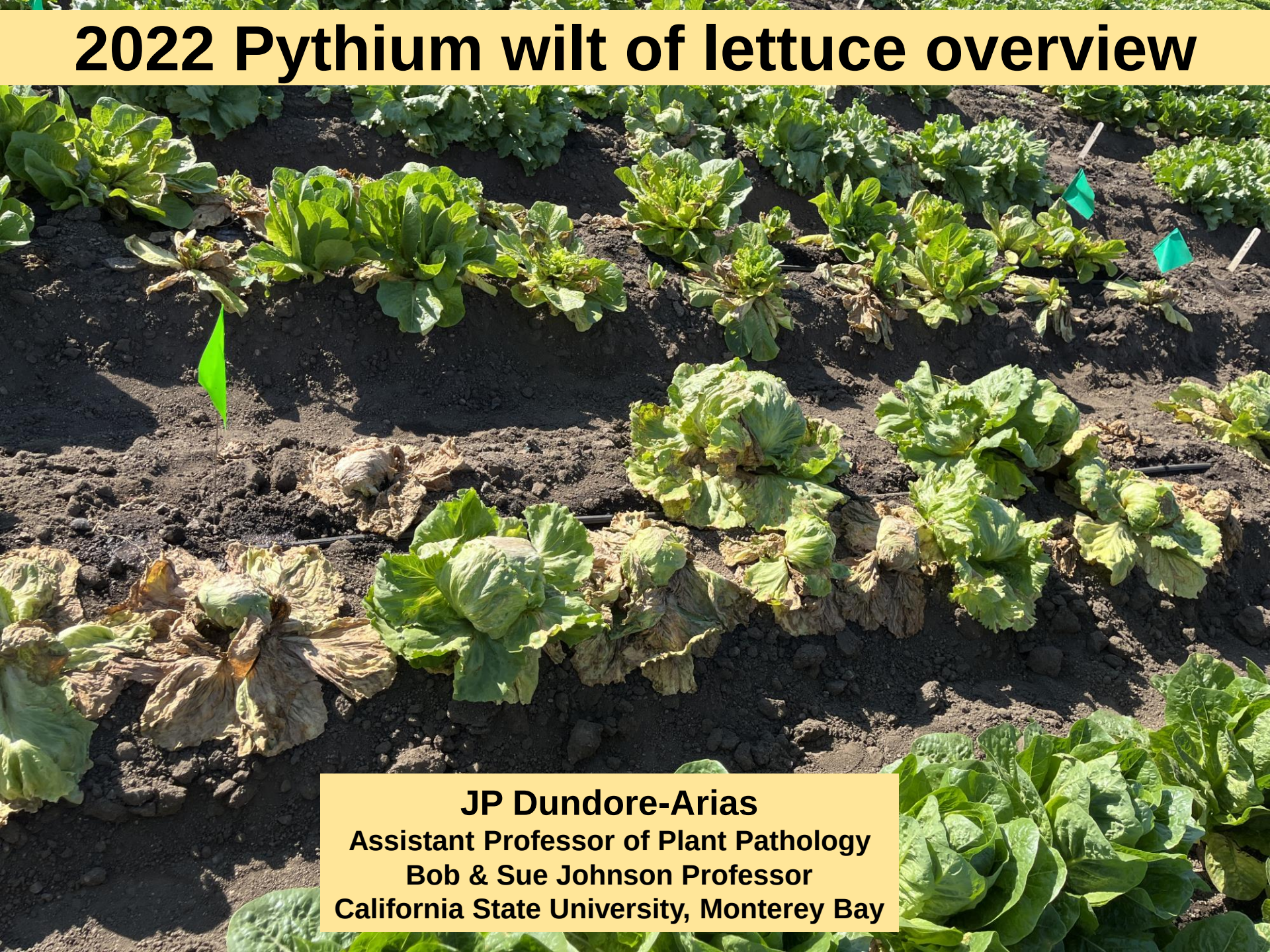
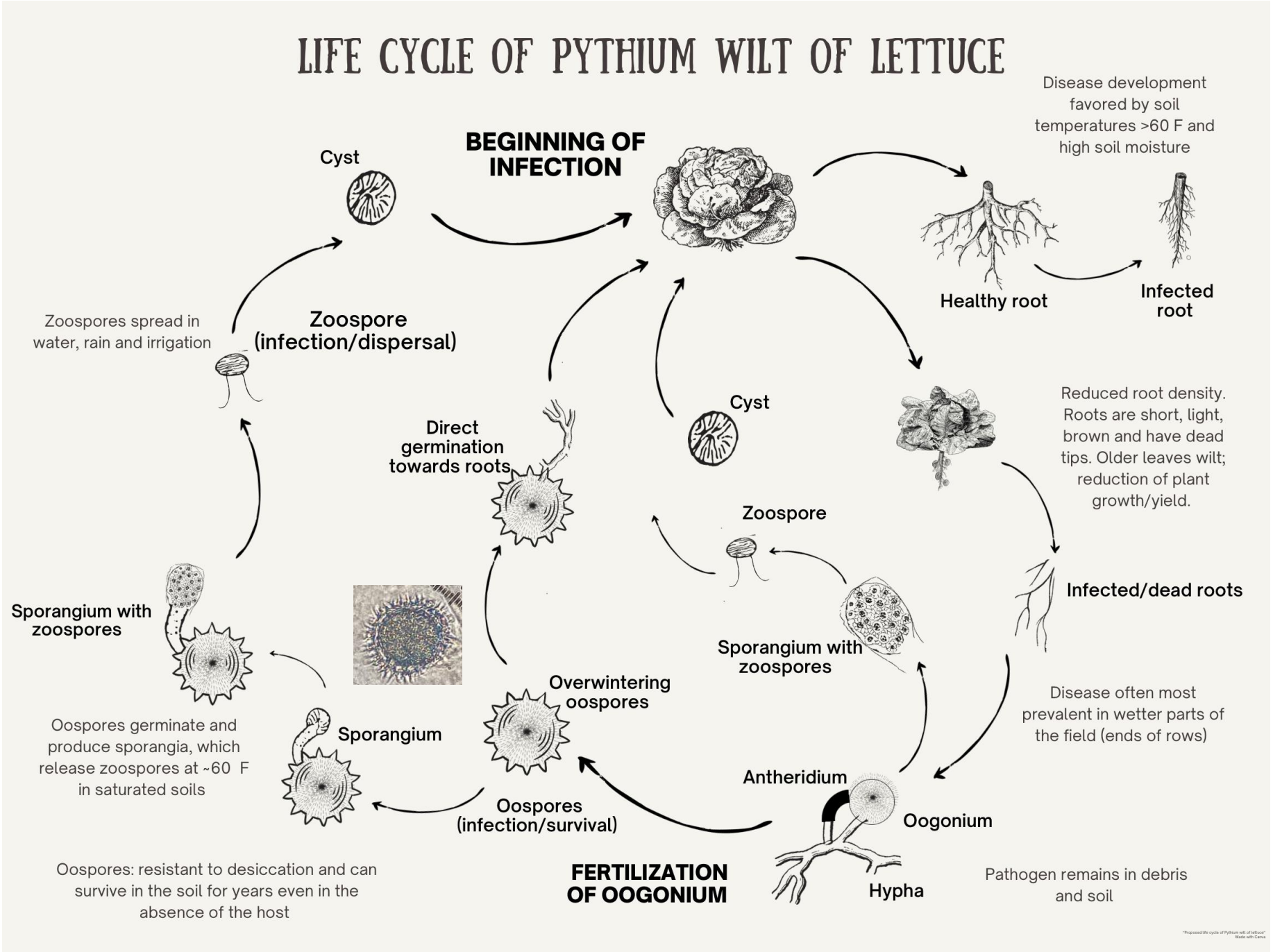
2022 Pythium wilt of lettuce overview



JP Dundore-Arias
Assistant Professor of Plant Pathology
Bob & Sue Johnson Professor
California State University, Monterey Bay

LIFE CYCLE OF PYTHIUM WILT OF LETTUCE



Dundore-Arias & Smith, 2022

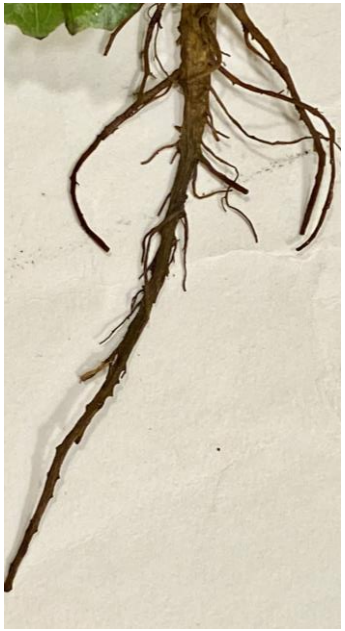
Pythium wilt of lettuce: Symptoms aboveground

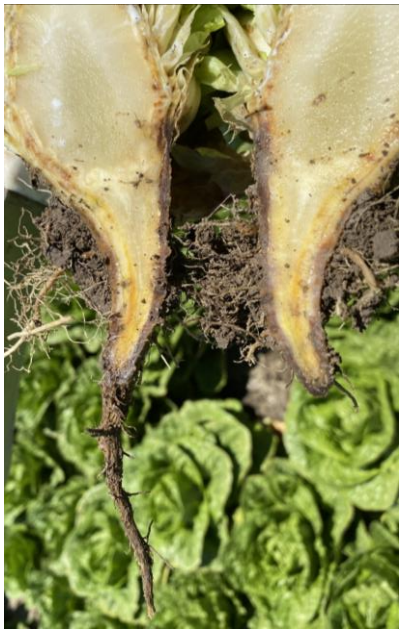
- Infected plants are characteristically **smaller**, contrasting with healthy adjacent plants
- Outer/older leaves are **yellow and wilted**
- Infected plants look **“water-stressed”**
- At **early stages wilting** occurs during the warmest point of the day while plants recover during the night
- Symptoms become irreversible leading to **plant desiccation and death**



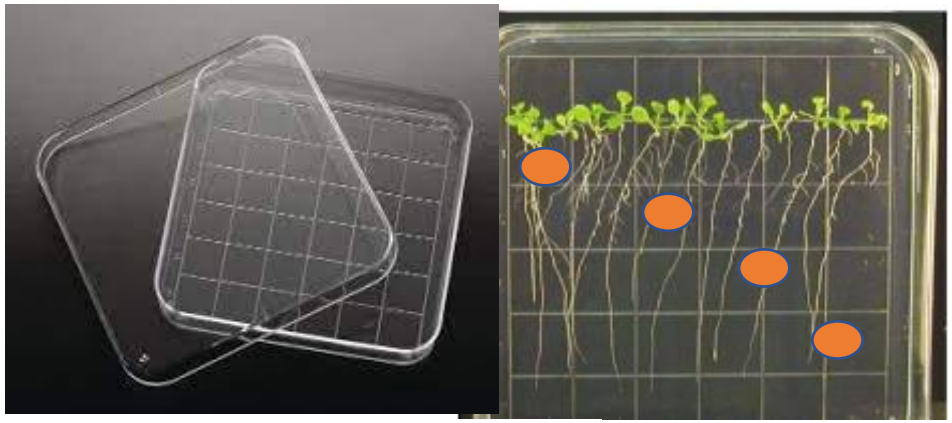

Pythium wilt of lettuce: Symptoms belowground

- Taproot of the infected plant is **misshapen, rough, discolored, and lacking in secondary rootlets**
- Root depth is severely impaired with **water-soaked and typically necrotic tissue**
- External **necrosis with no vascular discoloration** (exception of advanced infection)

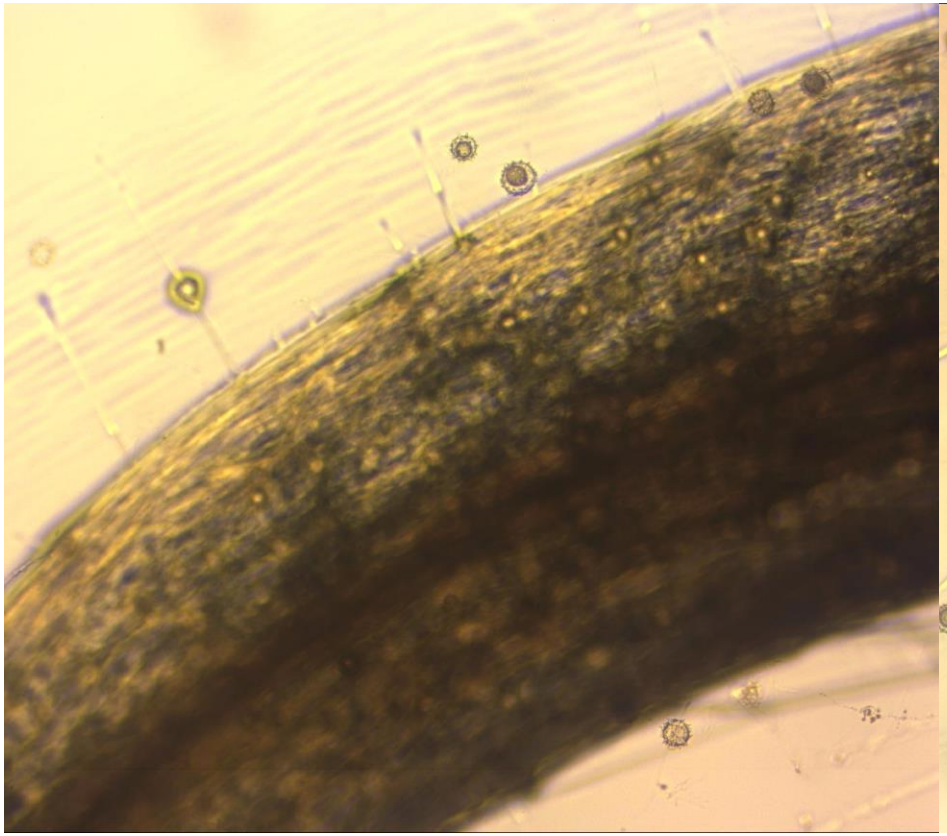
Localization of Pythium wilt pathogen inside the plant

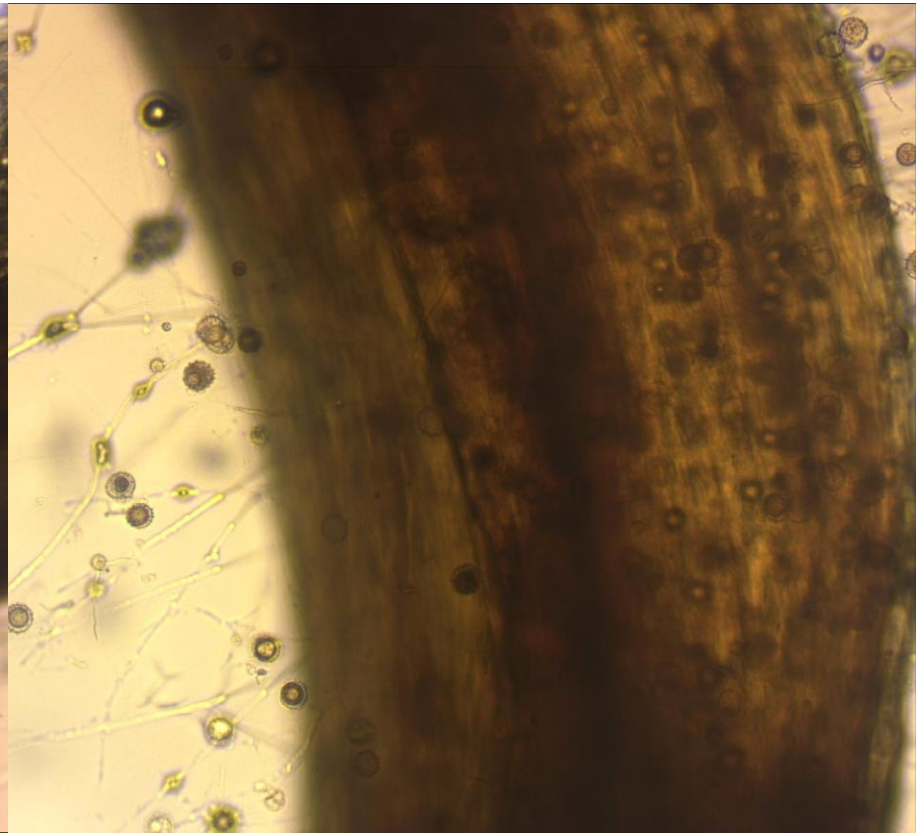


- Square agar plate with germinated seedlings
- *P. uncinulatum* added at different depths

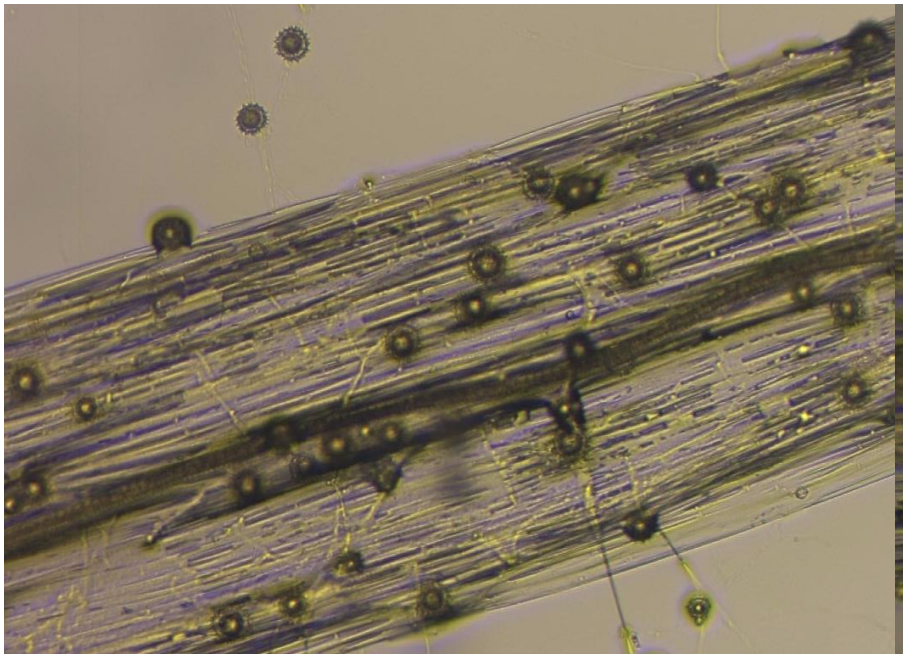
- Microscopy imaging

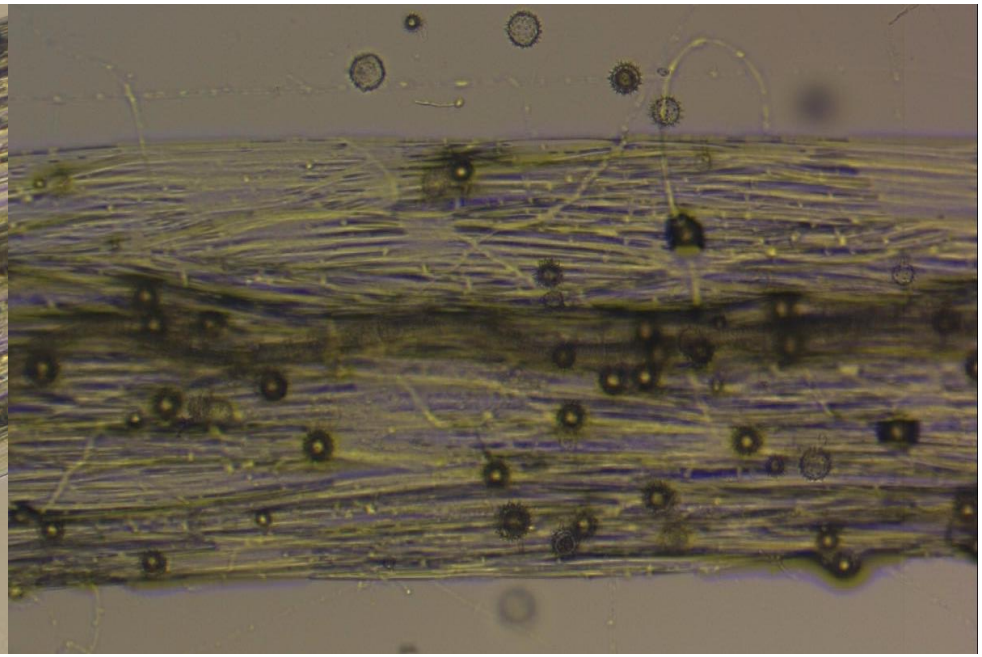
Oospores around and on the surface and in roots



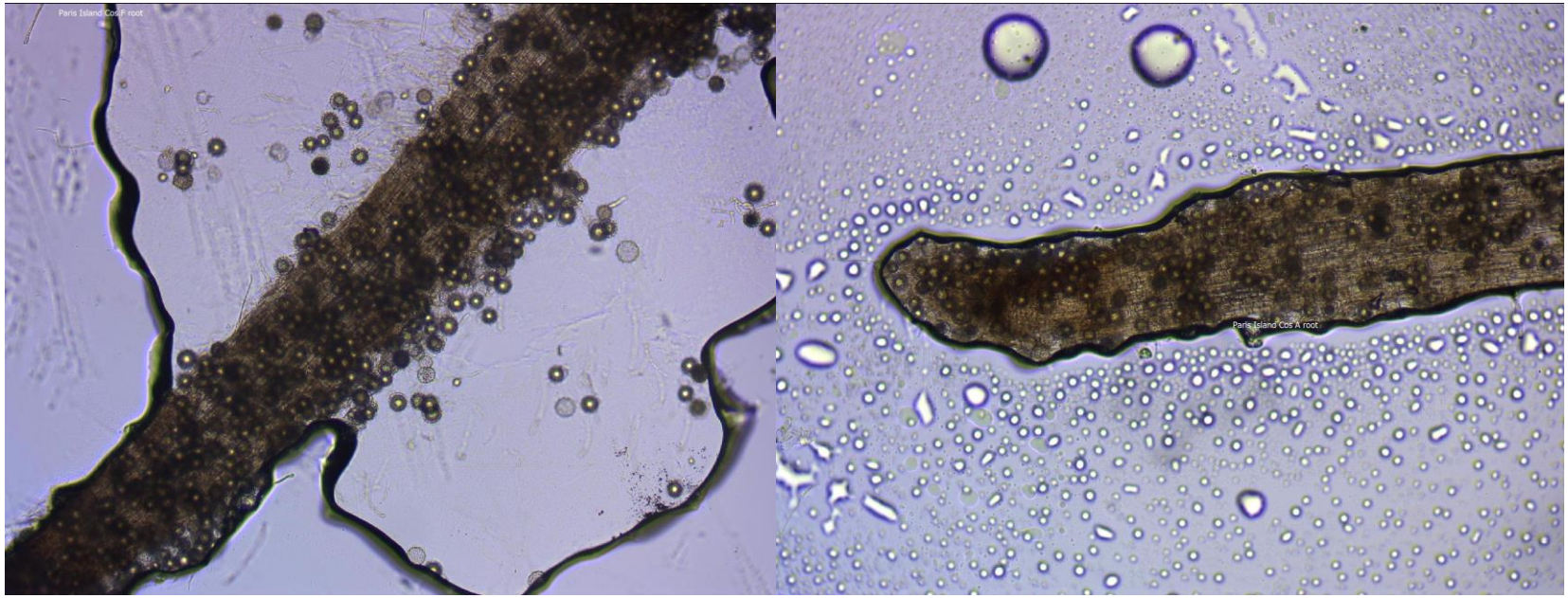


Oospores in the roots

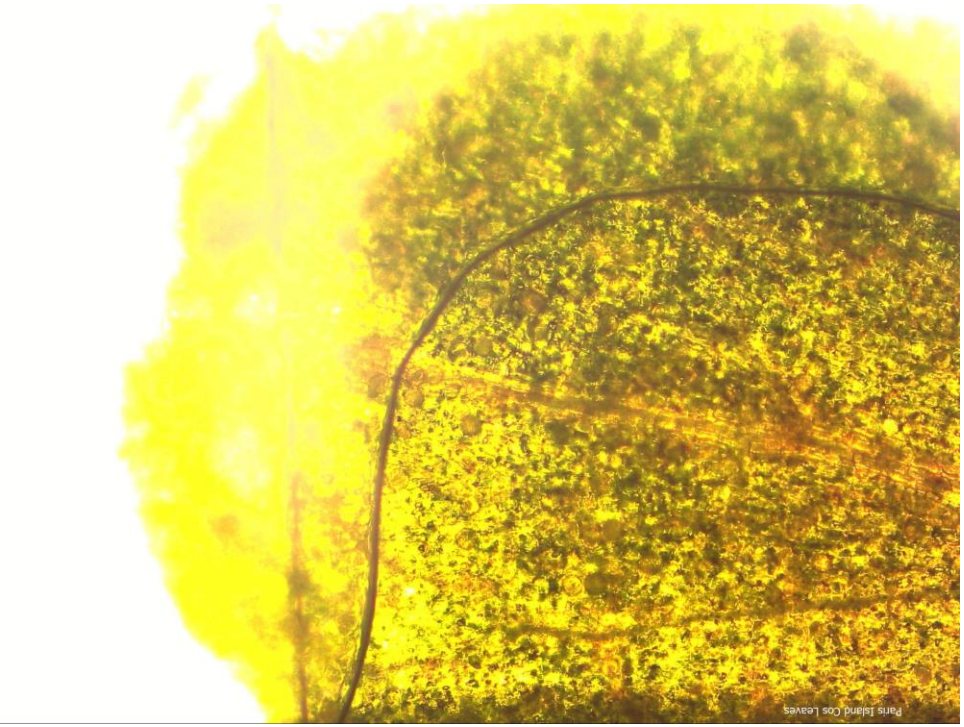


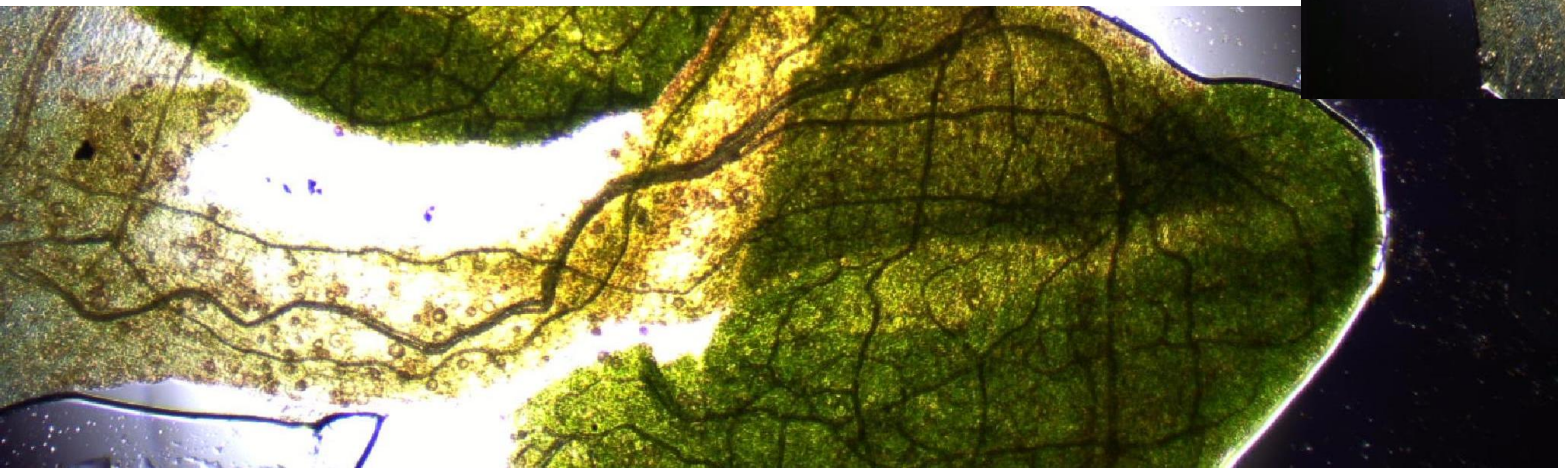


Oospores in the seedling stems



Oospores in the seedling leaves





Variety Trial for Pythium Wilt Tolerance

- Characterize disease tolerance/susceptibility of each variety (R. Smith, stay tuned!)
- Monitoring temporal changes in symptom development and disease incidence
- Determine the accuracy of above-ground wilting symptoms to predict Pythium Wilt infection

In collaboration with
Richard Smith
(SB170 grant)

Variety Trial for Pythium Wilt Tolerance

Tyler Barton
BS in Biology,
Fall 2022
Hire Him!!!

Carlos Rodriguez
UCCE

@ Spence Farm:

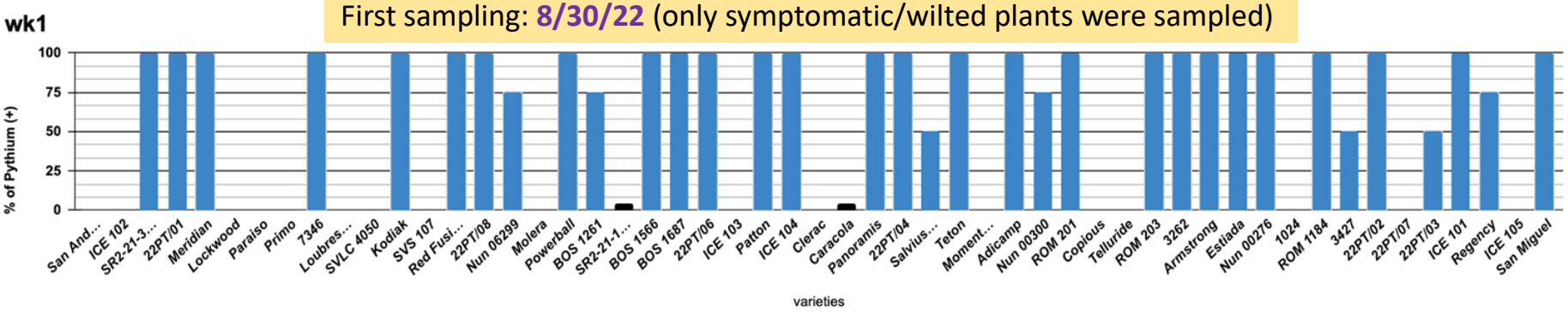
- Planting 7/12/22 (block 2)
- Samples (n=3) collected after the onset of symptom development (8/30/22)

@CSUMB:

- Roots were washed and photographed (week 3)
- Symptomatic root tissue showing some level of discoloration (even if plants were not wilted) was plated on a semi-selective media
- 4 replicates/sample
- Morphological characterization
- Isolate purification and molecular ID confirmation (ongoing)

Pythium Wilt incidence increases over time

First sampling: **8/30/22** (only symptomatic/wilted plants were sampled)



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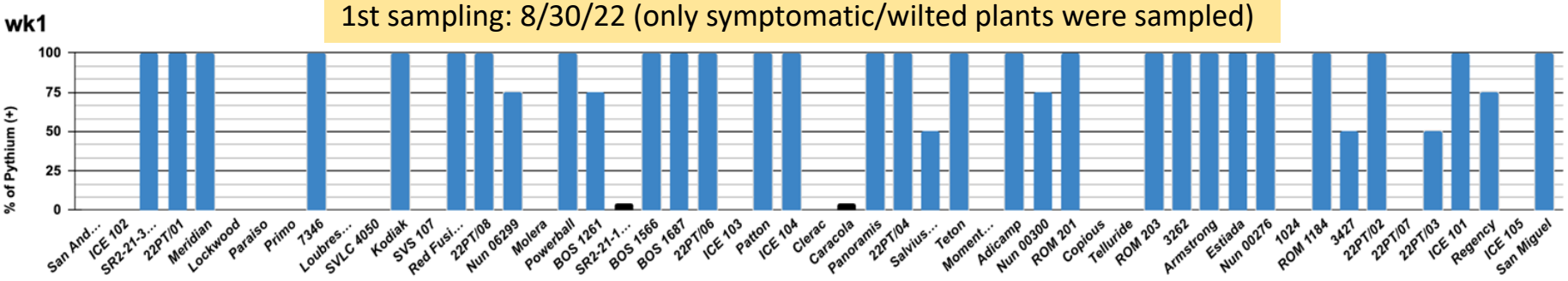
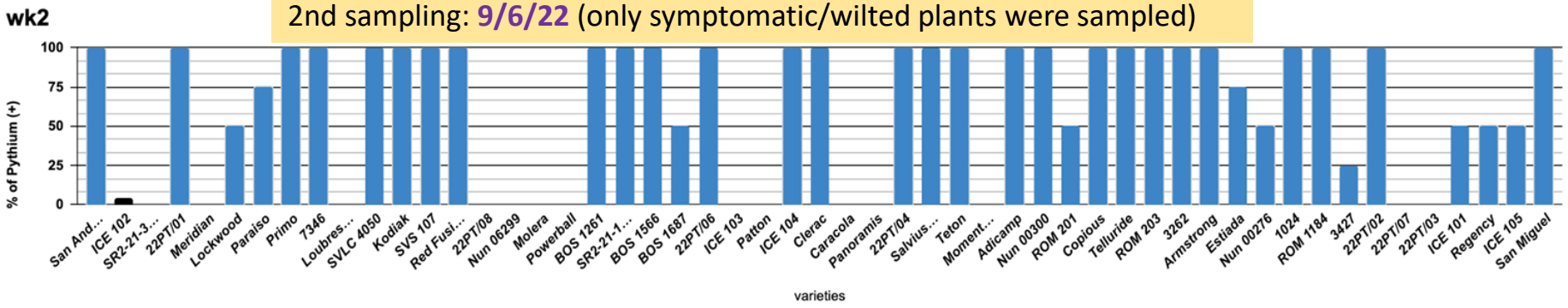


2nd sampling: **9/6/22** (only symptomatic/wilted plants were sampled)



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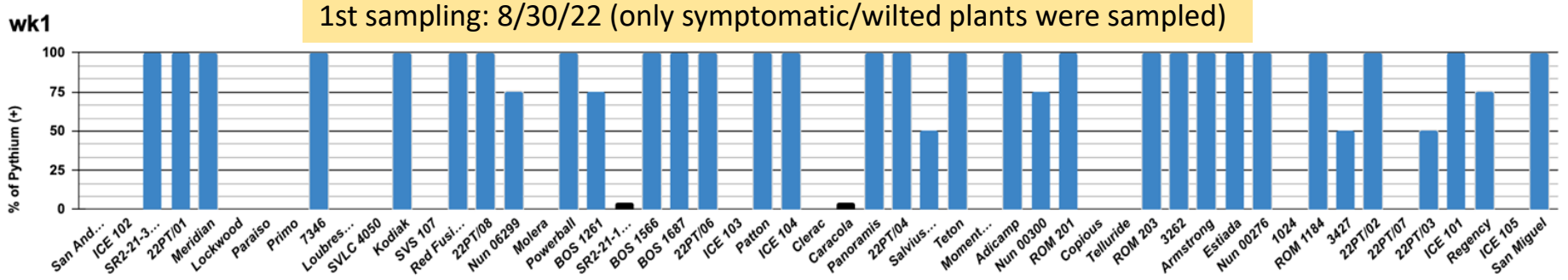

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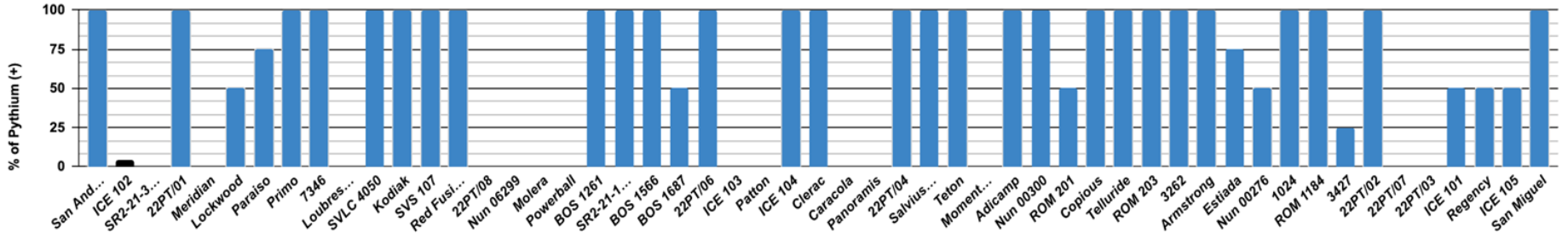
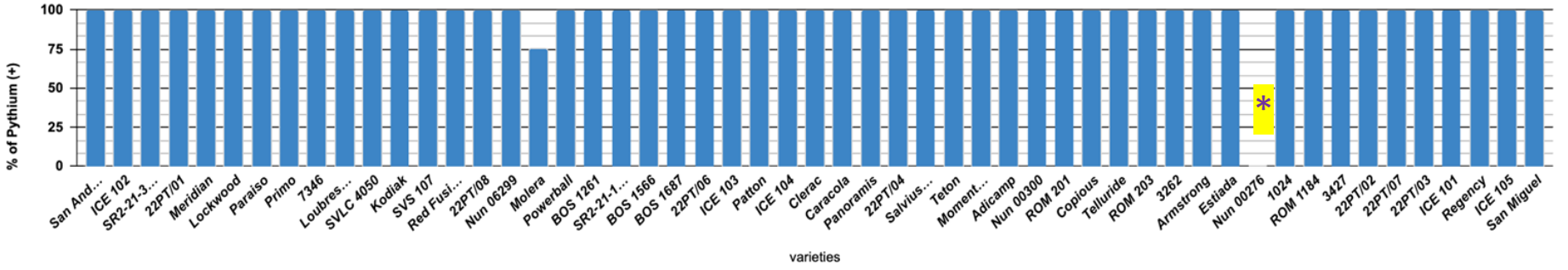
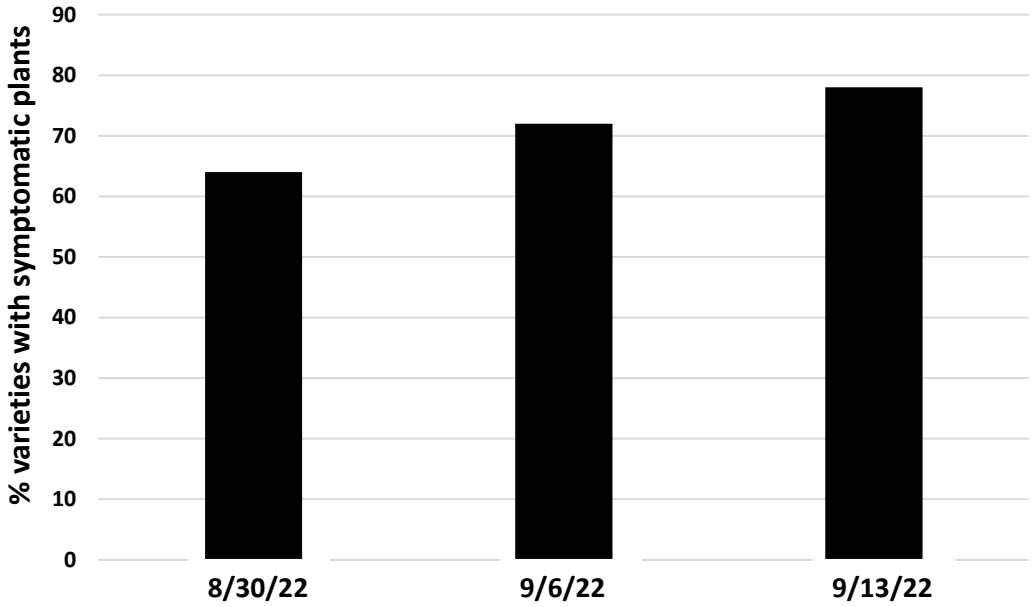


3rd sampling: **9/13/22** (both symptomatic/wilted and asymptomatic plants were sampled)



Pythium Wilt incidence increases over time



Overall observations:

- Symptom development and disease incidence progressed quickly
- High and widespread incidence of Pythium wilt in this trial, which worsened over time

Characterization of Disease Development

Wilting + : Root rot +

plants are symptomatic both above and below ground, and tested (+) for *Pythium*

Wilting + : Root rot -

plants are predominantly asymptomatic below ground, symptomatic above ground, and tested (+) for *Pythium*

Wilting - : Root rot +

plants are asymptomatic above ground, symptomatic below ground, and tested (+) for *Pythium*

Wilting - : Root rot -

plants are predominantly asymptomatic both above and below ground, but still tested (+) for *Pythium*

Characterization of Disease Development

Wilting + : Root rot +

68%

plants are symptomatic both above and below ground, and tested (+) for *Pythium*

Wilting + : Root rot -

9.5%

plants are predominantly asymptomatic below ground, symptomatic above ground, and tested (+) for *Pythium*

Wilting - : Root rot +

15%

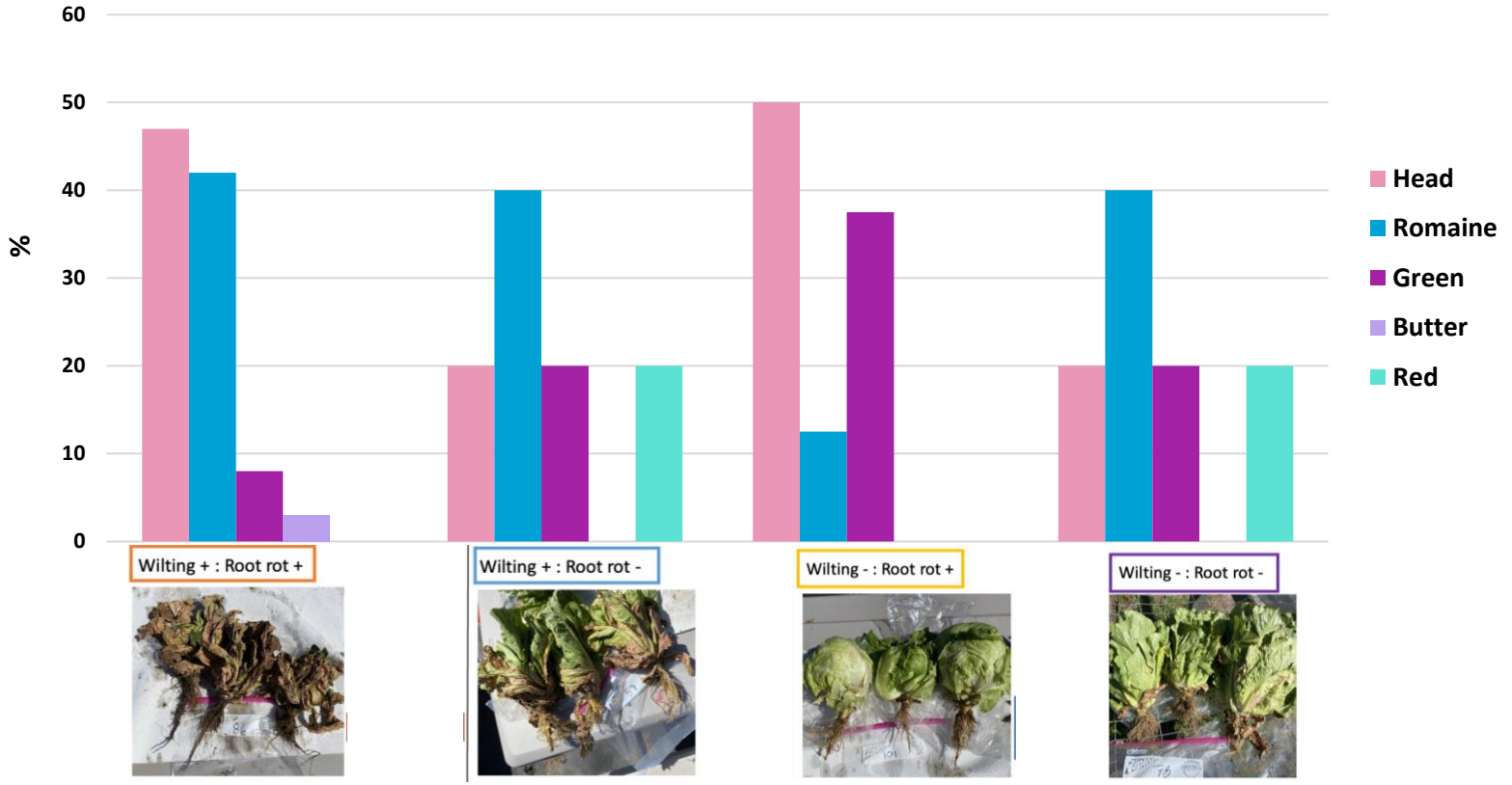
plants are asymptomatic above ground, symptomatic below ground, and tested (+) for *Pythium*

Wilting - : Root rot -

7.5%

plants are predominantly asymptomatic both above and below ground, but still tested (+) for *Pythium*

Characterization of Disease Development



Overall observations:

- Severe above-ground Pythium wilt symptoms were accurate predictors of infection, but already too late for any management intervention

- By the last week of the trial, all plants were infected with Pythium wilt, but disease development varied across varieties

Further Evaluations: Susceptible & tolerant varieties

In-vitro

Day 1 Day 5

P. uncinulatum

Control

Growth chamber

Overall observations:

- Consistent results from both *in-vitro* and inoculation trials revealing no ‘resistance’
- Additional work needs to be done to fine-tune methods to recognize/characterize tolerance

Six key characteristics to identify Pythium wilt

- Stunted wilting plants, with older leaves yellow/brown and upright/green younger tissues
- No soft/watery decay of crowns or roots
- Plants are not easily pulled from the ground
- Not vascular discoloration of roots or crowns
- Taproot exterior with distinctly dark brown to black rotting (necrosis)
- Feeder roots with extensive rotting or missing




Pythium wilt

Black root rot

Lettuce drop

Verticillium wilt

Fusarium wilt

Botrytis Crown Rot

Pythium wilt of lettuce: Diagnostics

- Symptoms can easily be mistaken for other diseases caused by soilborne (*Sclerotinia, Botrytis, Verticillium, Fusarium* and *Thielaviopsis*) or foliar pathogens (*Impatiens necrotic spot virus* or *Lettuce necrotic stunt virus*)

Table 1. Comparison of symptoms caused by soilborne pathogens of lettuce.

Symptoms	Pythium	Sclerotinia	Botrytis	Fusarium	Verticillium	Thielaviopsis
Small, stunted plants	yes	yes	yes	yes	no	yes
Wilted leaves	yes	yes	yes	yes	yes	no
Yellowed leaves	yes	yes	yes	yes	yes	no
Collapsed plants	yes	yes	yes	yes	yes	no
Decayed crowns	no	yes	yes	no	no	no
Vascular discoloration	no	no	no	yes	yes	no
Rotted root system	yes	no	no	no	no	no
Brown bands on roots	no	no	no	no	no	yes

Source: S. Koike

When unsure, send a sample to a disease diagnostics clinic (CDFA, TriCal Diagnostics)

Dundore-Arias Lab @CSUMB

Collaborators

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Alex Putman, UCR
Steve Koike, TriCal Diagnostics
PCAs and Growers
GSA INSV-Pythium Task Force

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Thank You!

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