



# An Overview of the Crop Bioprotection Research Unit

Ephantus Muturi  
USDA-ARS



# Mission



National Center for Agricultural  
Utilization Research Peoria, IL

Agricultural Research Service

- Deliver scientific solutions to national and global agricultural challenges.

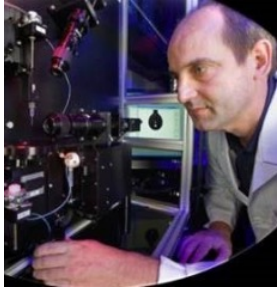
# RESEARCH FOCUS

- Develop new biological control products, processes and methods to control crop pests, plant diseases, and rural public health threats.
- The goal is to develop performance-competitive biological control technologies that reduce the use of chemical pesticides for a variety of farm and rural public health applications.

# PEOPLE



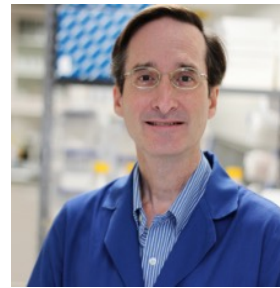
**Ephantus Muturi**  
Research  
Entomologist



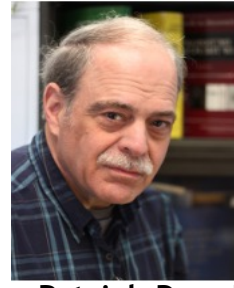
**Chris Dunlap**  
Research  
Chemist



**Jose Loius Ramirez**  
Research  
Entomologist



**Eric Johnson**  
Research Molecular  
Biologist



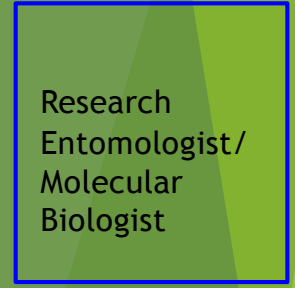
**Patrick Dowd**  
Research  
Entomologist



**Jeannie Klein-Gordon**  
Research Plant  
Pathologist



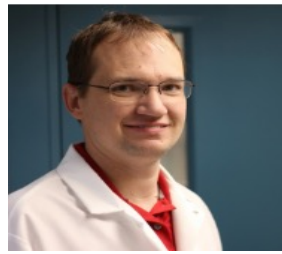
Research  
Microbiologist



Research  
Entomologist/  
Molecular  
Biologist



**Haley Gore**  
Biological Science  
Technician



**Mark Doehling**  
Biological Science  
Technician



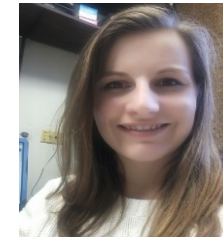
**David Lee**  
Biological Science  
Technician



**Erica Goett**  
Biological Science  
Technician



**Heather Walker**  
Biological Science  
Technician



**Maddy Adolf**  
Biological Science  
Technician



**Angela Payne**  
Biological Science  
Technician



**Kristin Duffield**  
Postdoc



**Lina Flor-Weiler**  
Entomologist



**Benjamin Ross**  
ORISE Fellow



**Sol Pinto**  
Visiting Scientist

# Current Projects

## **NP303: Plant Diseases**

Microbe-pathogen Interactions for Biological Control of Plant Diseases.

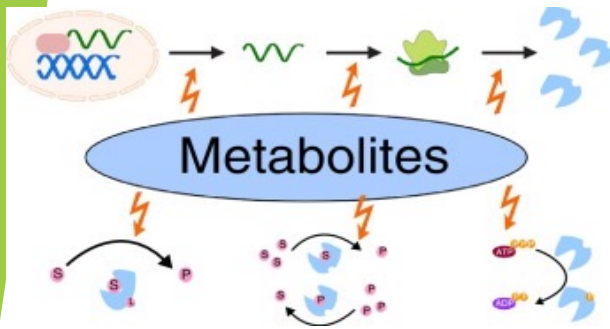
## **NP304: Crop Protection and Quarantine**

Discovery and Production of Beneficial Microbes for Control of Agriculture Pests.

## **NP104: Veterinary, Medical, and Urban Entomology**

Discovery and development of Microbial and Plant-Based Agents for Mosquito and Tick Control.

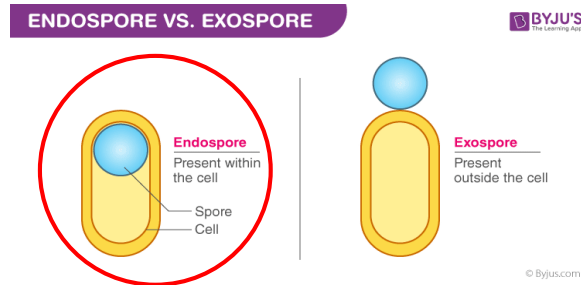
## NP 303: Understanding of Microbe-pathogen Interactions for Biological Control.



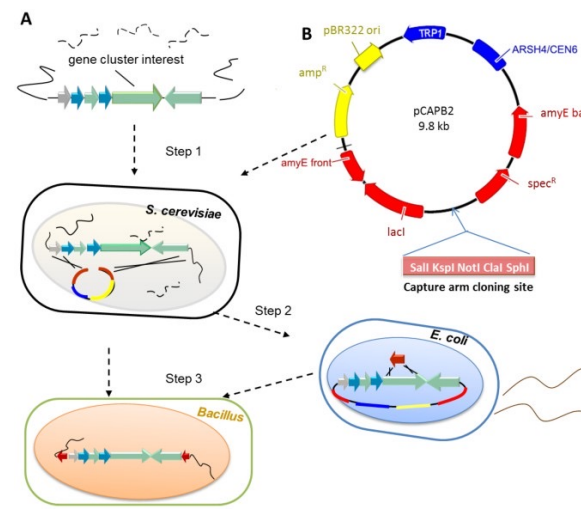
Identify new bioactive metabolites through genome mining.



Improved methods for application of beneficial microbes as crop protectants and growth promoters.



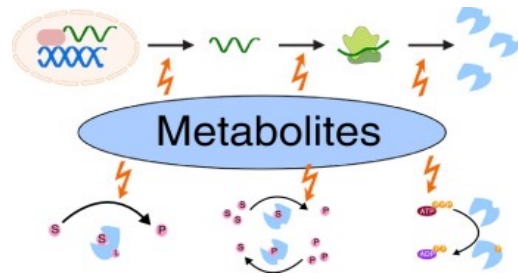
Identify new microbial agents that can be commercialized for crop protection.



Understand mode of action of microbial products when used as seed coating.

- Clone large biosynthetic gene clusters (BGCs) from a variety of bacteria into a well-studied laboratory host.
- Identify and purify the novel compounds produced by uncharacterized BGCs.
- Bioassay tests for antifungal and antibacterial activity.

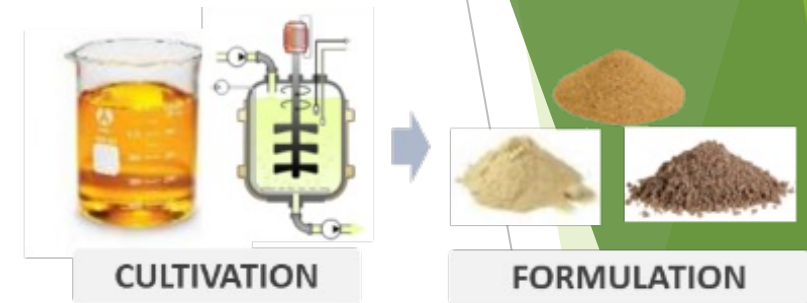
# NP 304: Discovery and Production of Beneficial Microbes for Control of Agriculture Pests



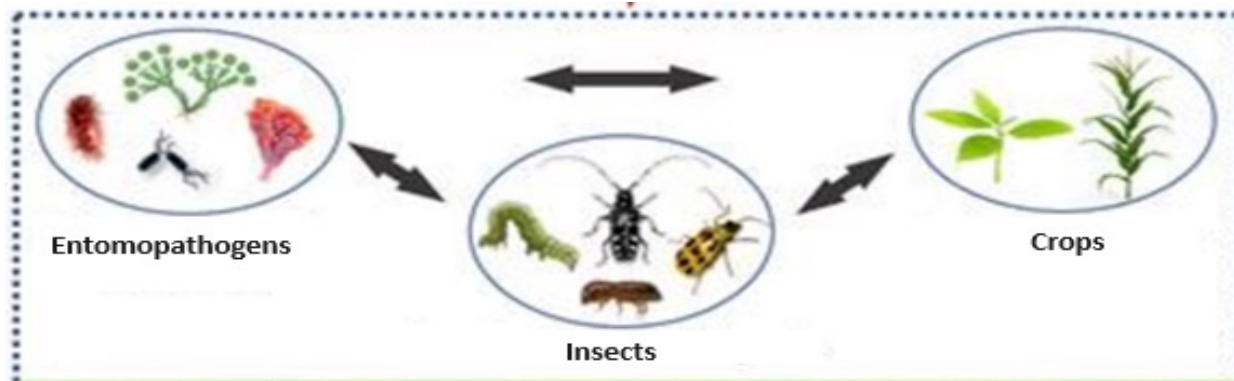
Identify new bioactive metabolites through genome mining.



Identify novel entomopathogenic bacteria and fungi for managing agricultural pests.



Develop new methods for selection, production, and stabilization of microbial biocontrol agents.

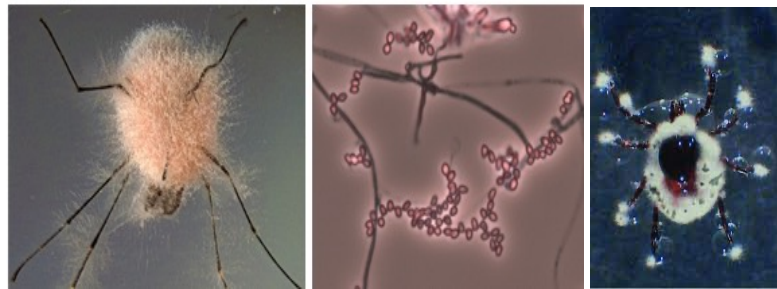


Expand fundamental knowledge of plant-insect-entomopathogen interactions.

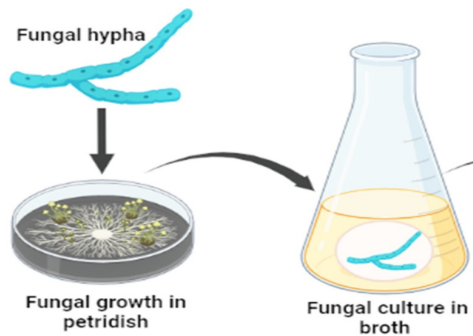


Characterize the microbiome of non-social bee species.

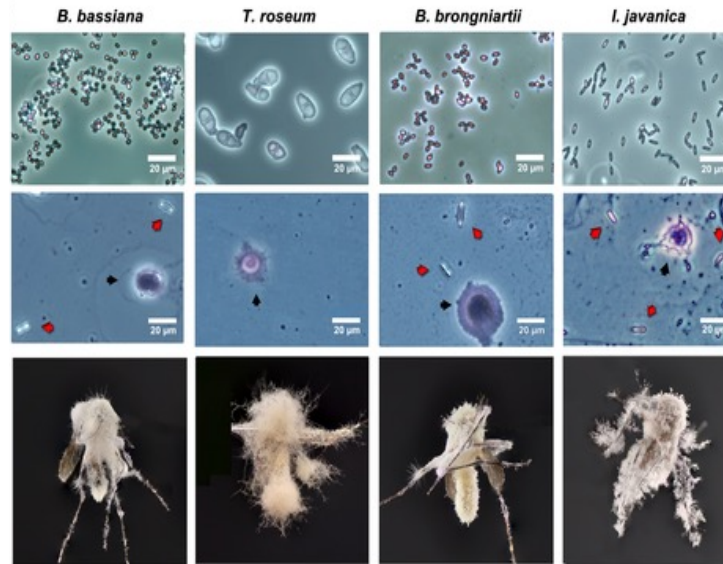
# NP 104: Microbial and Plant-Based Agents for Mosquito Control.



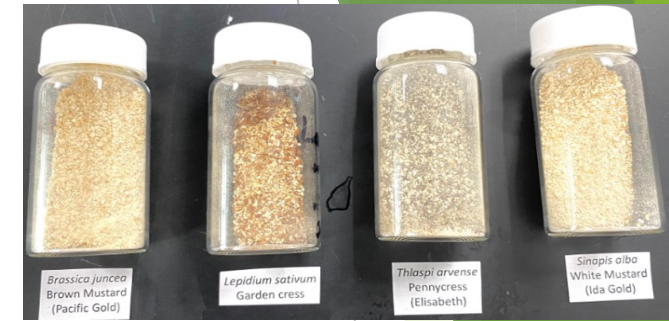
Identify novel entomopathogenic bacteria and fungi for mosquito and tick control.



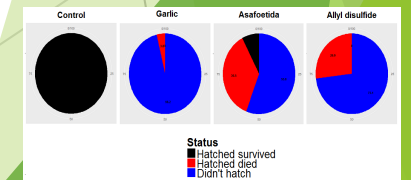
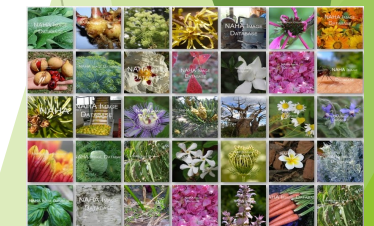
Identify microbial isolates with potential to produce bioactive with insecticidal and antimicrobial properties.



Understand the immune responses of the mosquito against entomopathogenic fungal infection and how the entomopathogen evades these immune responses to establish an infection.



- Utilization of brassica seed meals as biofumigants for tick control and larvicides for mosquito control.





# New Initiative

*MiniStock (Insect Meal Grand-Challenge)*

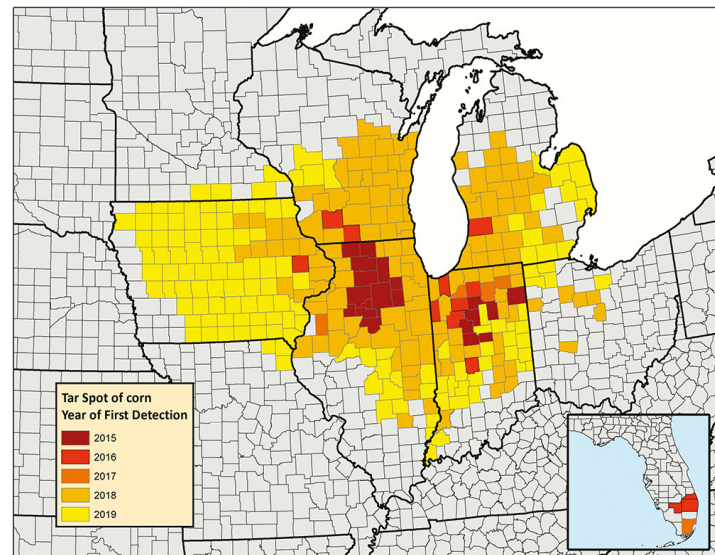
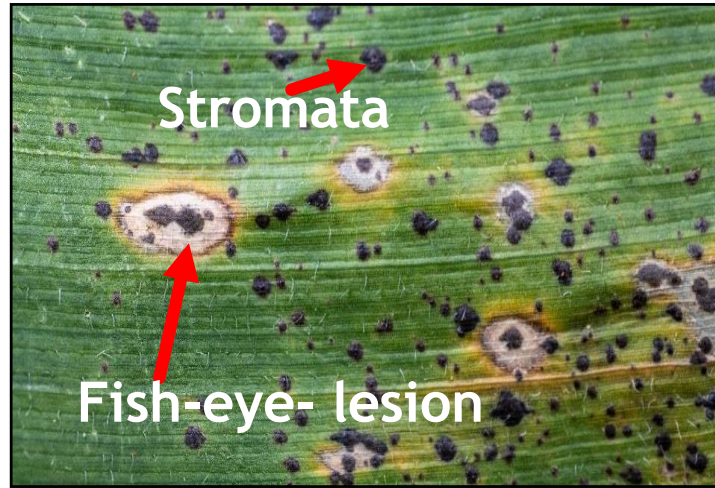


Viral entomopathogen surveillance and

Viral survey of farmed crickets in  
N. America (20 populations)

Cricket immune response to infection

# Tar spot of corn research

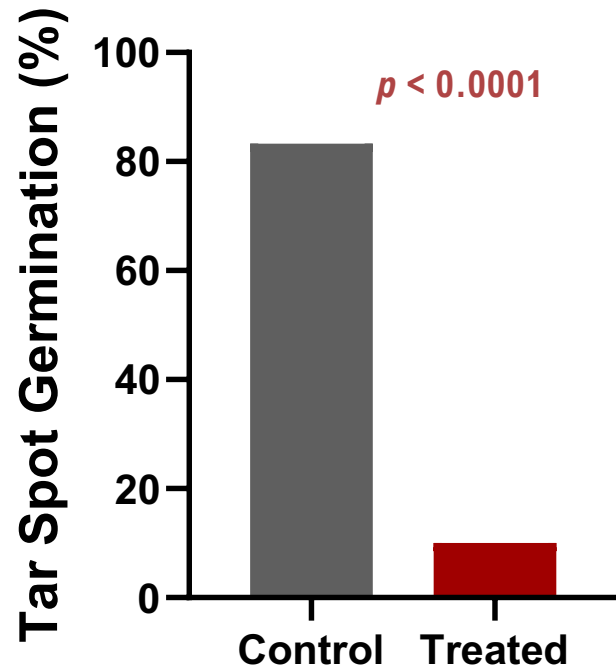


- Devastating foliar disease of corn characterized by small raised black spots (stromata) on leaves which can be surrounded by a tan halo, known as “fish-eye lesion”.
- Detected in the U.S. for the first time in Illinois and Indiana in 2015 and has now become widespread.
- In 2021, tar spot disease was associated with grain yield loss of 5.88 metric tons valued at US\$ 1.25 billion (Crop Protection Network).

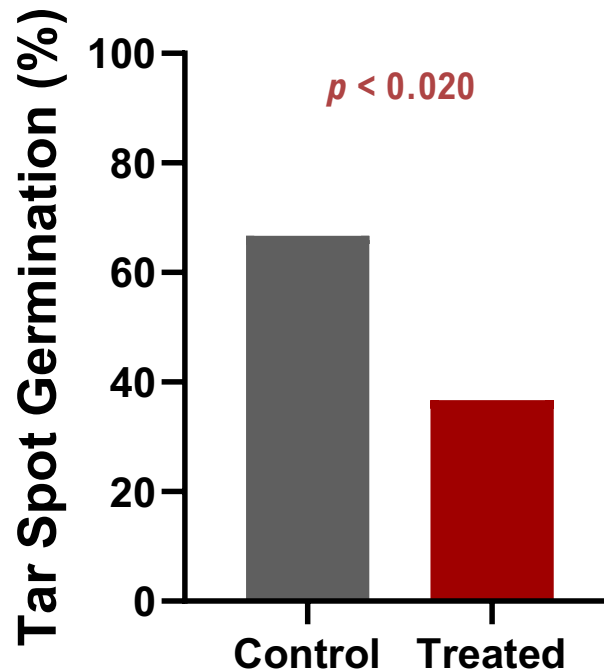
# Biological control agents for tar spot

Three beneficial fungi, one that is commercially available and two that were isolated from tar spot stromata inhibited tar spot germination in leaf assays.

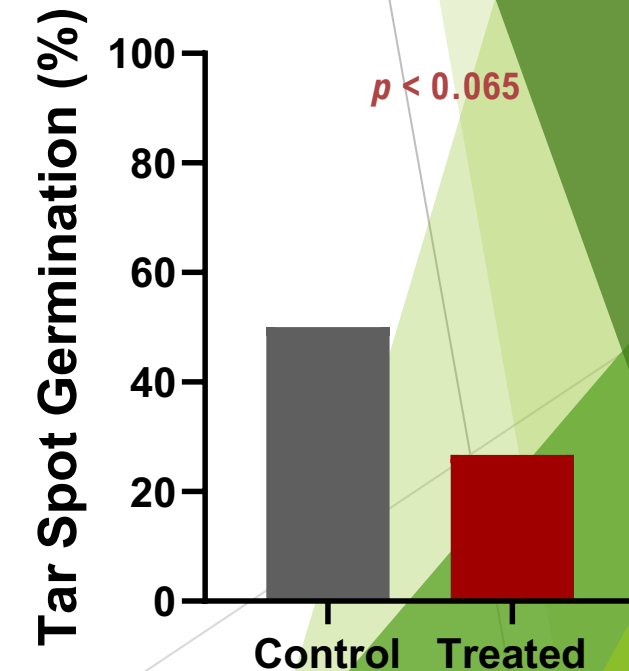
## *Gliocladium catenulatum* Microbe produced by Lallemand



## *Alternaria alternata / arborescens*

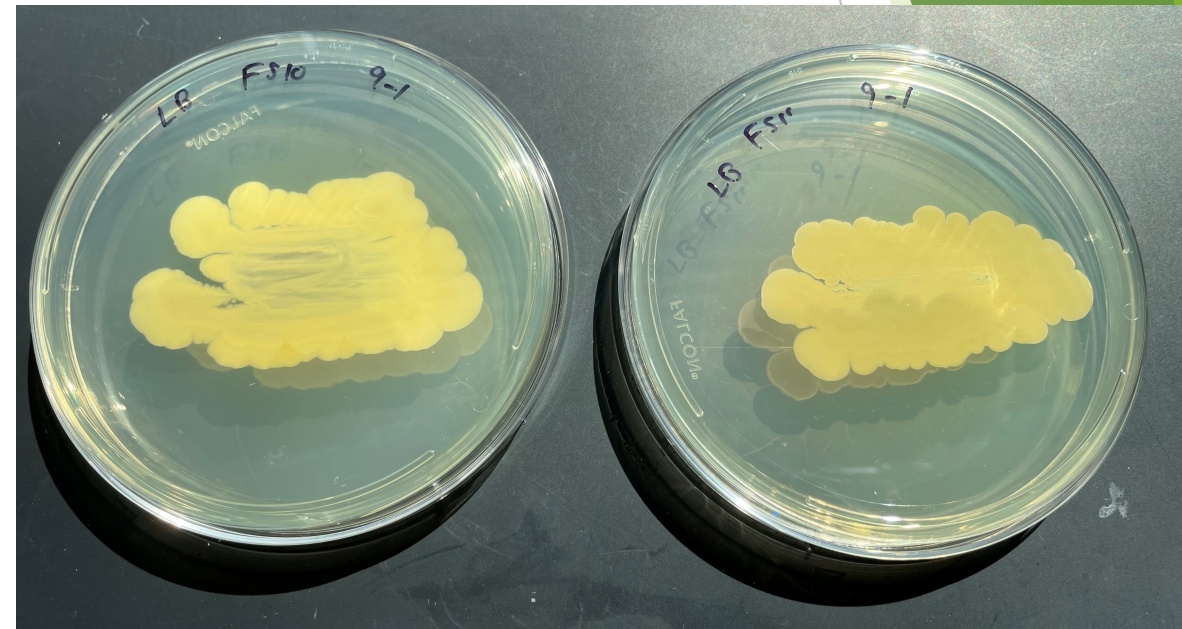
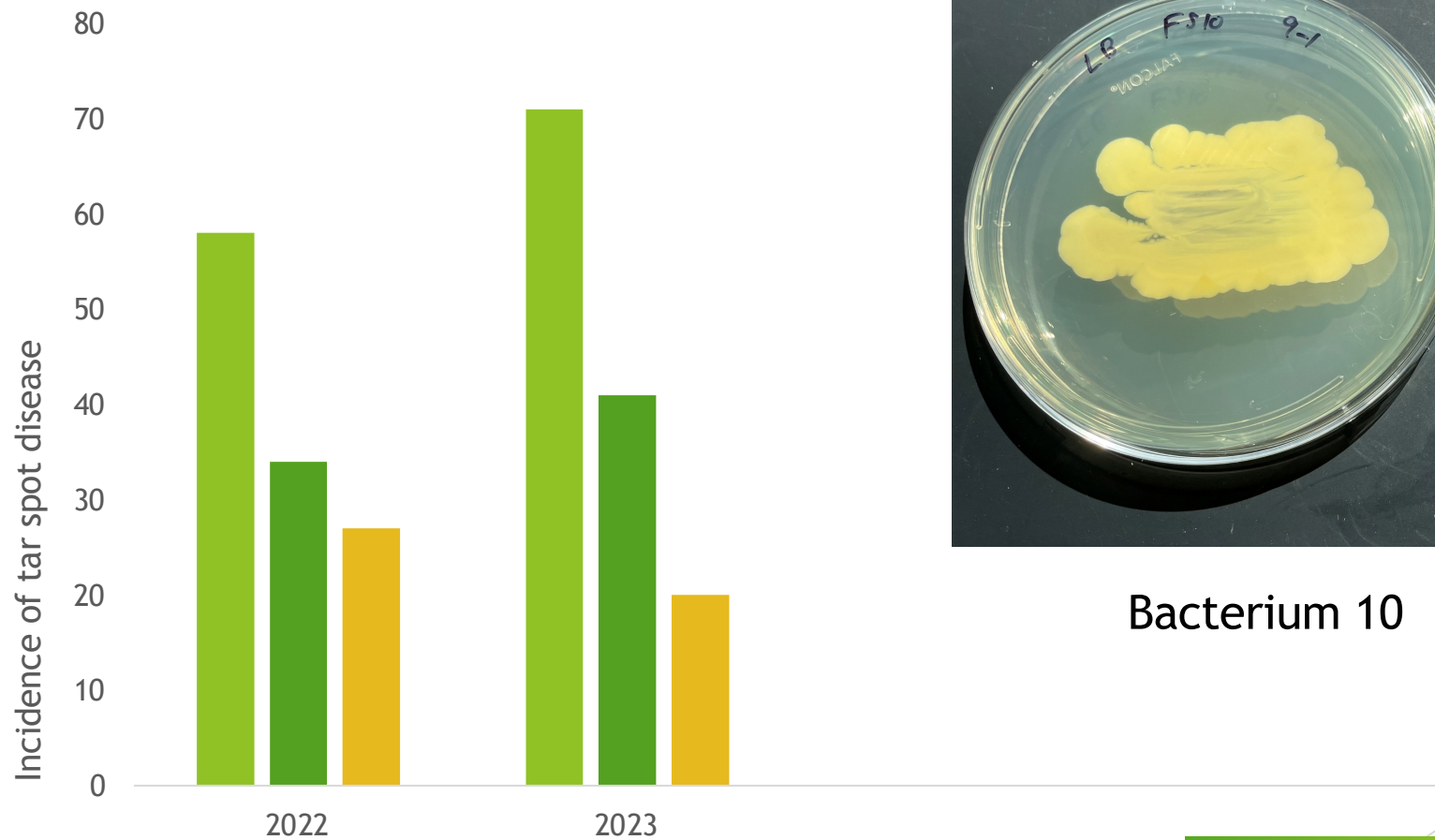


## *Cladosporium rectoides*



# Seed coating

Corn seed GE440 coated with bacteria suspensions and sown in a field plot in Peoria, Illinois in early summer had low incidence of tar spot disease compared to the untreated controls.



Bacterium 10

Bacterium 11

