Research-driven Solutions for Managing Impatiens Necrotic Spot Virus (INSV) Affecting CA Lettuce

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CA Assembly Committee on Agriculture
Informational Hearing
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USDA Agricultural Research Service

History of Impatiens Necrotic Spot Virus (INSV) in CA lettuce

- **1980s: First described in the Netherlands in ornamental crops.**
- **2006: Reported in lettuce in Monterey County.**
- **2006 – 2012: Minor to severe isolated outbreaks of INSV in lettuce.**
- **2018 – 2021: Severe outbreaks in Monterey County and other coastal lettuce regions. Up to 100% crop losses, losses = millions US$.**
- **2021: Reported in desert lettuce regions in California (Imperial and Riverside Counties) and Arizona.**

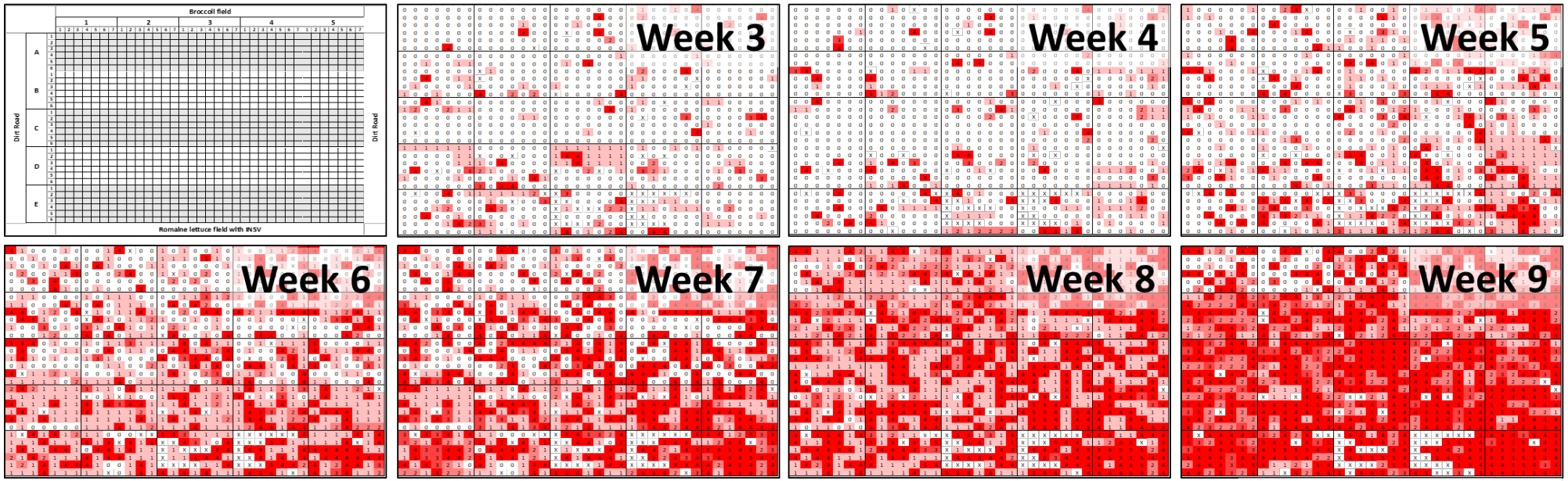

2020


2020


2021

2019

2019: Documenting the spread of INSV in commercial lettuce



Total loss = ~$81,000 USD

INSV severity

0	1	2	3	4	5

Western flower thrips: vector for INSV

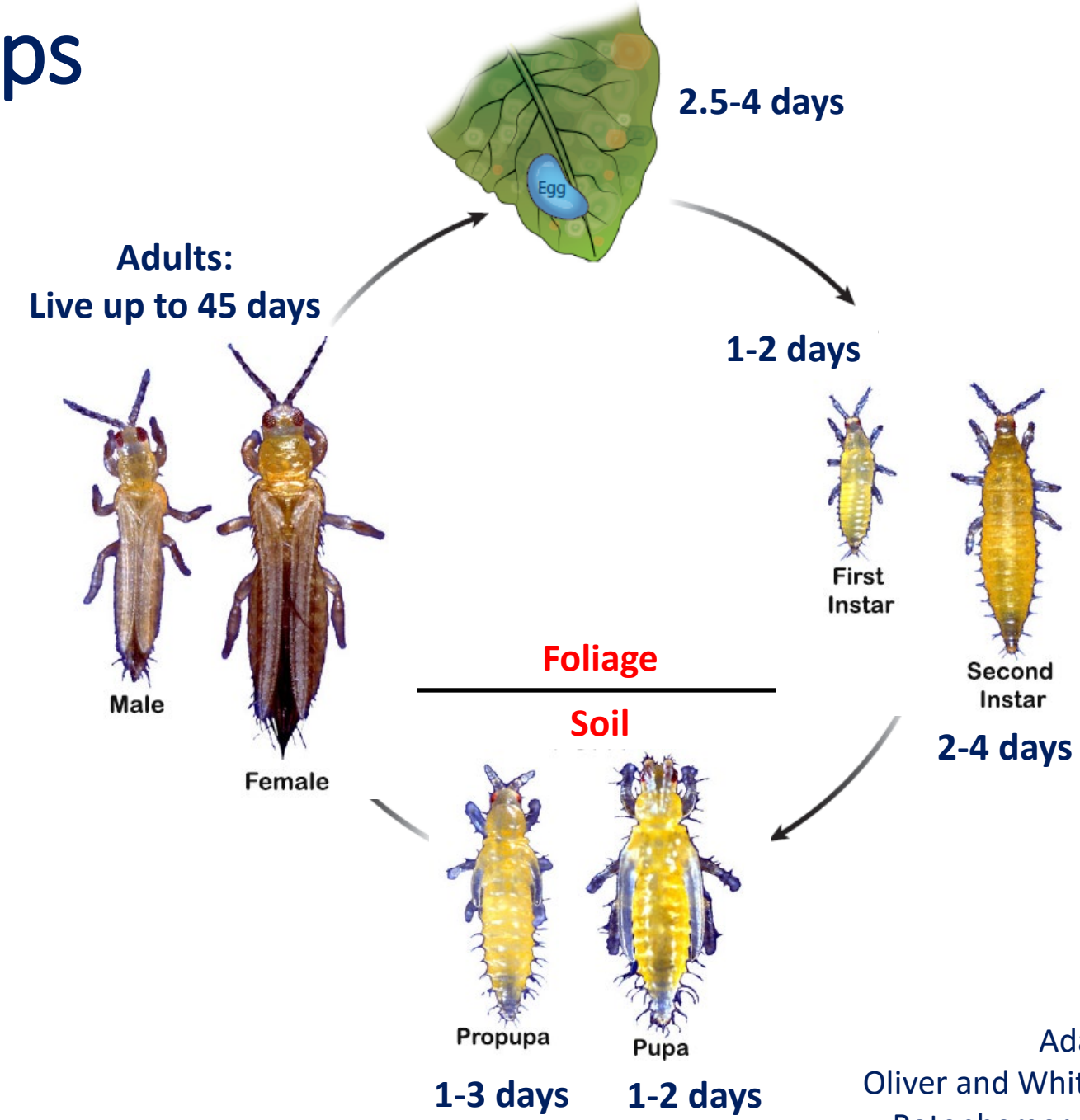
Western flower thrips

Biology

- Adults are 1-2 mm in length
- Female can lay 150-300 eggs
- Development: 7.2 – 40.0°C (45 – 104°F)
- Thrips host range = 100s of plants

Vectors of Tospoviruses

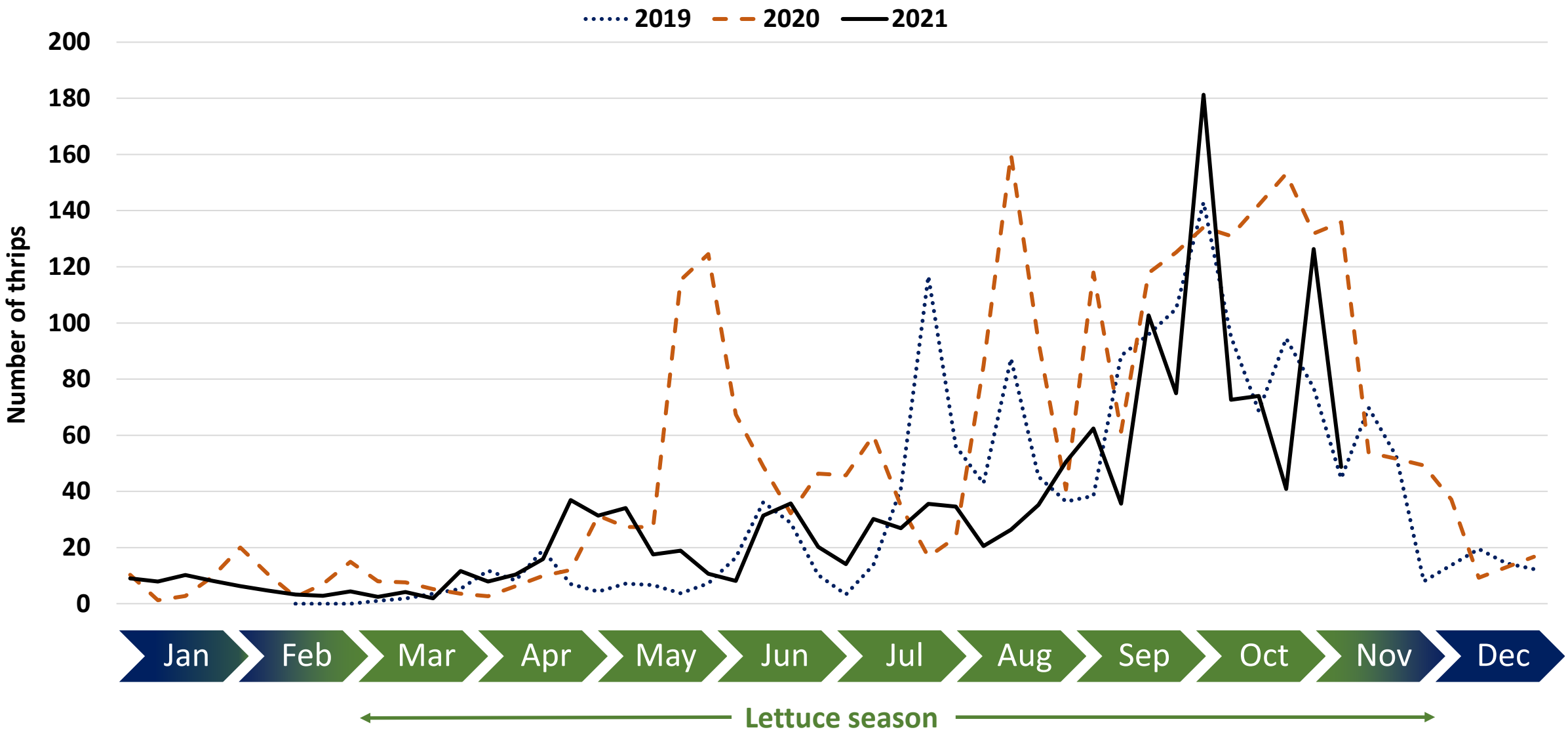
- *Impatiens necrotic spot virus* (INSV)
- *Tomato spotted wilt virus* (TSWV)
- INSV host range = 100s of plants



Adapted from
Oliver and Whitfield, 2016
Rotenberger et al., 2020

Thrips monitoring

Thrips/sticky card/week (21 total, average)



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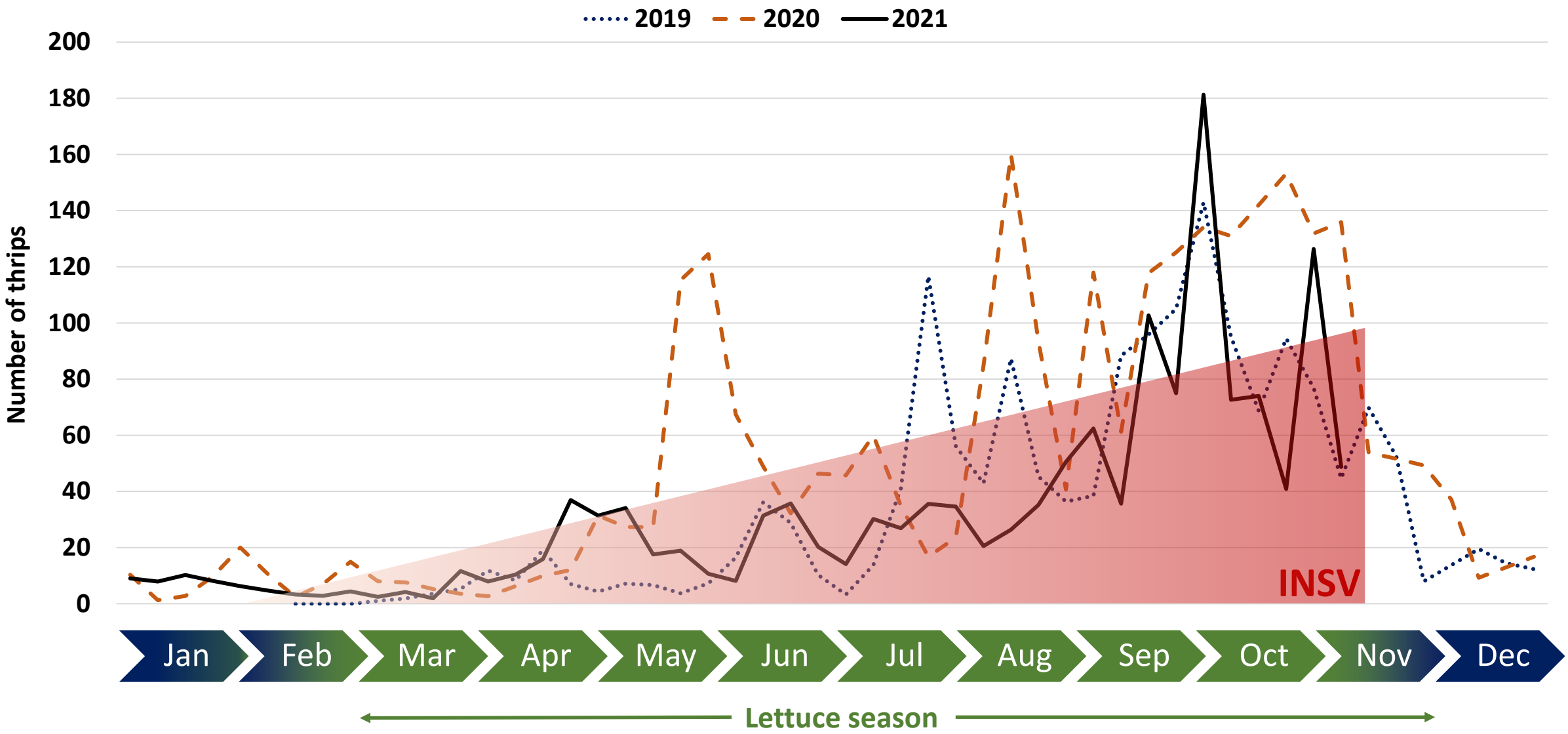
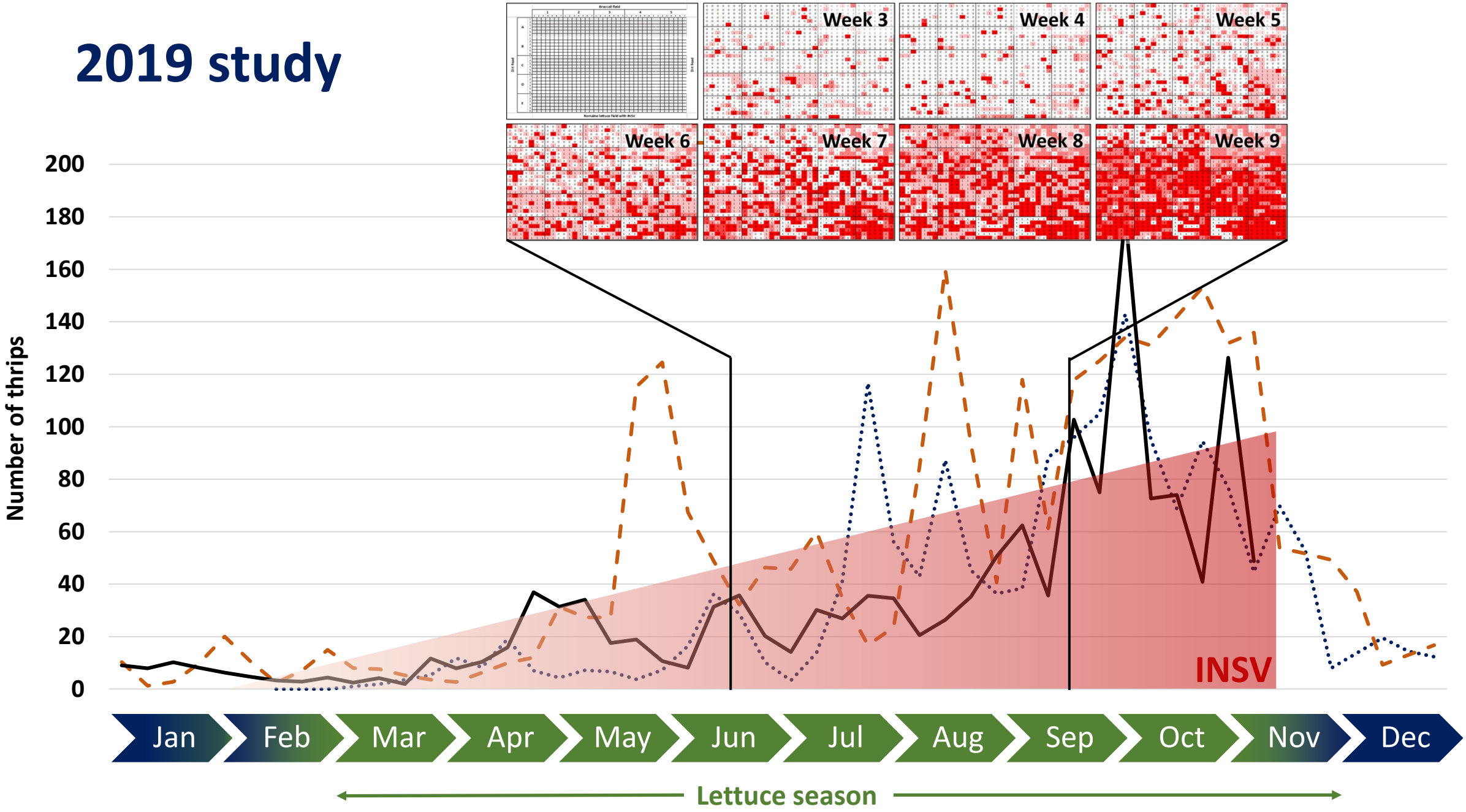
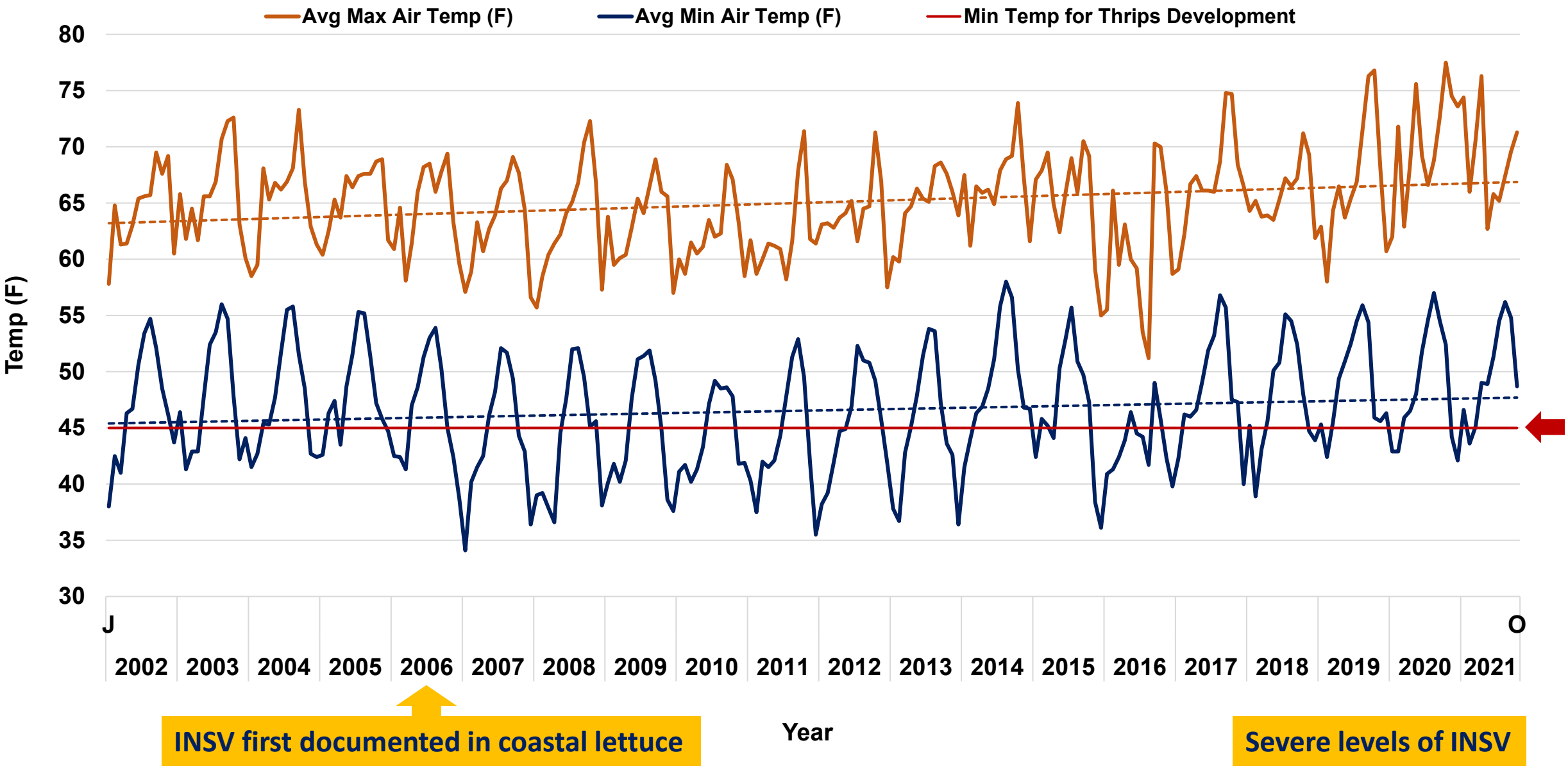


2019 study


Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Week 9
200
180
160
140
120
100
80
60
40
20
0
Number of thrips
INSV
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Lettuce season

Air temperature: 20 years



Management Challenges

Thrips

Small, cryptic insects: 1-2 mm in length

Highly reproductive: 100’s eggs per female

Long distance wind travel: >25 feet high

Very limited chemical options

Large host range: occupy 100’s plants, including vegetable, fruit, flowers grown in Monterey County

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INSV

No methods for preventing/treating the virus (e.g., vaccines)

No genetic resistance in lettuce varieties

Large host range: virus can infect 100's plants, including numerous weeds in Monterey County

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Thrips + INSV

Virus transmission occurs within minutes of feeding on lettuce

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+

Pythium

Co-infections

INSV + Pythium Wilt

Research Progress and Opportunities

Thrips

INSV

Thrips + INSV

Pythium

Research Progress and Opportunities

Thrips

Using predatory insects to combat thrips

Monitoring populations

Understanding patterns of movement and behavior

Precision sprays to reduce pesticide inputs

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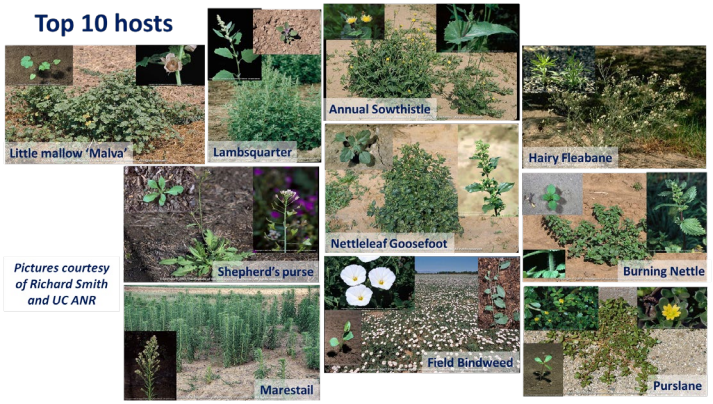
Weed abatement to reduce INSV reservoirs



Boosting plant immunity to fight viruses

Thrips + INSV

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Pythium

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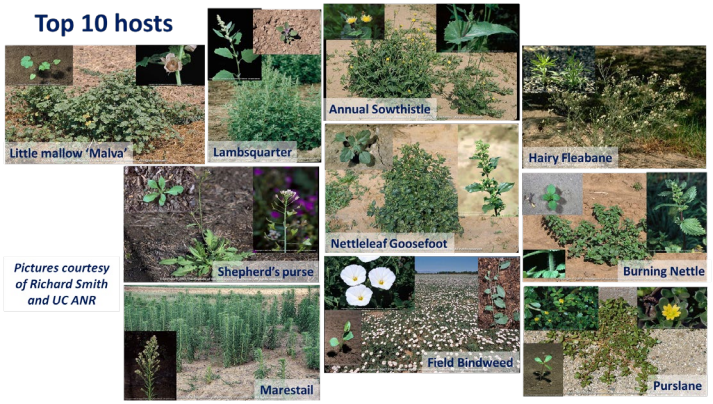

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Thrips + INSV

Improved detection programs to monitor thrips vectoring INSV

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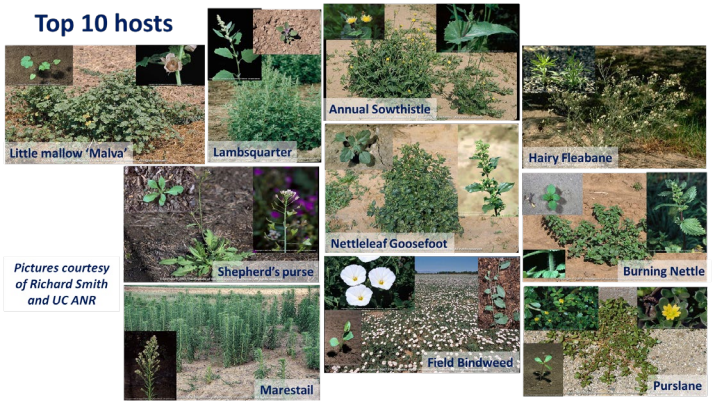

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INSV/Pythium interactions

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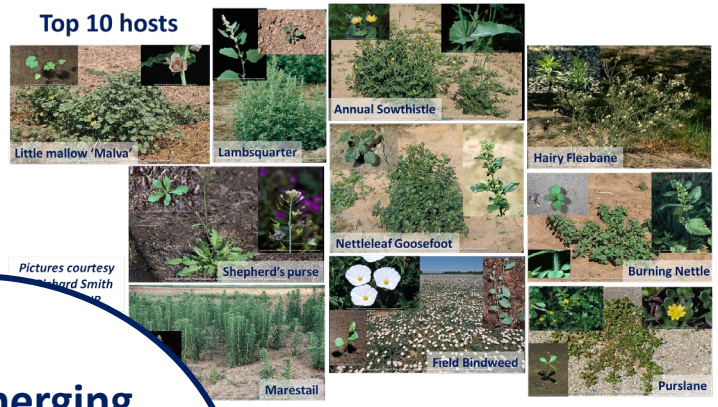

Boosting plant immunity to fight viruses

Novel/emerging biotechnologies for insect and disease management

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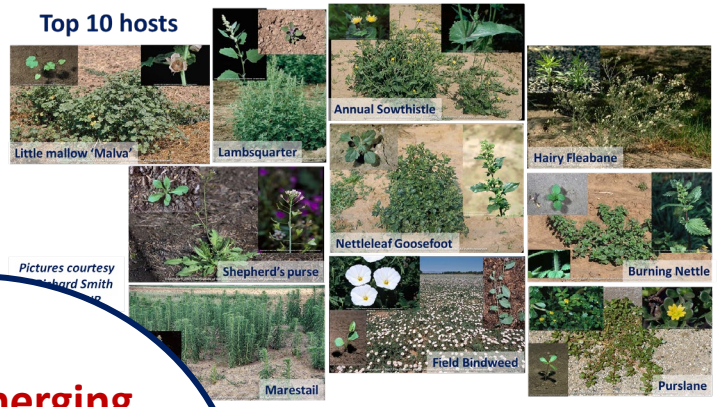

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Integrated Pest Management (IPM): Perspective

pathogens

MDPI

Article

Development of an IPM Strategy for Thrips and *Tomato spotted wilt virus* in Processing Tomatoes in the Central Valley of California

Ozgur Batuman [1,*], Thomas A. Turini [2], Michelle LeStrange [3], Scott Stoddard [4], Gene Miyao [5], Brenna J. Aegerter [6], Li-Fang Chen [7], Neil McRoberts [8], Diane E. Ullman [9] and Robert L. Gilbertson [8]

Research Team:
University of California Davis, Plant Pathology: 2
University of California Davis, Entomology: 2
University of California Cooperative Extension: 5

Research began: 2007
IPM paper published: 2020

Monterey County's Top Crops: 2020

Crop	Gross Production Value	Ac / ha	U.S. contribution
Strawberries	$922,683,000	10,044 / 4,064	28%
Leaf Lettuce	$712,681,000	54,912 / 22,222	61%
Head Lettuce	$428,580,000	39,077 / 15,813	56%
Broccoli	$341,495,000	43,943 / 17,783	48%
Cauliflower	$192,790,000	17,138 / 6,935	30%
Spinach	$141,284,000	16,430 / 6,648	38%
Nursery/Flower	$119,836,000	565 / 228	-
Brussel Sprout	$116,250,000	6,094 / 2,466	-
Celery	$114,920,000	9,905 / 4,008	57%
Wine Grapes	$105,991,000	44,886 / 18,164	3.6%

>100 different crops grown in Monterey County

FARM BUREAU MONTEREY

MONTEREY COUNTY AGRICULTURAL COMMISSIONER

Integrated Pest Management (IPM) model

Dara, 2020

THANK YOU

Collaborating scientists at:

USDA

University of California Cooperative Extension

California State University Monterey Bay

University of California, Davis

University of California, Riverside

Grower-Shipper Association INSV/Pythium Task Force

Assembly member Robert Rivas and CA Ag Committee

USDA Agricultural Research Service

California Leafy Greens Research Program

cdfa California Department of Food & Agriculture

California Environmental Protection Agency dpr Department of Pesticide Regulation

Grower-Shipper Association of Central California Since 1930