Quantifying airborne inoculum of *Phomopsis*

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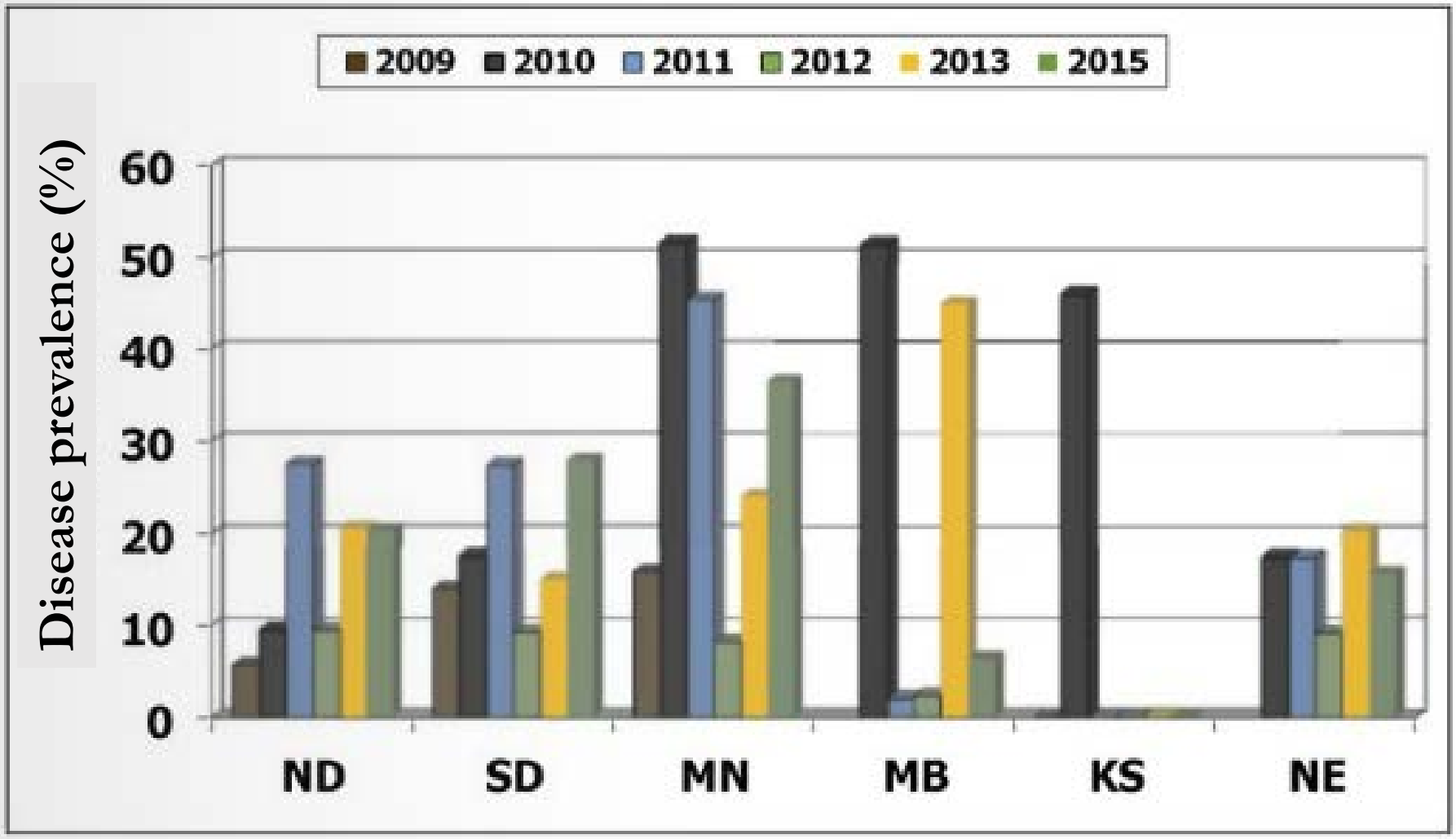
Prevalence of Phomopsis stem canker



(Hans Kandel and Tom Gulya, 2016 National Sunflower Association survey)

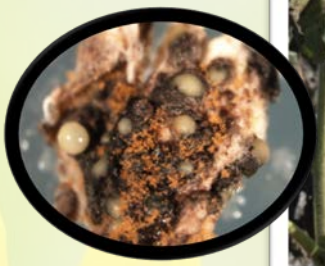
Phomopsis stem canker

- Three causal pathogens –
  - *P. helianthi* – detected in MN, ND, SD, OH, TX, IL and NE
  - *P. gulyae* - detected in MN, ND, SD, and NE
  - *P. stewartii* – detected in MN

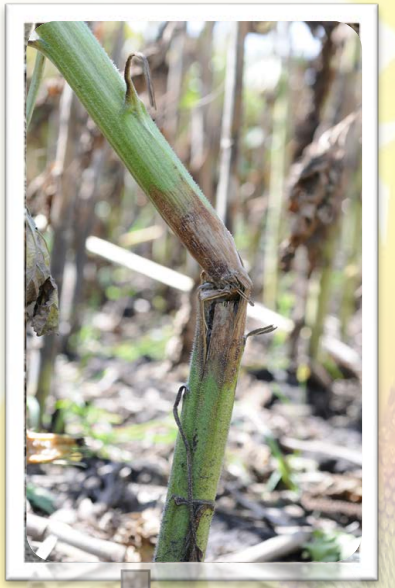
(Gulya et al. 2018, Herr et al. 1983; Mathew et al. 2015; Meyer et al. 2009; Olson et al. 2017; Yang et al. 1984)

Disease cycle

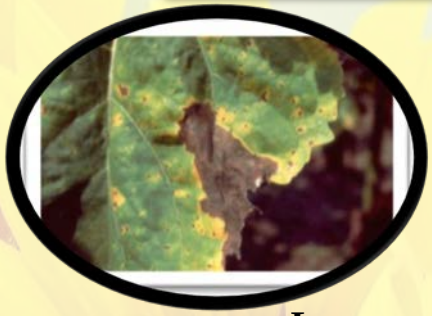
Lesions on the stems carry pycnidia (α-conidia and β-conidia)
Spring-Summer



Girdling lesions wilts and lodges the stem.
Summer



Relative humidity =90%
Temperatures = 21 to 26°C
Rainfall from budding to flowering



Leaves are infected at the margin by ascospores
Spring

Overwinters as mycelium in infested crop residues (perithecia)
Winter

Pictures by Dr. Sam Markell, Dr. Tom Gulya and Dr. Sue Thompson

Significance of the study

- Disease forecasting model
- Fungicide application timing

Research Objectives

1) Quantify the airborne inoculum of *P. helianthi* and *P. gulyae* over the growing season in MN, ND, SD and NE

2) Determine if the spore release by *P. helianthi* and *P. gulyae* is affected by weather.

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Quantifying *Phomopsis* inoculum

- Spore traps were established at 8 locations (MN=2, ND=2, SD=3, and NE =1)

- They were placed near or in the field (where fungicides were not applied)


08/11/2017


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Quantifying *Phomopsis* inoculum

- Assumption - spores are carried by prevailing winds

- Glass slides changed on a weekly or biweekly basis

Quantifying *Phomopsis* inoculum

Matter from glass slides

↓

DNA extraction (NucleoSpin kit)

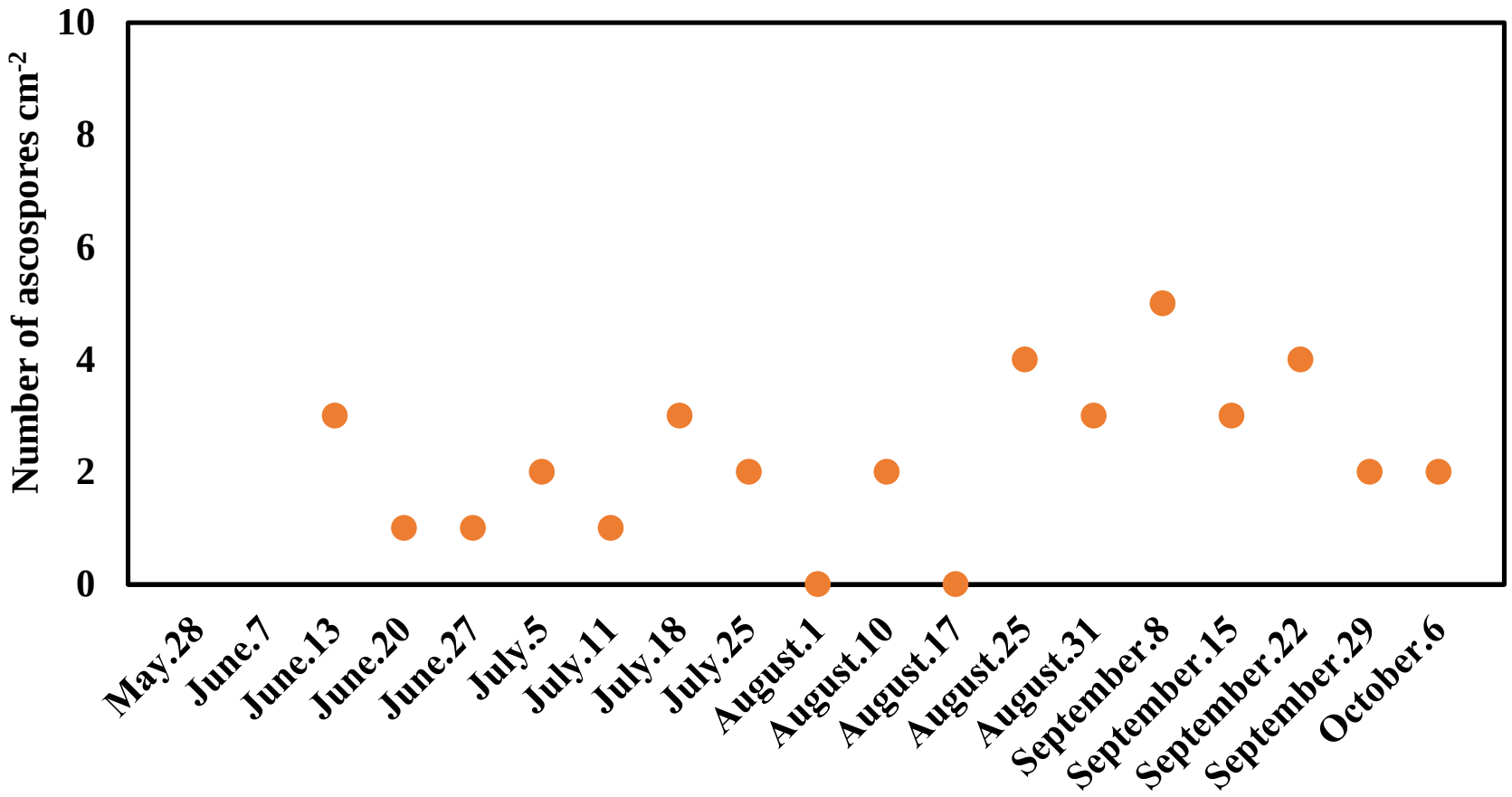
↓

Subjected to quantitative polymerase chain reaction (qPCR) that is specific to *P. helianthi* and *P. gulyae*

(Olson et al. 2016)

Results

Brookings, SD



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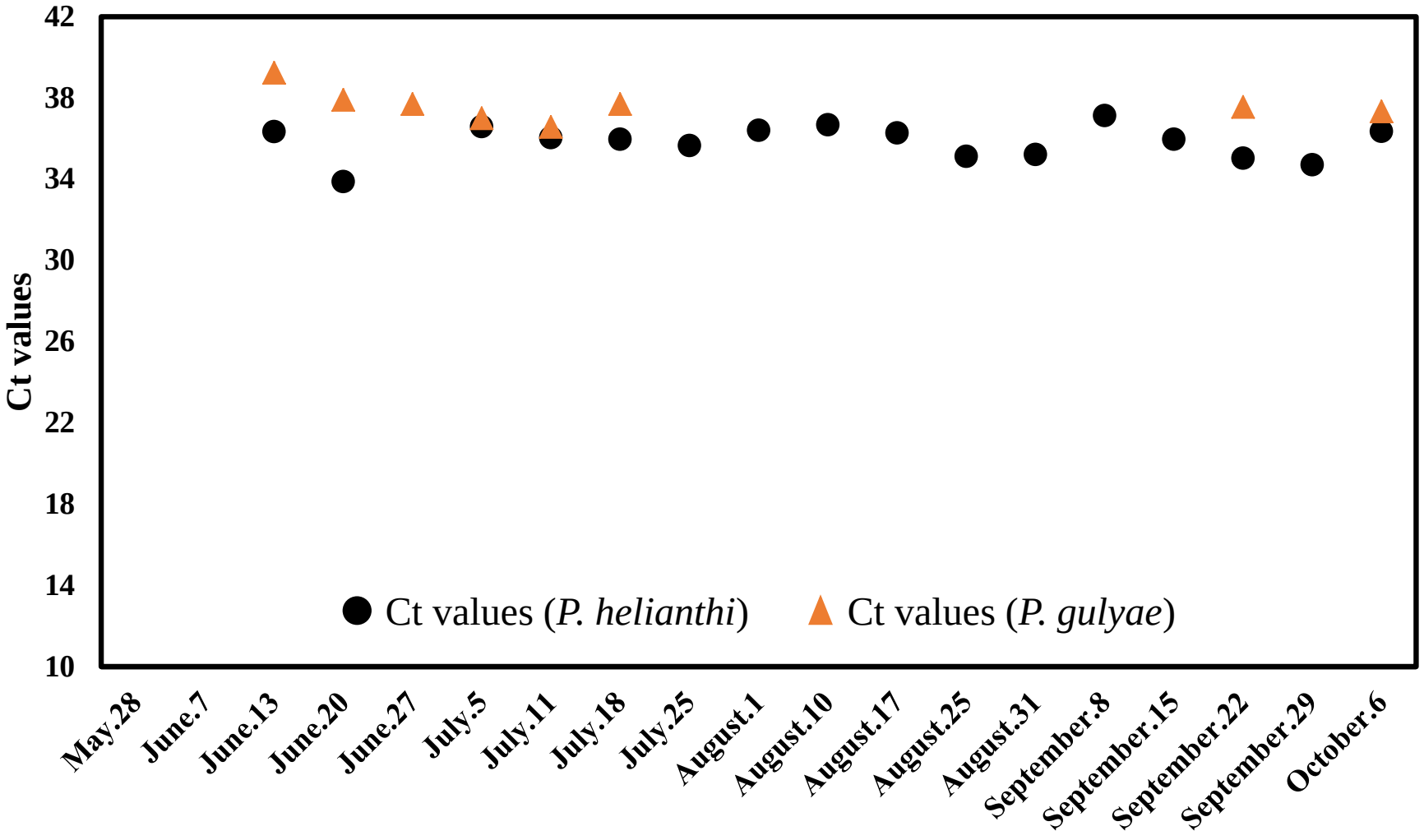
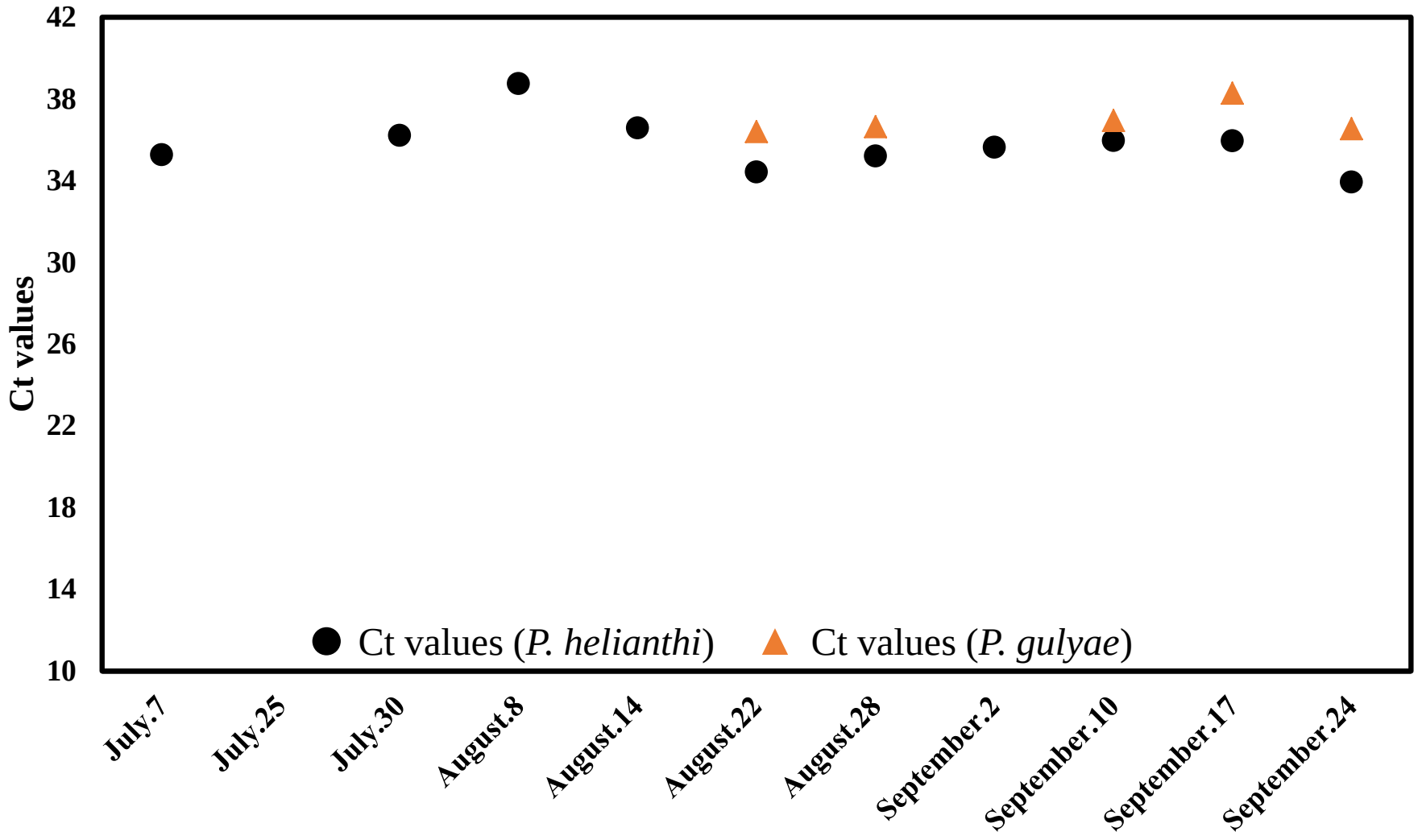


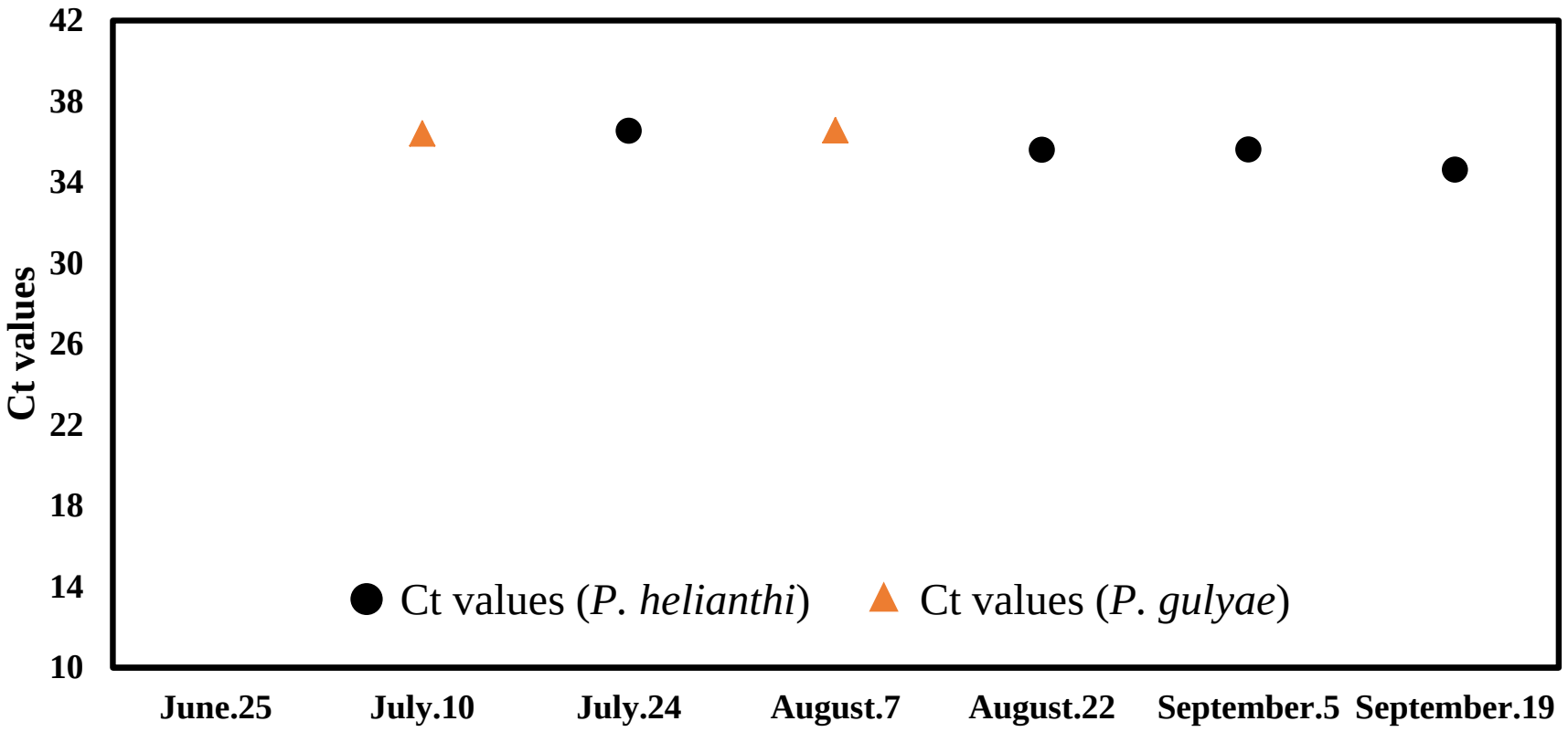
Results

Polk, MN



Results

Carrington, ND



Research Objectives

1) Quantify the airborne inoculum of *P. helianthi* and *P. gulyae* over the growing season in MN, ND, SD and NE

2) Determine if the spore release by *P. helianthi* and *P. gulyae* is affected by weather.

Correlation between weather and *Phomopsis* in Brookings, SD

Phomopsis helianthi

Weather	Correlation coefficient	P-value
Air temperature (^oC)	0.14	> 0.05
Relative humidity (%)	-0.27	> 0.05
Wind speed (m/s)	0.11	> 0.05
Rainfall (mm)	-0.13	> 0.05
Solar radiation (W/m^2)	0.04	> 0.05

(Analyzed using R v3.3.2)

Correlation between weather and *Phomopsis* in Brookings, SD

Phomopsis gulyae

Weather	Correlation coefficient	*P*-value
Air temperature (°C)	0.02	>0.05
Relative humidity (%)	0.53	>0.05
Wind speed (m/s)	0.28	>0.05
Rainfall (mm)	0.18	>0.05
Solar radiation (W/m^2)	-0.10	>0.05

(Analyzed using R v3.3.2)

Correlation between weather and *Phomopsis* in Polk, MN

Phomopsis helianthi

Weather	Correlation coefficient	*P*-value
Air temperature (°C)	0.41	>0.05
Relative humidity (%)	- 0.44	>0.05
Wind speed (m/s)	- 0.56	>0.05
Rainfall (mm)	0.46	>0.05
Solar radiation (W/m^2)	- 0.29	>0.05

(Analyzed using R v3.3.2)

Correlation between weather and *Phomopsis* in Polk, MN

Phomopsis gulyae

Weather	Correlation coefficient	*P*-value
Air temperature (°C)	0.02	>0.05
Relative humidity (%)	-0.14	>0.05
Wind speed (m/s)	0.15	>0.05
Rainfall (mm)	-0.26	>0.05
Solar radiation (W/m^2)	-0.34	>0.05

(Analyzed using R v3.3.2)

Correlation between weather and *Phompsis* in Carrington, ND

Phomopsis helianthi

Weather	Correlation coefficient	*P*-value
Air temperature (°C)	0.96	0.03*
Relative humidity (%)	0.08	> 0.05
Wind speed (m/s)	-0.03	> 0.05
Rainfall (mm)	-0.34	> 0.05
Solar radiation (W/m^2)	0.98	0.01*

(Analyzed using R v3.3.2)

Summary

- The qPCR assay detected both *P. helianthi* and *P. gulyae* from the spore trap glass-slides
- *Phomopsis helianthi* was detected in all the 8 locations
- *Phomopsis gulyae* was detected only in 6 locations.

Summary

- No significant correlation between weather and *Phomopsis* inoculum observed at all locations except for Carrington, ND.

- In Carrington, ND, air temperature and solar radiation was significantly and strongly correlated with *Phomopsis* inoculum

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NDSU

UNIVERSITY OF Nebraska Lincoln

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Acknowledgments

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RESEARCH. EDUCATION. ECONOMIC DEVELOPMENT.

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