Module 6
IPM for CEA

2026 Greenhouse Hydroponic Tomato Workshop with Dr. Triston Hooks

Outline

1. What is IPM?
2. IPM Strategies for CEA
3. Common Tomato Pests

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Mucci Farms

IPM for CEA

What is IPM?

- Integrated Pest Management is a holistic approach to dealing with pests

- *"A comprehensive approach to managing host stress that is economically and ecologically sustainable" (Peterson et al., 2018)*

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IPM for CEA

What is a pest?

- A pest is an unwanted organism
- A pest can simply be a nuisance but can also cause significant harm to your plants
- A pest can be an insect, plant, bacteria, fungi, nematode, animal, or even human!

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New Mexico

IPM for CEA

What is a pest?

- Some pests can cause devastating diseases to plants!
- *Estimated $30 bn/yr is lost due to disease! (Walker and Frederick, 2019)*
- *Estimated a third of all agricultural yield is lost due to pests!*

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Ontario Greenhouse Veggies

IPM for CEA

What about CEA?

- *CEA is pest free, right?!*
- CEA can avoid many pests, but it is not invulnerable!
- The same controlled environment that optimizes plant growth can also become a pest paradise!

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Astrobiology. 2021 Sep;21(9):1029-1048. doi: 10.1089/ast.2020.2399. Epub 2021 Apr 29.

Fusarium oxysporum as an Opportunistic Fungal Pathogen on *Zinnia hybrida* Plants Grown on board the International Space Station

Andrew C Schuerger [1], Bimal S Amaradasa [2], Nicholas S Dufault [2], Mary E Hummerick [3], Jeffrey T Richards [3], Christina L Khodadad [3], Trent M Smith [4], Gioia D Massa [4]

Affiliations + expand

PMID: 33926205 DOI: 10.1089/ast.2020.2399

IPM for CEA

What about CEA?

- Pests can wreak havoc in CEA systems too!
- Greenhouse, indoor vertical farm, container farm, or even in space!
- No amount of sterilization, prevention, or pesticides can eliminate all pests!

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A New Hope

IPM for CEA

What can we do?!

- *"There are alternatives to fighting" – Obi-Wan*
- IPM is critical for CEA!
- *"A comprehensive approach to managing host stress that is economically and ecologically sustainable" (Peterson et al., 2018)*

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IPM for CEA

The IPM Philosophy

- There will always be pests
- Pest management, not elimination
- Be pro-active, not reactive
- No silver bullets!

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IPM practical goals

- Less pesticides and resistances in agriculture
- Economically and ecologically sustainable agriculture
- *Resilient agriculture that will persist for future generations*

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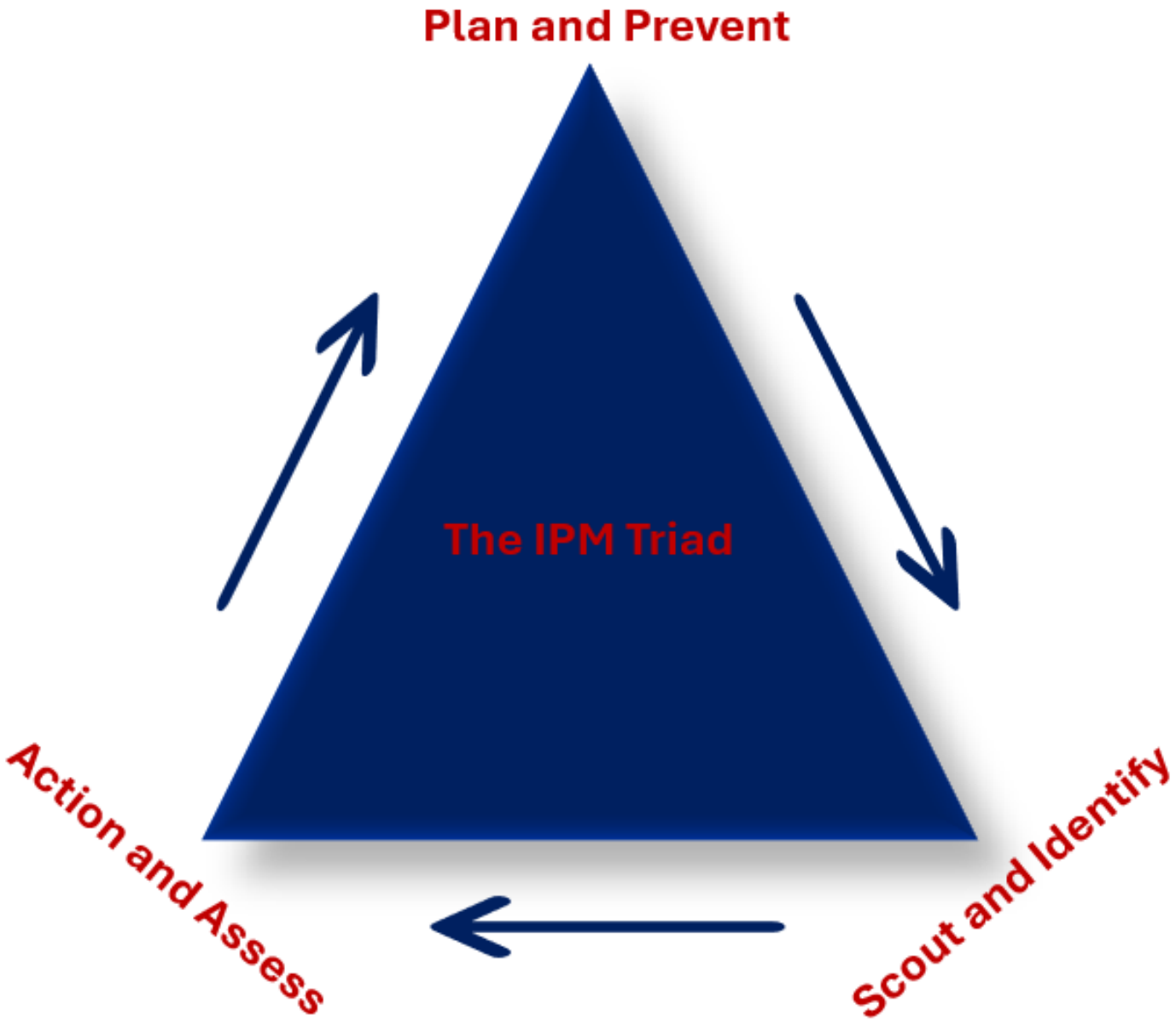

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IPM Strategies

The IPM Triad:

1. *Plan and Prevent*
2. *Scout and Identify*
3. *Action and Assess*

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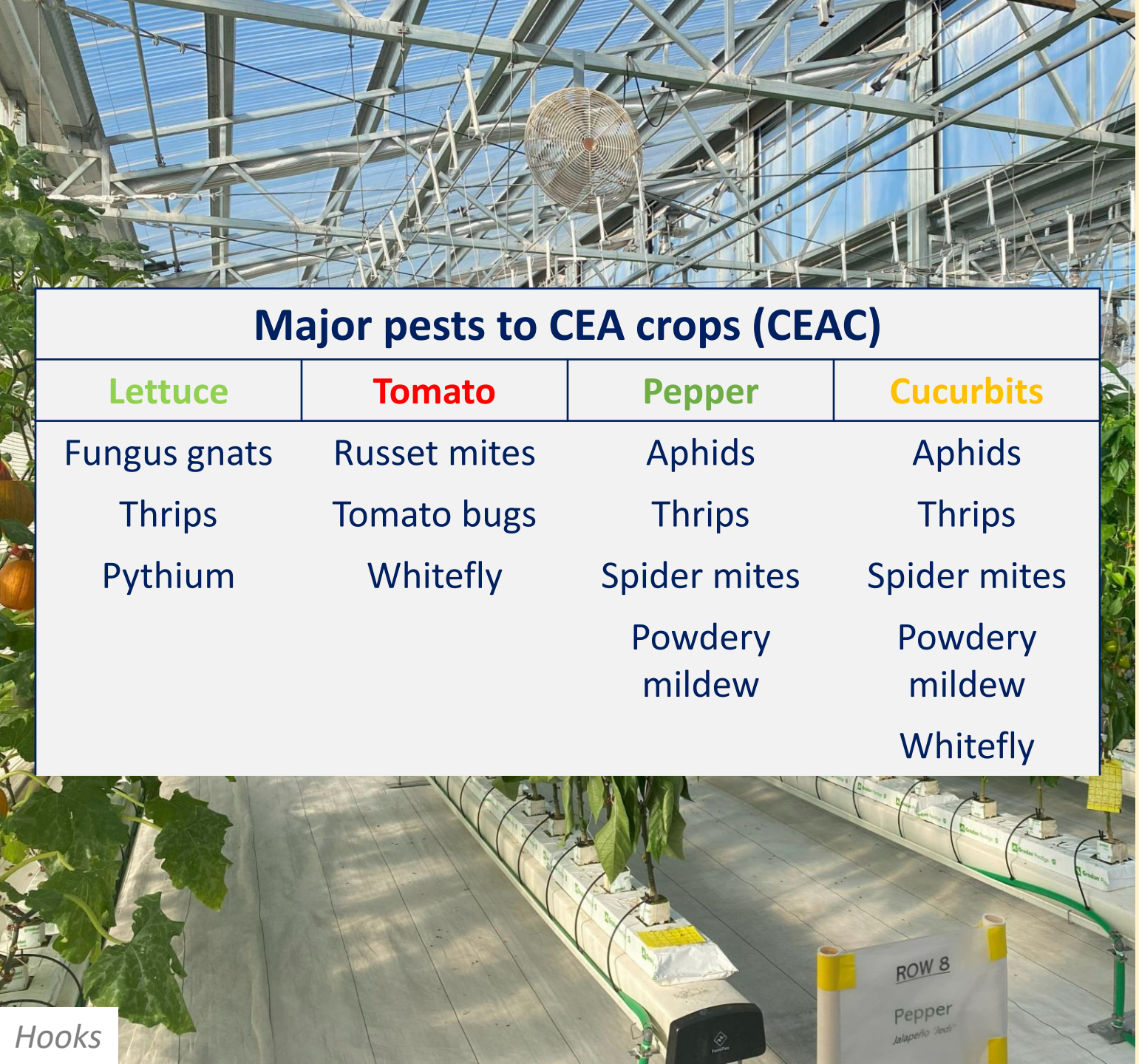

Major pests to CEA crops (CEAC)			
Lettuce	Tomato	Pepper	Cucurbits
Fungus gnats	Russet mites	Aphids	Aphids
Thrips	Tomato bugs	Thrips	Thrips
Pythium	Whitefly	Spider mites	Spider mites
		Powdery mildew	Powdery mildew
			Whitefly

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1. *Plan and Prevent*

- Develop a comprehensive plan
- Start by knowing your crop(s), environment, and common pests

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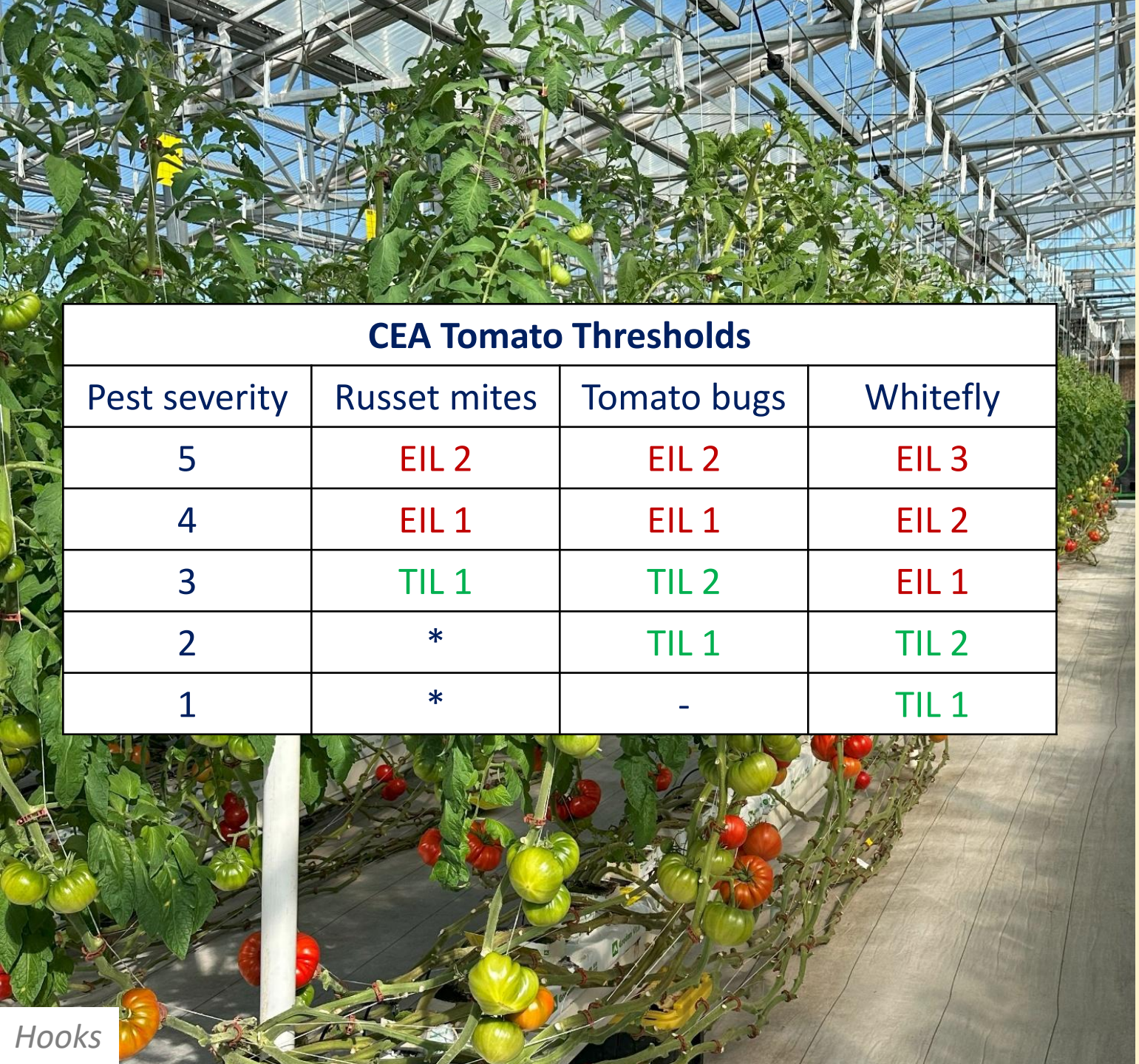

CEA Tomato Thresholds			
Pest severity	Russet mites	Tomato bugs	Whitefly
5	EIL 2	EIL 2	EIL 3
4	EIL 1	EIL 1	EIL 2
3	TIL 1	TIL 2	EIL 1
2	*	TIL 1	TIL 2
1	*	-	TIL 1

Hooks

IPM for CEA

1. *Plan and Prevent*

- Establish thresholds that can help guide your IPM actions
- Tolerable injury level (TIL)
- Economic injury level (EIL)
- *Take action at TIL to avoid EIL!*

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IPM for CEA

1. *Plan and Prevent*

- Prevention starts with sanitation practices!
- Clean hands, feet, tools, and surfaces
- *You are the number one vector for pests!*

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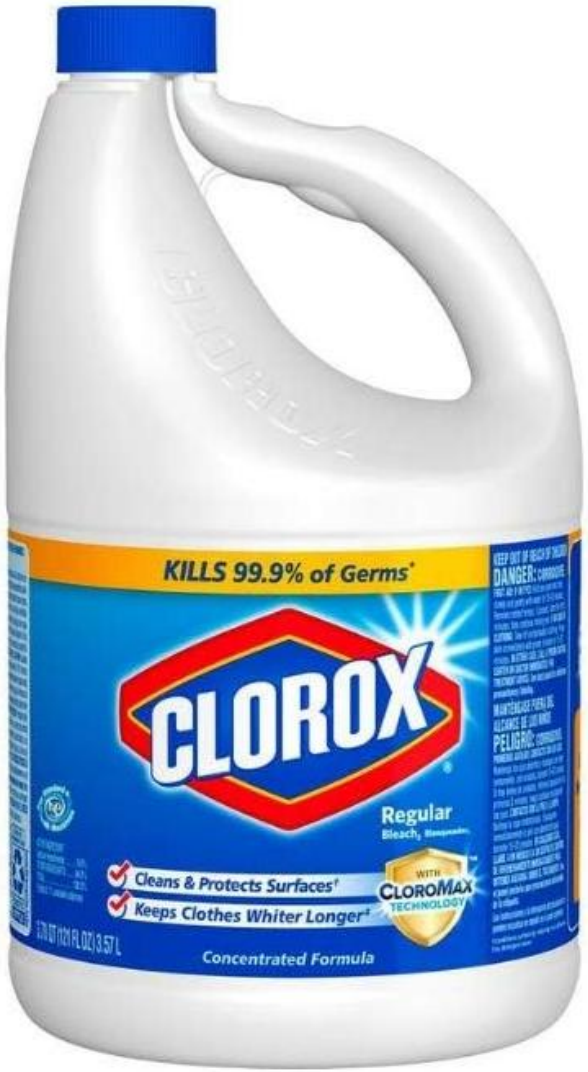

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1. *Plan and Prevent*

- Sanitation is simple, it just needs to be consistent
  - Soap and water
  - 10% bleach (kills viruses)
  - 1:150 Zerotol HC (kills bacteria and fungi)

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IPM for CEA

1. *Plan and Prevent*

- Prevention is based on keeping pests out of your CEA!

- Consider insect screens (150 microns), vestibules, clothing, and quarantine practices

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Arbico Organics

IPM for CEA

2. *Scout and Identify*

- Scouting is critical for IPM and early detection of pests!
- The sooner you find a pest the easier it is to manage
- Identification is key to know friend from foe

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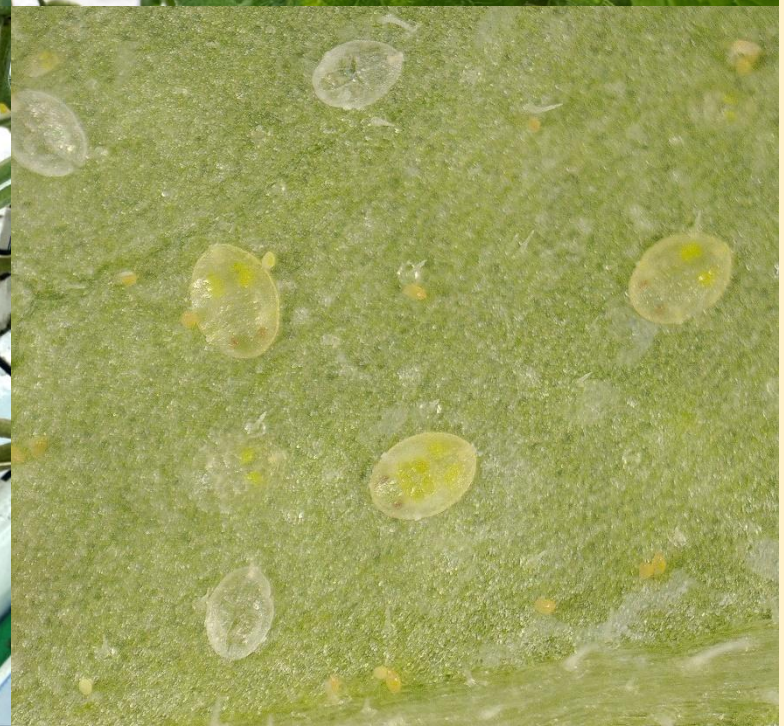

IPM for CEA

2. *Scout and Identify*

- Scouting also includes the identification of pest damage, symptoms, habits, and lifecycle!

- Thrip damage, whitefly damage, whitefly eggs and crawlers, and russet mites on tomato stems…

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IPM for CEA

2. *Scout and Identify*

- Scouting requires active searching for pests
- Pests are smart and will hide!
- Look under leaves, inside flowers, upper and lower canopy, etc.

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Hooks

IPM for CEA

2. *Scout and Identify*

- Scouting is a regular (weekly) and methodical practice
- Can use a map and legend to record *incidence* and *severity*
- Incidence is location/occurrence
- Severity is population/damage

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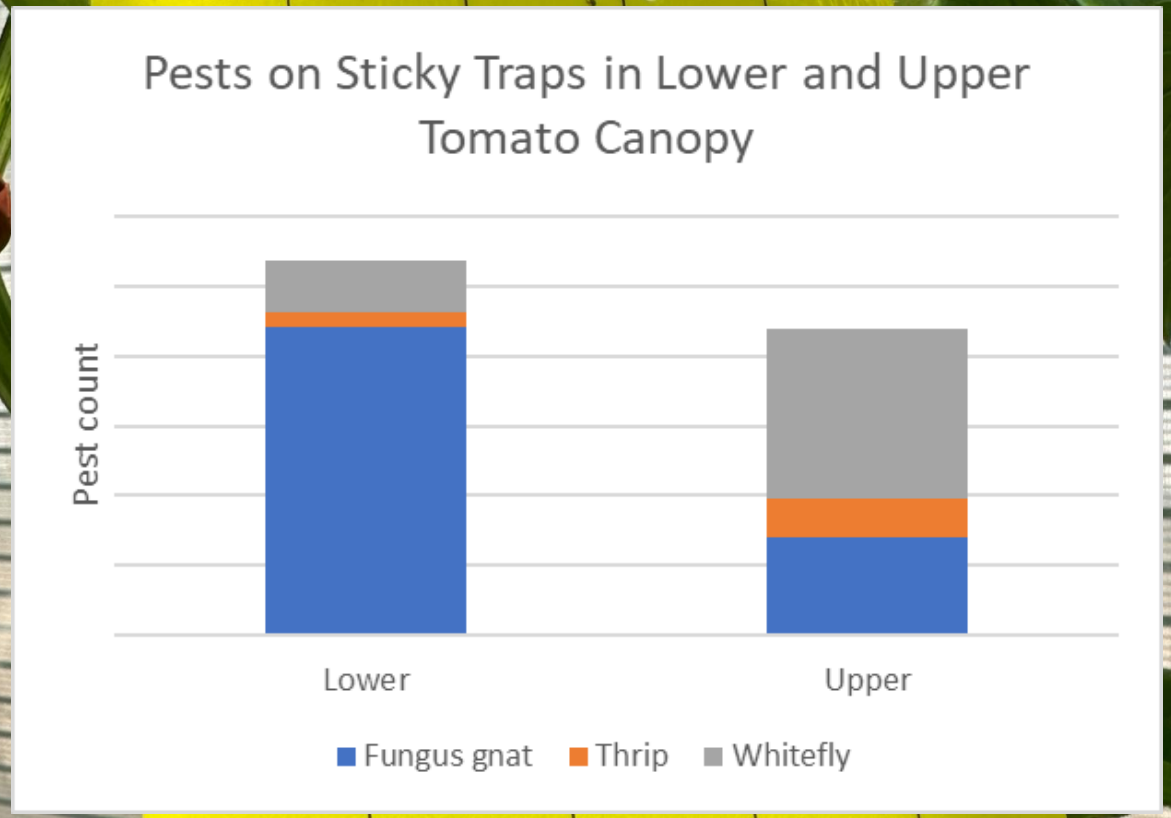
IPM for CEA

2. *Scout and Identify*

- Use sticky traps to help with scouting
- Can only trap flying pests such as gnats, thrips, and whitefly
- Place in critical areas such as upper and lower canopy or near high traffic areas
- Location can be important for specific pests!



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3. *Action and Assess*

- IPM actions can be categorized as cultural, mechanical, biological, and chemical practices

- Cultural and mechanical practices focus on prevention based on what, where, and how you grow

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Arbico, Koppert

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3. *Action and Assess*

- Biological and chemical actions are mostly taken in response to scouting and guided by thresholds
- Rule of thumb is to use scalable actions and reserve restricted pesticides (aka nukes) as a last resort!

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3. *Action and Assess*

- Biological practices include beneficial insects that are exciting but can be challenging to implement

- Generalist predators include ladybugs, lacewing larvae, assassin bugs, and mantids

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Arbico Organics, Koppert

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3. *Action and Assess*

- Specialist preadators are host-specific and include parasitic wasps and predatory mites
- *Aphidius colemani for aphids*
- *Encarsia and Eretmocerus for whitefly*
- *Persimilis and Swirskii for spider mites*

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3. *Action and Assess*

- Biological practices also include <u>microorganisms</u> such as beneficial nematodes, fungi, and bacteria

- Can compete, kill, or protect the plant from pests and pathogens!

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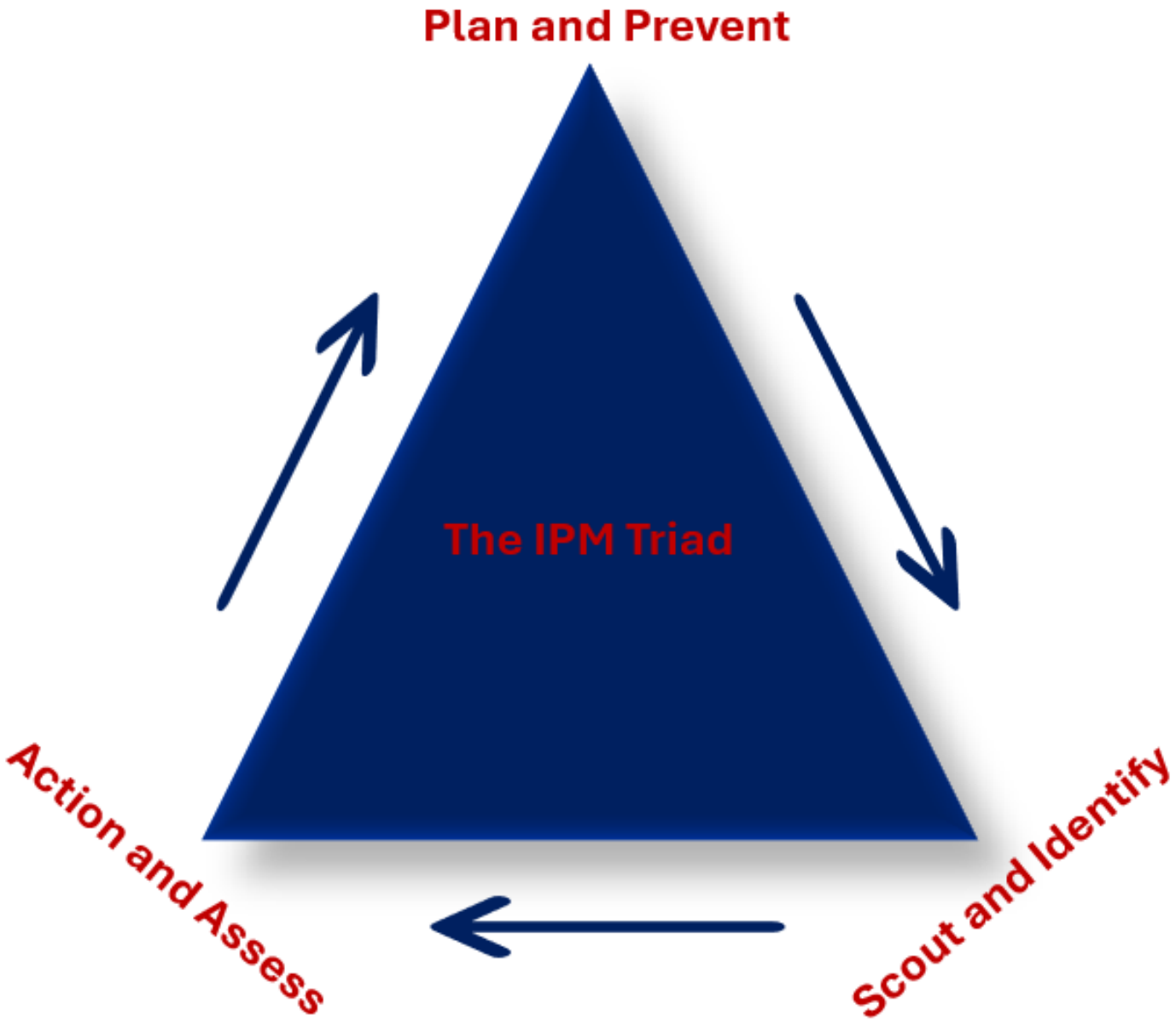

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3. *Action and Assess*

- *When the dust settles, the job ain't done!*
- Assess the effect of IPM actions via pest counts and scouting
- Continue the IPM Triad to maintain a healthy CEA system!

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Common Pests in CEA

- Aphids e.g. *Myzus persicae* (green peach aphid)
- Piercing damage, asexual and viviparous, transmits virus (CMV), farmed by ants, and can defend themselves with siphunculi!

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Common Pests in CEA

- Thrips e.g. *Frankliniella occidentalis* (Western flower thrip)
- Ubiquitous, rasping damage with frass, completes lifecycle in the substrate/litter, lays eggs inside plant tissue, and can transmit viruses (TSWV, TSV)

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Common Pests in CEA

- Whitefly e.g. *Bemisia tabaci* (Silverleaf whitefly)
- Piercing damage, completes lifecycle on plant leaves, secretes honeydew, can transmit viruses (TYLCV, ToTV)

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Common Pests in CEA

- Spider mites e.g. *Tetranychus urticae* (Two-spotted spider mite)
- Arachnid, spins webs, always found in large colonies, stippling damage, prefers warm and dry environments

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Common Pests in CEA

- Russet mites e.g. *Aculops lycopersici* (Tomato russet mite)
- Arachnid, parachutes with webs, invisible to the naked eye, starts in lower canopy moves up, look for rust color on stems and leaves, check with tape and microscope!

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Common Pests in CEA

- Tomato bug e.g. *Engytatus modestus*

- Adults are mobile, fly, and feed heavily on tomato growing points, cause circular rings of damage, nymphs appear similar to aphids but can run and jump like an acrobat!

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"Each insect has its own odor, and the dogs will always notice" (hortidaily.com)

“With PATS-C we are more timely aware of an infestation” (hortidaily.com)

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The Future of IPM

- Digital scouting, bug cannons, vacuums, dogs, robots, drones, lasers, and AI!

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References

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4. The IPM Paradigm, Gray et al, 2009
5. Hooks 2022-2025 UA-CEAC Teaching Greenhouse unpublished data

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