Relationship Between *Fusarium virguliforme* and *Heterodera glycines* in WI Fields

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Introduction

Fusarium virguliforme, the causal agent of sudden death syndrome (SDS), and *Heterodera glycines*, soybean cyst nematode (SCN), are economically important pathogens of soybean in the Midwestern U.S., including Wisconsin. With inconsistent results regarding the relationship between *F. virguliforme* and *H. glycines*, more research is needed to elucidate potential interactions in order to provide more effective management recommendations for growers. Therefore, the objectives of this study were to i.) determine the incidence of *F. virguliforme* and *H. glycines* in commercial soybean fields in Wisconsin and to ii.) compare the distribution and population densities of *F. virguliforme* and *H. glycines* to determine if establishment of these two pathogens is interrelated.

Materials and Methods

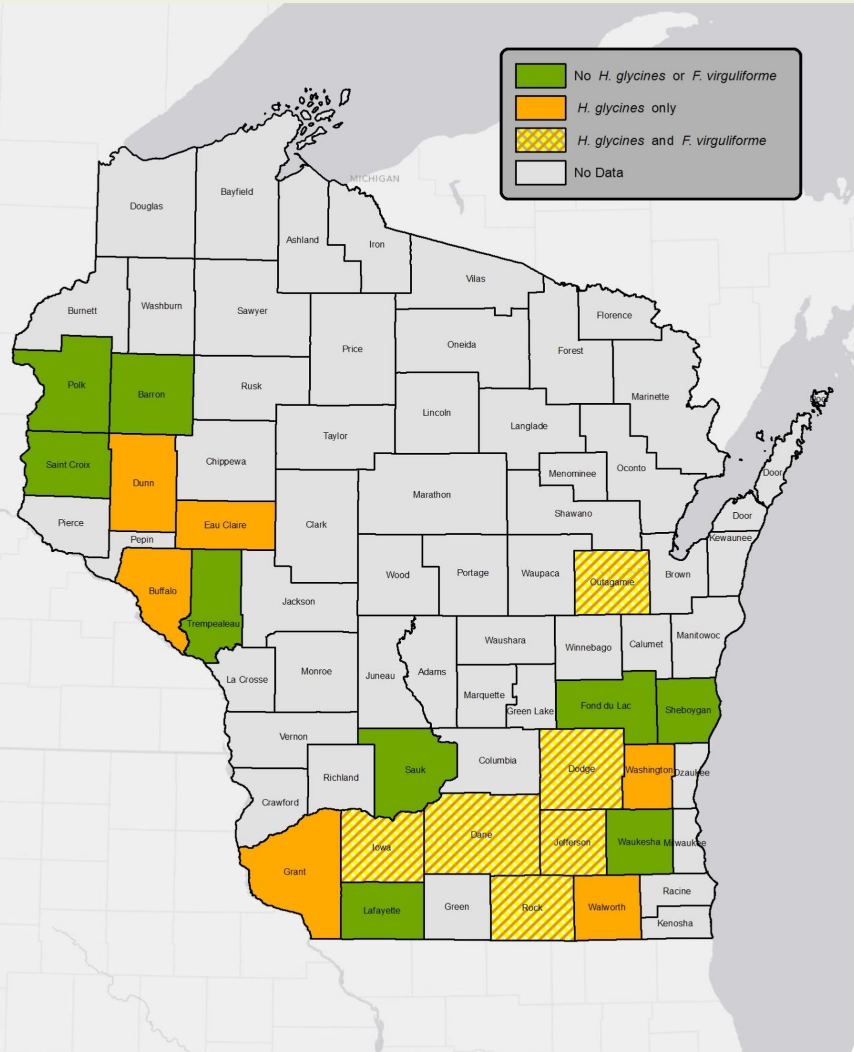
- Soil samples were voluntarily submitted from commercial soybean fields throughout Wisconsin by growers, crop consultants, and extension personnel in the 2011 and 2012 field seasons as part of a Wisconsin Soybean Marketing Board program that offers free SCN soil testing to stakeholders.
- A 100 cc subsample of soil was removed from the sample for wet-sieving and centrifugal-flotation and extraction of SCN cysts and subsequent egg counts following a modification of Jenkins (1964) procedure.
- A separate 500 mg subsample of soil was also removed for quantification of *F. virguliforme* using quantitative polymerase chain reaction (qPCR) based on primers and probe sequences adapted from Mbofung et al. (2011).
- Two different response variables, presence/absence and population, were derived from the qPCR analysis.
- To investigate the relationship between the presence and absence of *F. virguliforme* and *H. glycines*, samples were divided into two sets where one set contained samples where no *F. virguliforme* or *H. glycines* were detected (311 out of 435 samples), and the other set contained samples where at least one or both pathogens were detected (124 out of 435 samples), treating detection of each pathogen as a binomial variable.
- The Kendall tau rank correlation coefficient was used to measure the association between *F. virguliforme* and *H. glycines* detection and population densities.
- Subsequent logistic regression was used to describe the relationship between the probability of finding *H. glycines* (dependent variable) in a given soil sample based on detecting *F. virguliforme* (independent variable) in the same sample.

Results

2011

- 135 samples submitted
- 56 samples positive for *H. glycines* (41.5%)
  - Populations ranged from 5 - 10,050 eggs/100cc soil
  - Average egg count was 1,668 eggs/100cc soil
- 10 samples positive for *F. virguliforme* (7.4%)
  - Populations ranged from Detected - 401,252 spores/g soil
  - Average population from quantifiable samples was 122,071 spores/g soil (n=4)

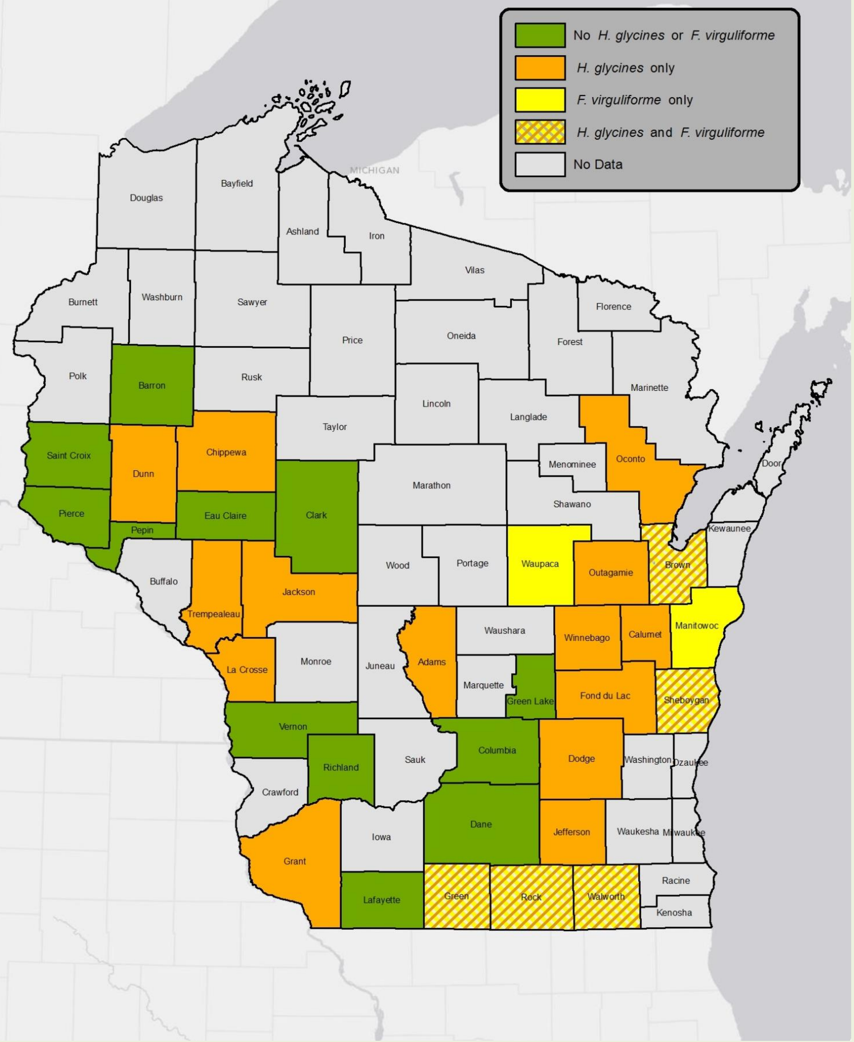
Figure 1. 2011 Wisconsin counties with soil sample submission and resulting pathogen detection



2012

- 318 samples submitted
- 64 samples positive for *H. glycines* (20.1%)
  - Populations ranged from 5 - 37,200 eggs/100cc soil
  - Average egg count was 2,911 eggs/100cc soil
- 13 samples positive for *F. virguliforme* (4.1%)
  - Populations ranged from Detected - 11,224 spores/g soil
  - Average population from quantifiable samples was 10,741 spores/g soil (n=5)

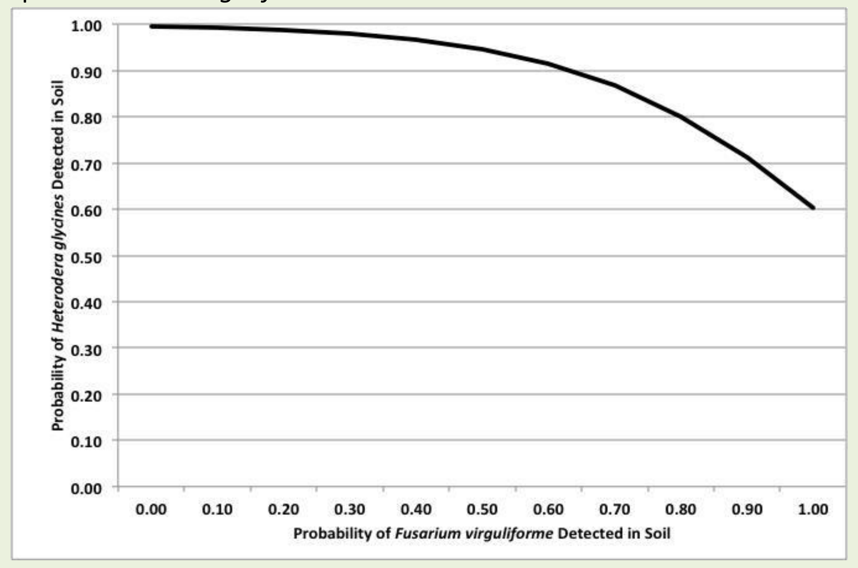
Figure 2. 2012 Wisconsin counties with soil sample submission and resulting pathogen detection



Results cont'd

- Association between *F. virguliforme* and *H. glycines* detection was negative ($\tau = -0.59$, $P < 0.01$)
- No relationship between *F. virguliforme* spore populations and *H. glycines* egg populations was found ($\tau = 0.01$, $P = 0.87$)

Figure 3. Predicted probability of soil samples testing positive for *H. glycines* based on the probability of the same sample testing positive for *F. virguliforme*.



- Best fitting logistic regression model based on samples that tested positive for *F. virguliforme* and/or *H. glycines* (n=124) was: Probability of *H. glycines* detected in a 100 cc soil sample =

  exp(5.31 - 4.89**F. virguliforme*) / [1 + exp(5.31- 4.89**F.virguliforme*]

  Max-rescaled R^2 = 0.56; Area under the receiver operator curve (ROC) = 0.94

Conclusions

- Counties testing positive for *H. glycines* in 2011 and 2012 were representative of the confirmed SCN-positive regions of the state.
- *F. virguliforme* detection was concentrated in counties in southern and eastern Wisconsin, extending the range originally described by Berstein et al. (2007).
- Counties where both *F. virguliforme* and *H. glycines* were found in the same sample occurred infrequently.
- The negative correlation between *F. virguliforme* and *H. glycines* detection suggests both pathogens do not rely on each other for colonizing fields.

References

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