:

Above ground - leaf yellowing and reddening, twisting, witches' brooming

Below ground – stunted and malformed roots, adventitious root growth

Crops affected: Lettuce, celery, cilantro, coriander, endive, escarole, and many more!!!



Vector: Aster leafhopper (ALH)

Adult

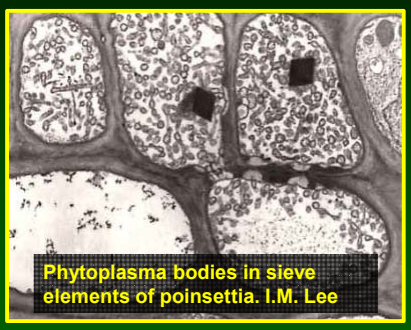
Immature

- *Macrosteles quadrilineatus* Forbes (Hemiptera: Cicadellidae)
- Approximately 4 mm long
- Light greenish-yellow in color (seasonally variable)
- Widely distributed in the U.S.

Aster yellows phytoplasma (AYp), *Ca.* phytoplasma asteris

Small (0.4 µm diameter) , wall-less prokaryotic organism of the provisional genus *Candidatus*

Infects > 350 species in 38 plant families



Phytoplasma bodies in sieve elements of poinsettia. I.M. Lee

Obligately associated with host (insect and plant) and not mechanically transmissible

Current AY management

April | May | June | July | August | Sept. | Oct.

Carrot

Planting — Crop growth — Harvest

Aster Leafhopper

Migratory — Local — 1st – 3rd Generation

- Foliar insecticide applications (or row cover!!!!!!)
- Pyganic , Azera
- Synthetic pyrethroids (RUP requirement)
- Systemic neonicotinoids

Flea beetle Management in Leafy Greens

Flea beetle (several species)

Appearance

- Small, shiny black beetles
- Hind legs enlarged for jumping
- Overwinter as adults
- 2 generations per year

Damage

- Adults chew small circular holes
- Can kill small plants
- Larvae in soil are not damaging

Flea Beetle Management

Cultural

- Exclude adults with row cover
- Attract adults to alternate trap crop (Indian mustard)
- Avoid early planting

Biological

- No effective controls

Chemical

- Spray to control adults (synthetic pyrethroids)
- DO NOT disrupt biological controls of other pests (aphids)
- Neonicotinoid or spinosad insecticides
- Entrust WP, SpinTor SC,

Seed corn maggot Lifecycle

Adult

- Small grey black fly

Eggs

- Small, white, laid on soil

Larvae

- White maggots
- 4 instars
- 3-4 generations/year
- 200, 600, 1000, DD_{39}

Pupae

- Brown, oval, in soil

Seed corn maggot: Seasonal Biology & Damage

Occurrence

- Overwinter in soil as pupa
- Adults emerge in spring
- 1st generation weeds

Damage

- Larvae hatch and tunnel in germinating seeds
- Cool weather, which delays plant emergence
- Green manure incorporation
- Plants compensate well for damage

Seed corn maggot Management

Cultural

- Planting dates (fly-free periods)
- Speed up germination: pre-sprout, mulch, warm soil
- Avoid green manure

Biological

- Fungal epidemics / soil insects

Chemical

- In-furrow treatments
- Broadcast treatments
- Seed treatments (registered & experimental)

Insecticide Seed Treatment

Entrust (spinosad) – Registered 2010

*FarMoreFI500 (fludioxonil, mefenoxam, azoxystrobin, spinosad, and thiamethoxam)

*Cruiser 5FS (thiamethoxam) *In Review (2014-2015)

**Sepresto (clothianidin+imidacloprid)

**Researchable

Aphids – Green Peach Aphid

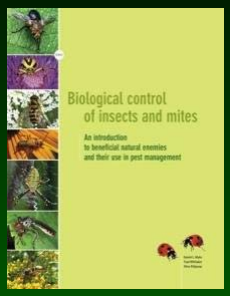
- Soft-bodied insects
- Wings present or absent
- Cornicles (tail pipes)
- Honeydew
  - Sooty mold
- May transmit viruses
- Reduces plant vigor, stunting, malformation

Aphid Monitoring

- Check as many plants as possible
- Look at terminal buds and lower leaf surfaces
- Cast skins, honeydew, & sooty mold are indications of aphid infestation.
- Yellow sticky traps can monitor winged aphids

Aphid IPM

- Sanitation
  - Remove alternate hosts (weeds)
- Limit the use of quick-release fertilizer
- Beneficial Insects
  - Green lacewings
  - Ladybeetles
  - Parasitic wasps



http://learningstore.uwex.edu/Search.aspx?k=A3842

Aphid Parasitoids & Predators




Aphid Chemical Control

- **Rotate chemicals every 2-3 applications to prevent insecticide resistance**

AdmirePro / Marathon (imidacloprid) - drench

Fulfill / Endeavor – (pymetrozine) applied as a foliar with slow kill - but stop feeding fast

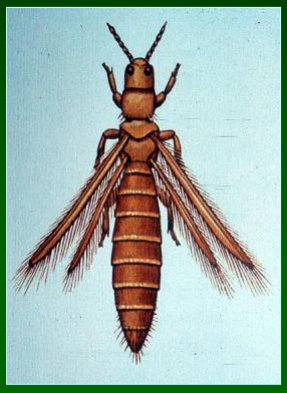
Beleaf - (flonicamid) - foliar

Azatin (azadirachtin) - foliar

Botanigard (Beauvaria bassiana) - foliar

Thrips – Western flower thrips (WFT)

- Thrips, complete metamorphosis
- 4 narrow, fringed wings
- Rasping-sucking mouthparts
- Virus vectors (TSWV & INSV)

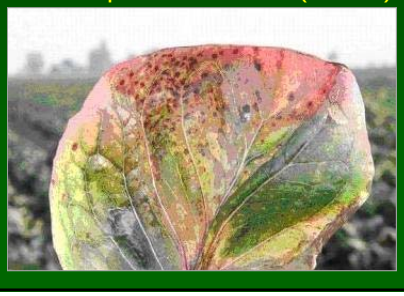


Thrips Damage

- Rasping mouthparts puncture plant surfaces
- Egg-laying also damages plants
- Injury appears in streaks rather than spots 'silvering'
- Buds fail to open.

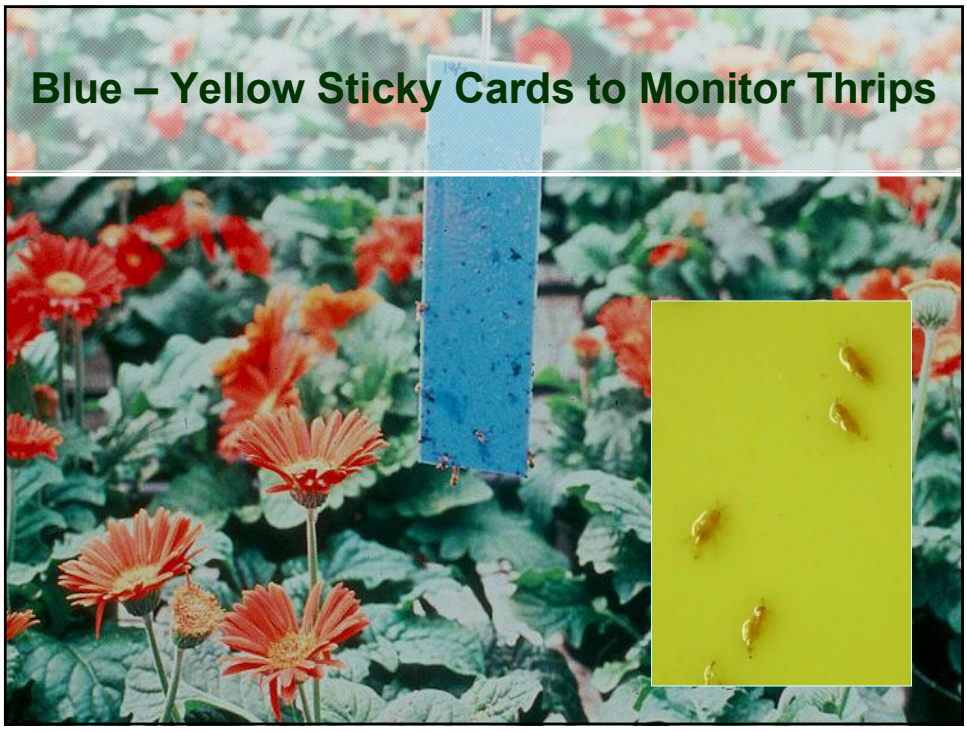
Thrips Damage – Virus Infection

Tomato spotted wilt virus (TSWV)



Impatiens necrotic spot virus (INSV)

Blue – Yellow Sticky Cards to Monitor Thrips



Thrips IPM

- **Sanitation**
  - Remove weeds that act as a thrips (virus) refuge.
  - Remove and destroy crop residues and affected plants after harvest.
  - Remove all soil debris from greenhouse.
- **Pasteurize soil to kill immature thrips.**

Thrips Chemical Control

- **Treat at 3-5 day intervals with very good coverage**
- **Rotate chemicals to prevent WFT resistance**

– Conserve (spinosad)
– Radiant (spinetoram)
– Avid (abamectin)
– Pedestal (novaluron - IGR)

- Merit (imidacloprid)
- Flagship (thiamethoxam)
- Safari (dinotefuran)

– predacious mites (*Amblyseius cucumeris)*
– *Beauvaria bassiana* (Botanigard)
– M-pede (insecticidal soap)
– Azatin (azadiractin)
– Entrust (spinosad)