Understanding the importance of bloom in blueberry anthracnose

(causal pathogen: *Colletotrichum fioriniae*)

Timothy J. Waller, Jennifer Viaciunas, Christine Constantelos, and Peter V. Oudemans

Rutgers New Jersey Agricultural Experiment Station
Cooperative Extension Cumberland County
Philip E. Marucci Blueberry and Cranberry Research and Extension Center 1918–2018
American Cranberry Growers Association
Northeast SARE Sustainable Agriculture Research & Education
USDA

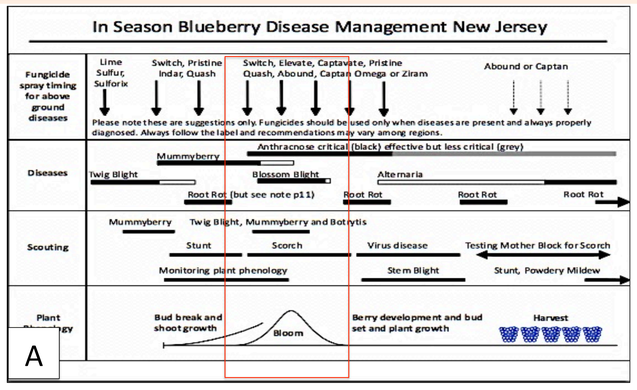
Rutgers Cooperative Extension of Cumberland County
Agriculture & Natural Resources County Agent III
291 Morton Ave.
Millville, NJ 08332-9776

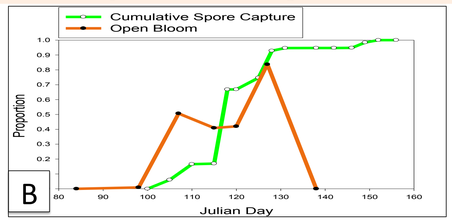
Contact information:
twaller@njaes.rutgers.edu
(856)-451-2800
https://njaes.rutgers.edu/nursery/

RESEARCH HYPOTHESIS: Plant signals produced during bloom play a critical role in the infection process and sporulation events of the blueberry anthracnose pathogen *Colletotrichum fioriniae*. Quantification of this relationship will elucidate factors related to optimizing disease control / management strategies.

INTRODUCTION: *C. fioriniae,* is a latent pathogen that infects numerous horticultural crops including many *Vaccinium spp*. This pathogen is only adequately controlled during bloom in many pathosystems, due to the role that host flowers play in the initial stages of infection and inoculum buildup. Floral extraction methods (*floral extracts (FE)*) and field rainwater monitoring devices were developed to capture bioactive host/floral signals. In order to understand, and ultimately exploit, this host:pathogen relationship, a robust glass coverslip bioassay was utilized to **investigate the spatiotemporal dynamics of floral signals on *C. fioriniae*.**

Bloom is critical to the control and lifecycle of *C. fioriniae*

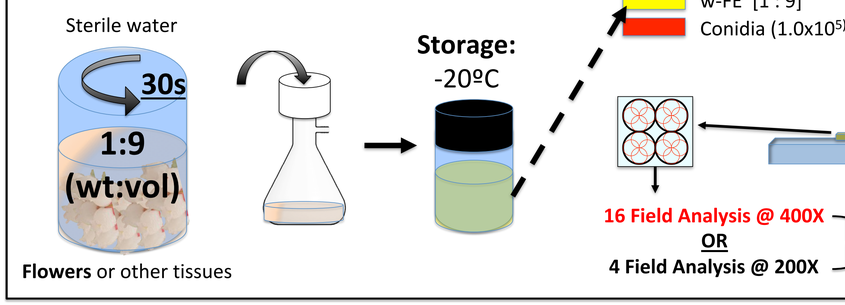




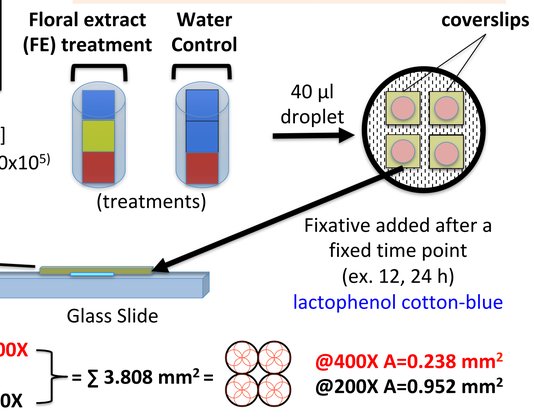
(A) Bloom time fungicide applications are ***critical*** to fruit rot control **(A)**
(B) Correlation of *C. fioriniae* spore release to the bloom period **(B)**
(C) *C. fioriniae* overwinters in dormant flower buds (possible evolutionary relationship)

Water-based floral extraction and subsequent bioassay methodology. This technique can be applied to many other host plant tissues, acquiring both water soluble and water mobilized (dislodged) bioactive compounds. The bioassay quantifies germinated primary inoculated conidia, secondary conidia production (sporulation), and appressorium formation across time points and temperatures. Both methods are highly adaptable.

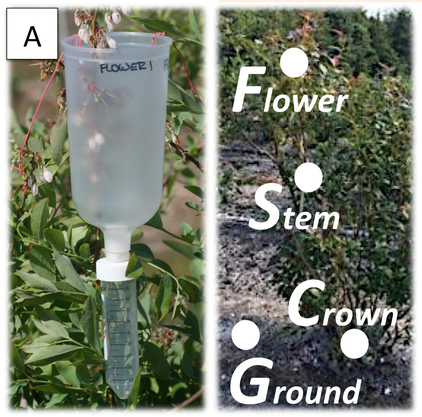
In vitro water-based extraction

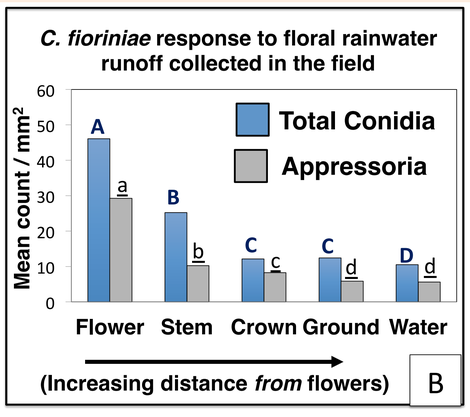


Glass coverslip bioassay



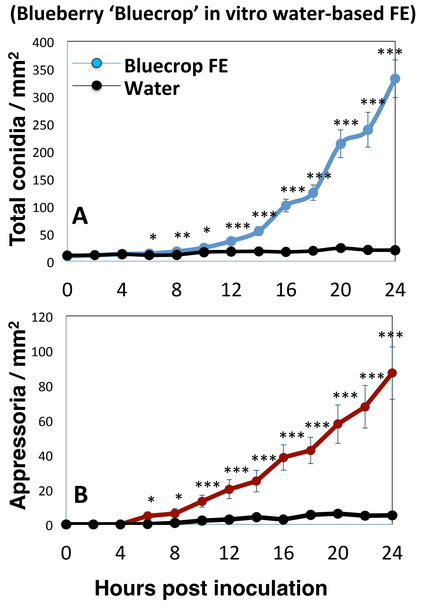
Closer to flowers = greater stimulation





(**A**) Detail of device and deployment locations. (**B**) Bioactivity of the rainwater collections using the glass coverslip bioassay, demonstrating the mobility of floral signals. (**C**) Image of blueberry inflorescence, note the overlap of fruit and developing ovaries.

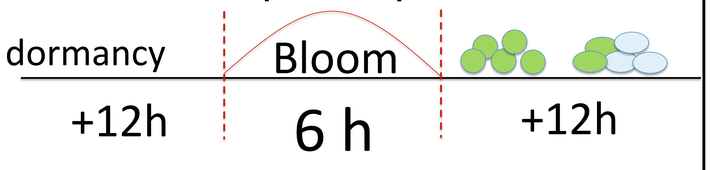
Mobility of floral signals in flower rainwater runoff

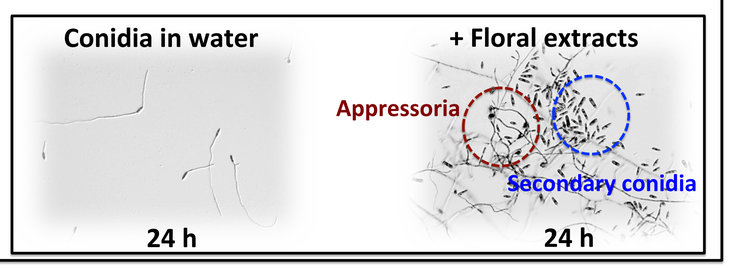


Flowers reduce the time

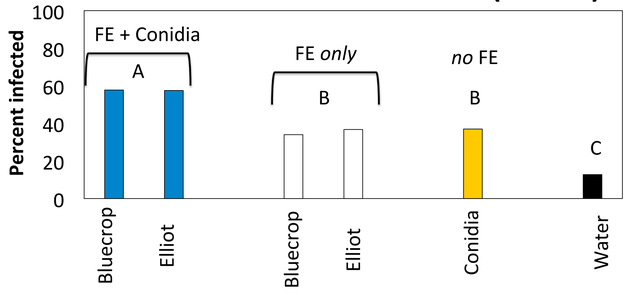
needed for *C. fioriniae* to form infection structures and replicate
SO
During bloom there will be a greater number of overall
infection periods and **inoculum build-up**

Wetness period requirements



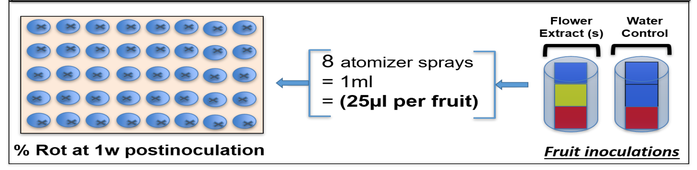


Conidia + FE = more infection (at 1wk)



'Elliot' blueberry fruit (a resistant cultivar) were atomizer inoculated with combinations of FE, conidia (*C. fioriniae*), and water.

Detached fruit inoculation methods



Conidia in the presence of floral signals (FE) infect more readily

DISCUSSION AND MOVING FORWARD

These data have partially elucidated 'why' the critical disease control window for blueberry anthracnose is during the bloom period. Bioassays utilizing FE enabled baseline data acquisition, wetness period time requirements, mobility of floral signals, and infection rates. The bioassay's flexibility also allows for future in vitro fungicide screenings that could utilize key epidemiological host signals, thus increasing confidence in pathogen response.

Armed with this knowledge, exploiting this pathogen:host relationship is the next step in moving towards grower recommendations, fungicide use patterns, and 'trap-based' sprays.

Waller, T. J., Gager, J. D., and Oudemans, P. V. 2019. Colletotrichum fioriniae development in water and chloroform-based blueberry and cranberry floral extracts. JoVE 146:e58880. **(WATCH VIDEO METHODS)**

Waller, T. J., Vaiciunas, J., Constantelos, C., and Oudemans P. V. Evidence the blueberry floral extracts influence secondary conidiation and appressorial formation of Colletotrichum fioriniae. Phytopathology. 108, 561-567 (2017). **(Full manuscript)**