Analysis of Weather, Microclimate and Canopy Density on Sclerotinia Stem Rot Disease in Canola

Reanne Pernerowski [1], Paul Bullock [2], Dilantha Fernando [3]

Sclerotinia stem rot disease (SSR) in an increasingly important disease in the Canadian prairies creating unpredictable yield losses ranging between 5 and 100 percent in Manitoba. Management is extremely important due to the little commercially available resistant canola varieties. Caused by the fungus *Sclerotinia sclerotiorum,* sclerotinia begins its life cycle as sclerotia in the soil. Under specific environmental conditions sclerotia germinates and eventually releases ascospores into the surrounding atmosphere. Ascospores land on senescing flower tissue of the canola plant and subsequently land on the leaves and stems and begin to kill the entire plant.

Canopy density and weather are important factors known to influence disease incidence of SSR as they are capable of modifying the microclimate and creating various environments that affect all levels of the disease cycle. Several researchers have proven that moderate temperatures and moisture is required for sclerotia germination, increasing temperatures and decreasing relative humidity is required for day time release of ascospores and moisture and humidity is required within the canopy for spore germination on petals and for further infection. This study attempts to validate these findings and more accurately depict the specific environmental conditions, and canopy densities most favourable to disease development and incidence. By understanding the environmental requirement for SSR, cost effective management strategies can be implemented based on the findings obtained within this study. More importantly, weather can be used as an indicator of risk in canola crops in Manitoba which can be used to determine appropriate fungicide application rates and timing.

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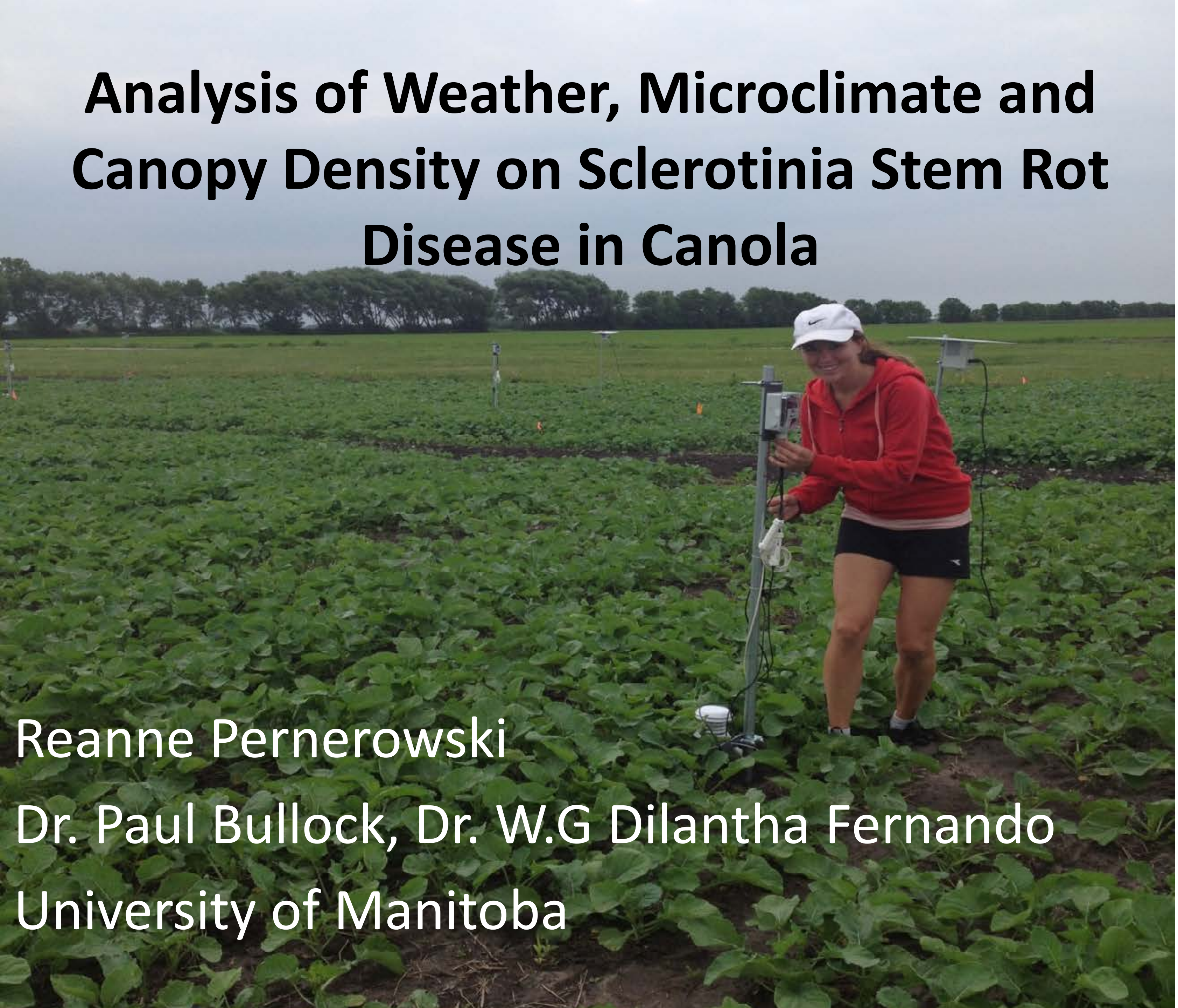

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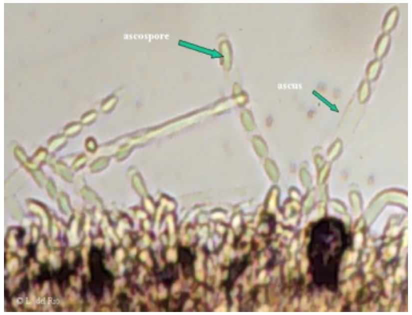
Sclerotinia Stem Rot (SSR)
Canadian Prairies

- Fungus *Sclerotinia sclerotiorum*
- Economically important disease of canola
- Reduce yields by 0.4 to 0.5 times the percentage of infection (Manitoba Agriculture)
- Losses ranging from 5-100%

Disease cycle of Sclerotinia

Apothecia germination



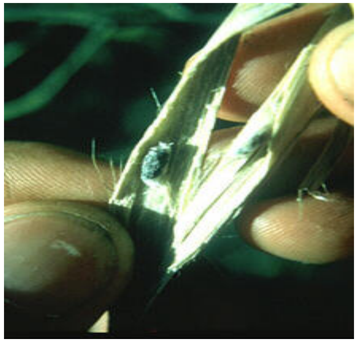
Windborne ascospores

Infection stage

Petal infection

Leaf infection

Lesions spread on stem



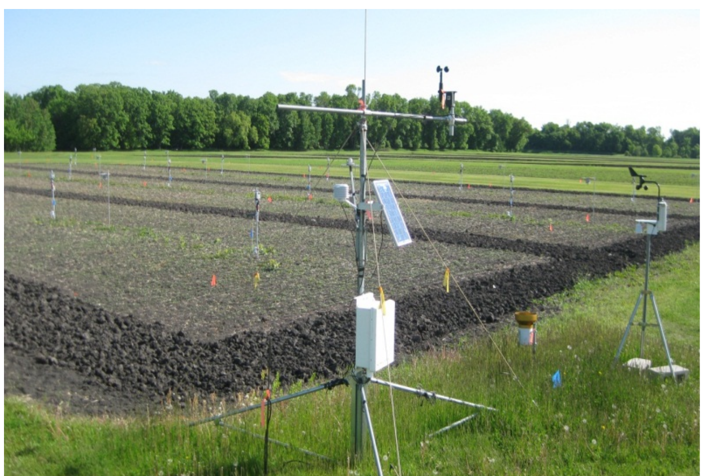
Sclerotia form in stem

Management of SSR

- Crop rotations (4 years) with non host crops
  - Limitations
- Genetic Resistance
  - Cultivar availability
- Fungicide applications
  - Costly, timing
- Biological control agents
- Tillage
- Seeding rates and row spacing
- Disease forecasting

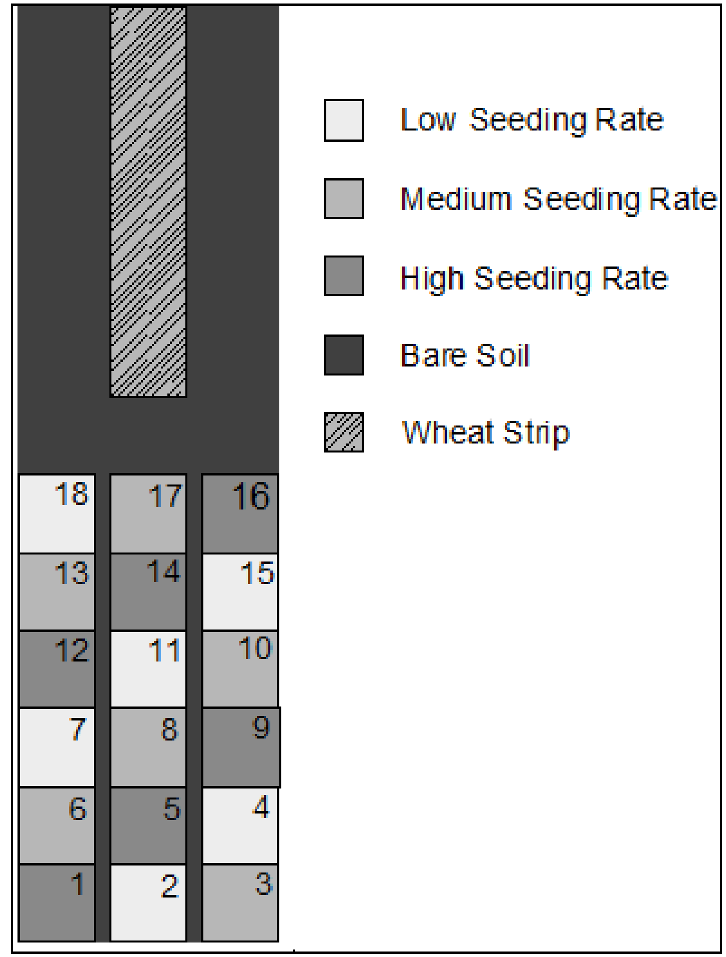
Objectives

1. Impact of microclimatic conditions in varying canopy densities on *S. sclerotiorum*
2. Assess risk of SSR disease on canola based on standard weather conditions
3. Impact of a disease infected field containing a non-host wheat crop on sclerotinia disease development and spread by spore dispersal



Study Sites and Layout

- Carman
  - 2011
  - 2012
- Winnipeg
  - 2011
  - 2012
- 3 treatments of **high**, **medium** and low seeding rates and fertilizers treatments



Field Setup

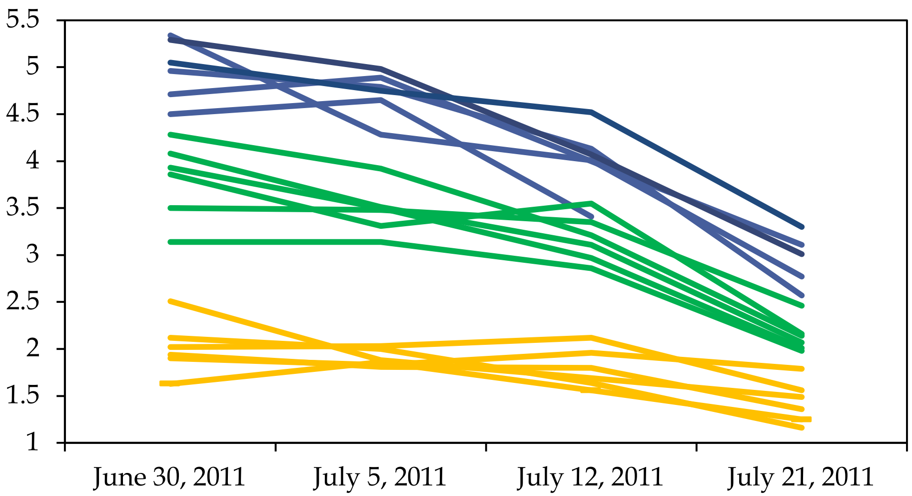
- Even Inoculation
  - Canola, Wheat
- Weather station
  - Wind, RH, temperature, solar radiation, rainfall
- Microclimate stations
  - RH, temperature, soil moisture and temperature, leaf wetness
- Misting
- Rotorods


Carman Flowering 2011

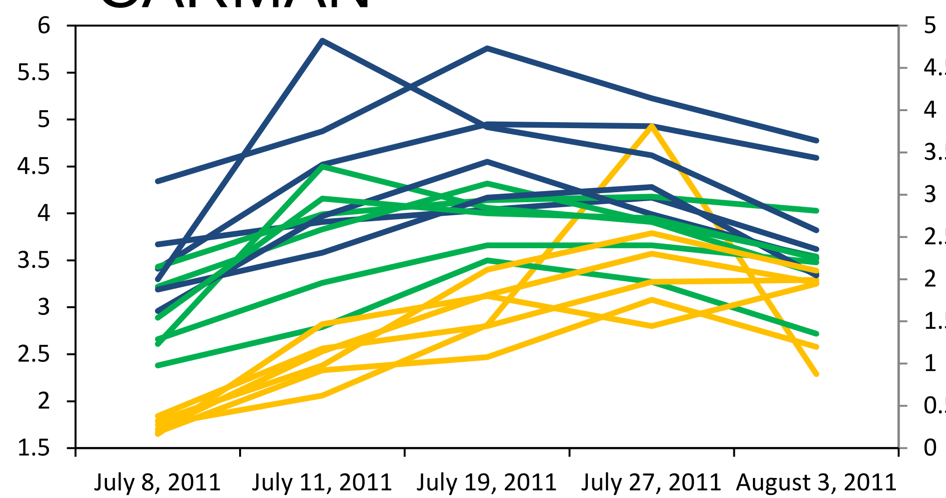
Effects of Canopy Density and Misting on Microclimate and Disease

Seeding Rate – Crop Density

WINNIPEG 2011



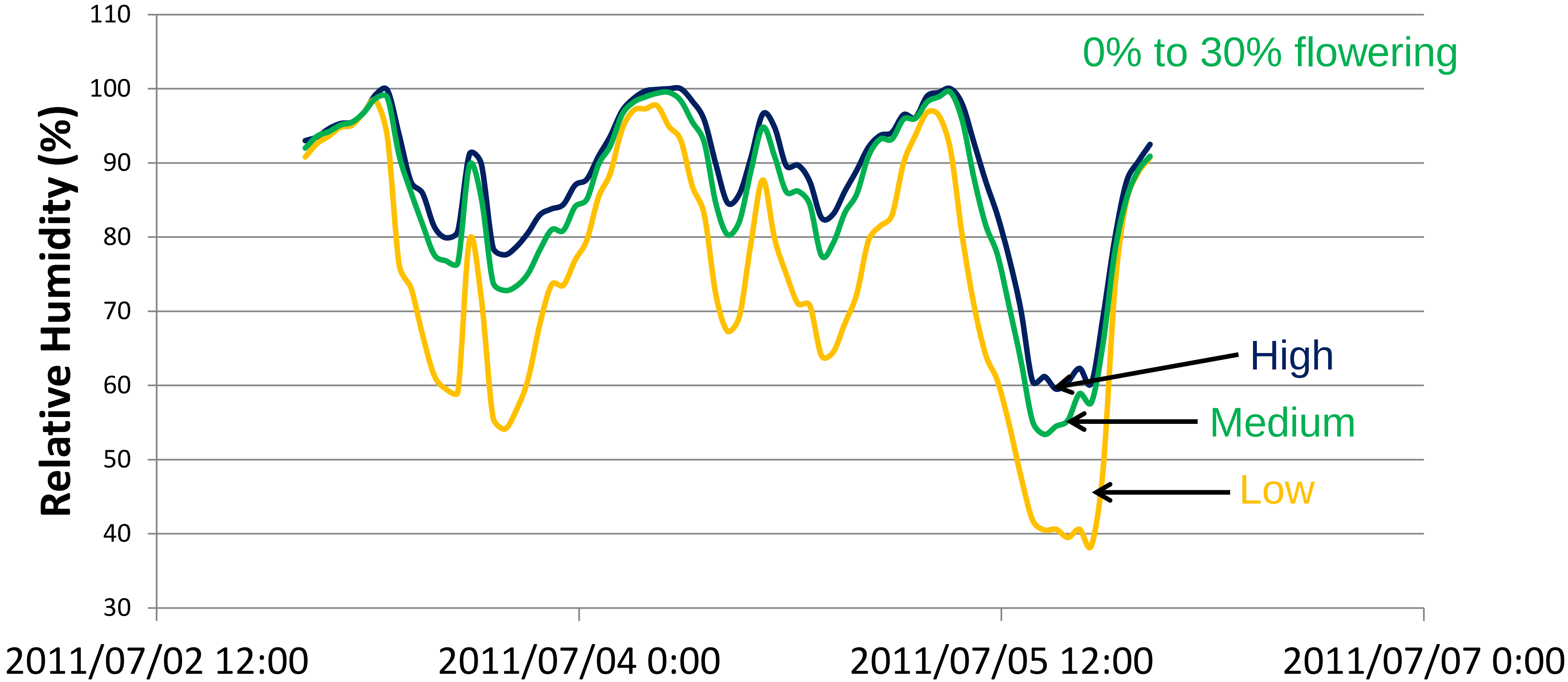
CARMAN 2011



LOW MEDIUM HIGH

Hourly Relative Humidity among Canopy Densities

- Winnipeg 2011

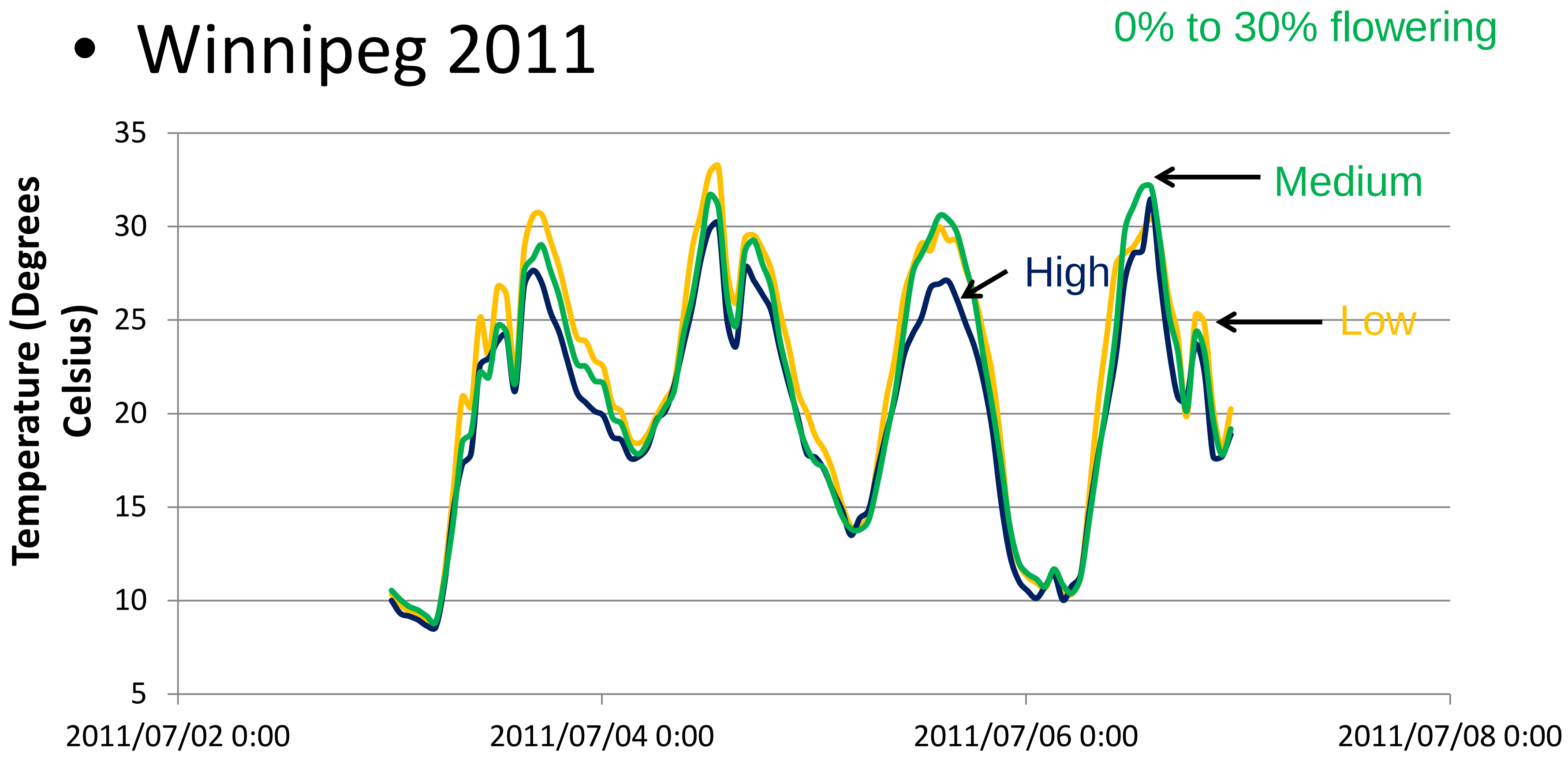


FLOWERING PERIOD

Average RH: significant differences among all plot densities

Hourly Temperature among Canopy Densities

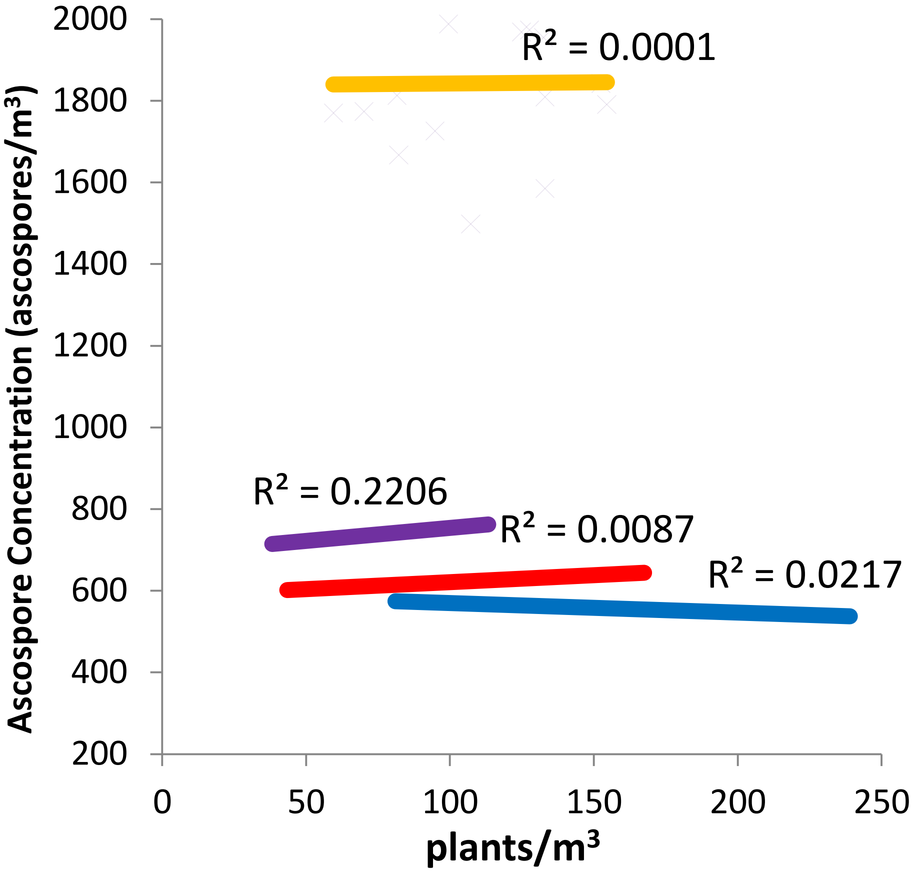
- Winnipeg 2011

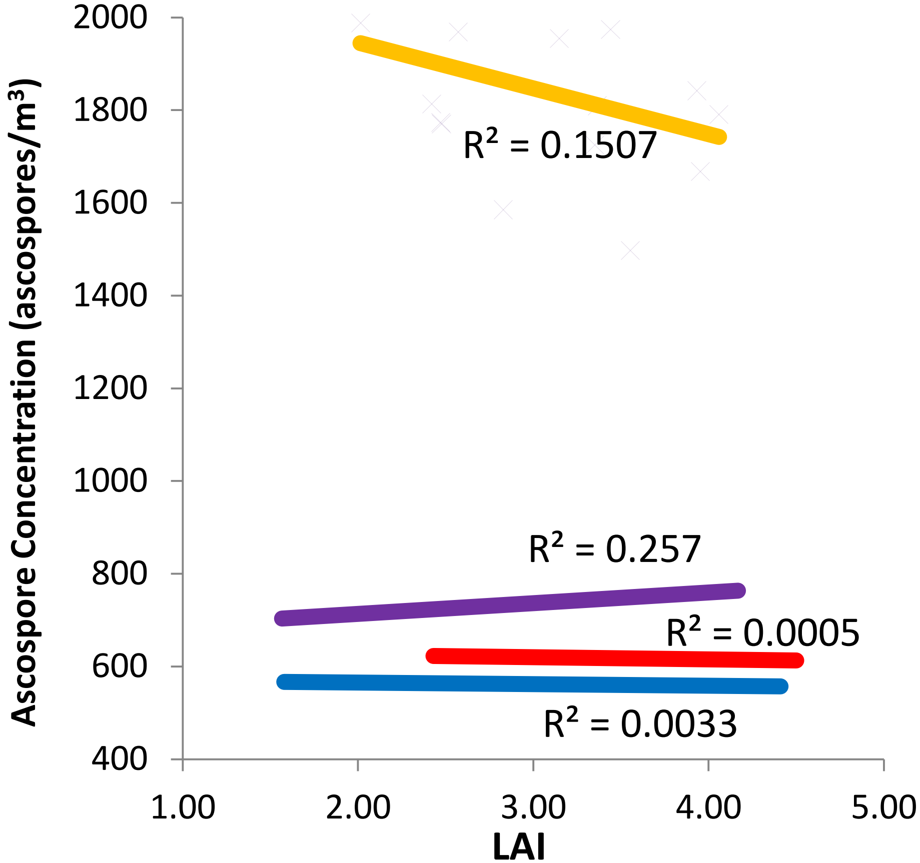


FLOWERING PERIOD

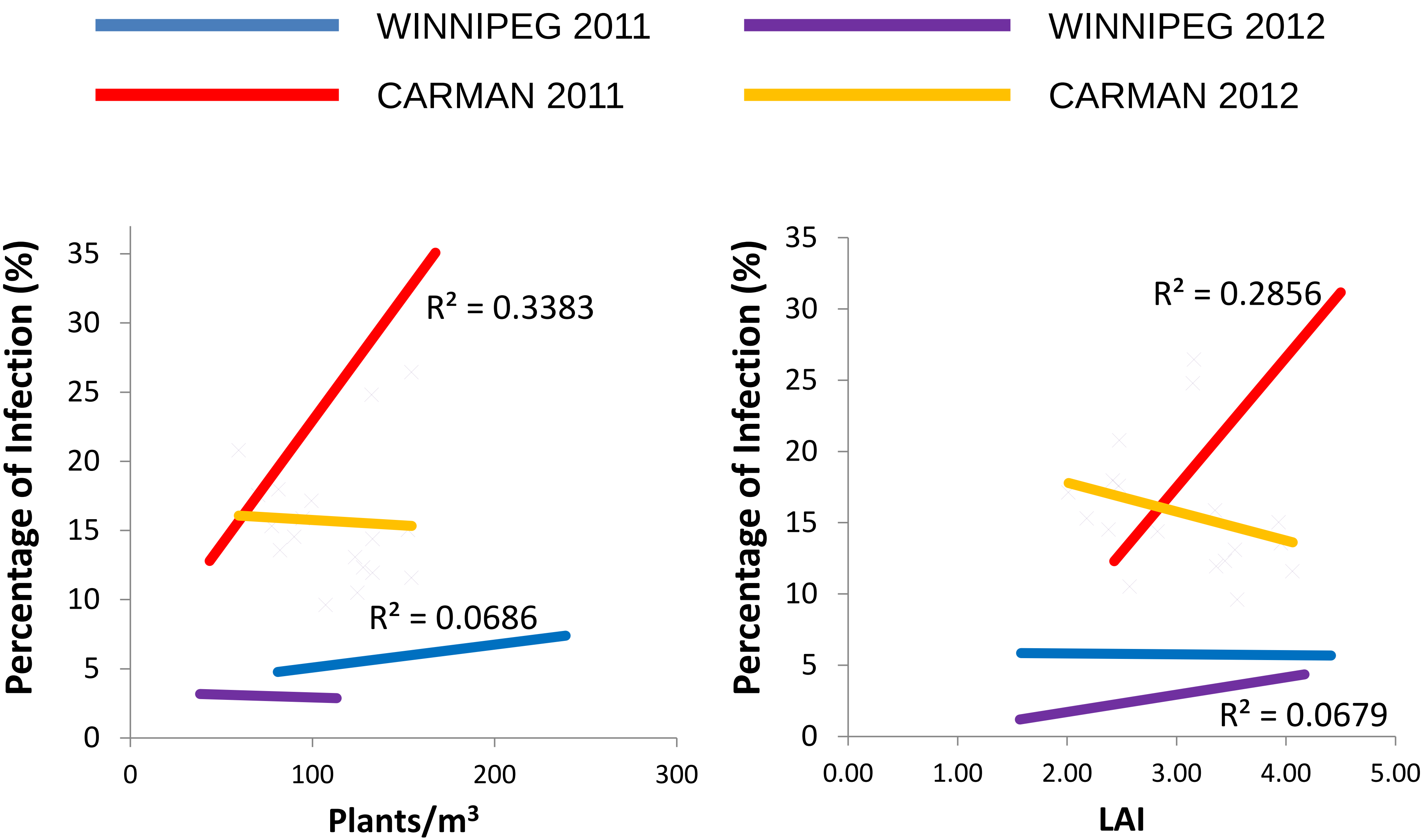
Average Temperature: significant differences among all plots densities

Total Daily Mean Ascospore Concentrations (ascospores/m^3)





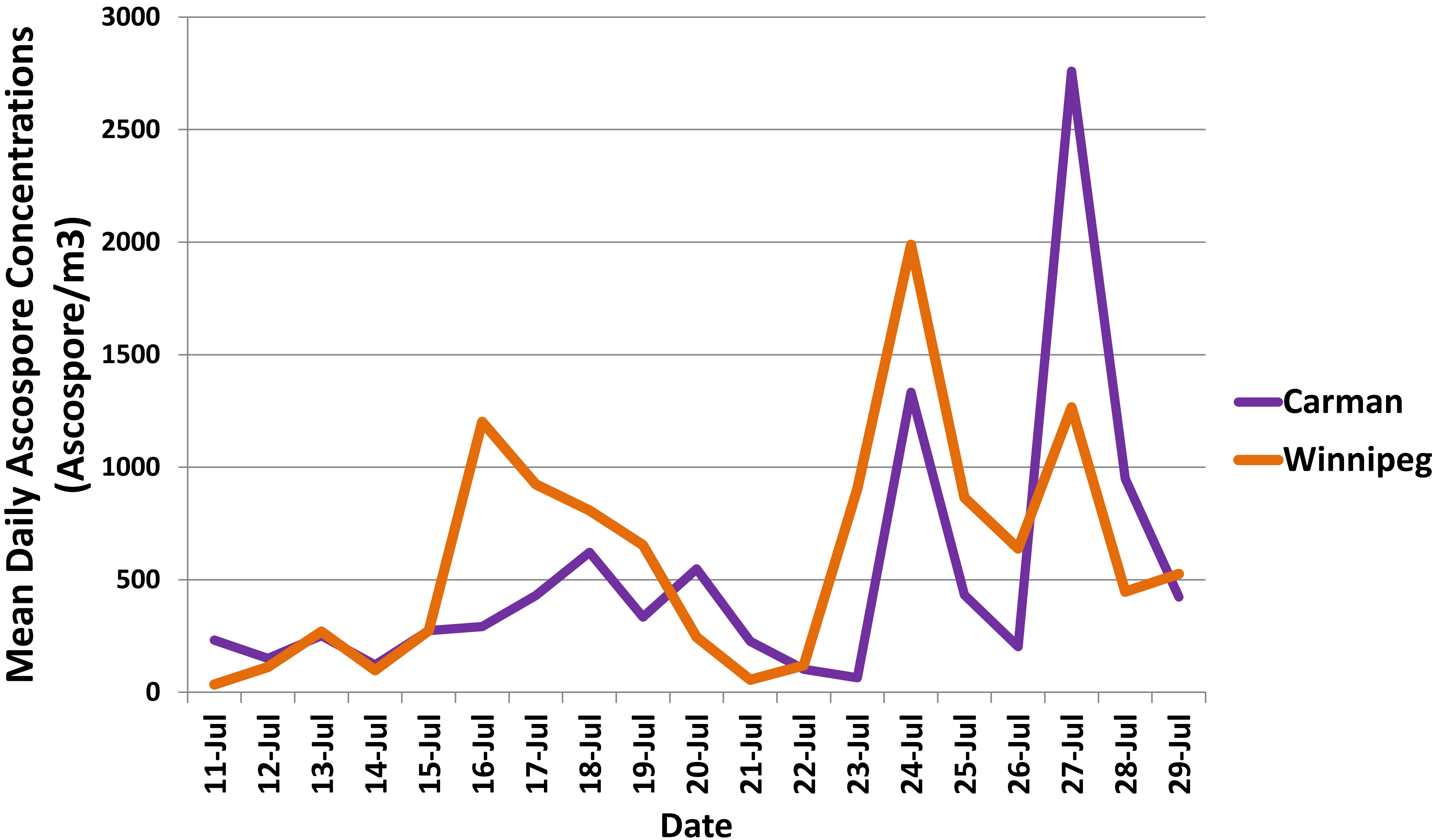
Percentage of Infection



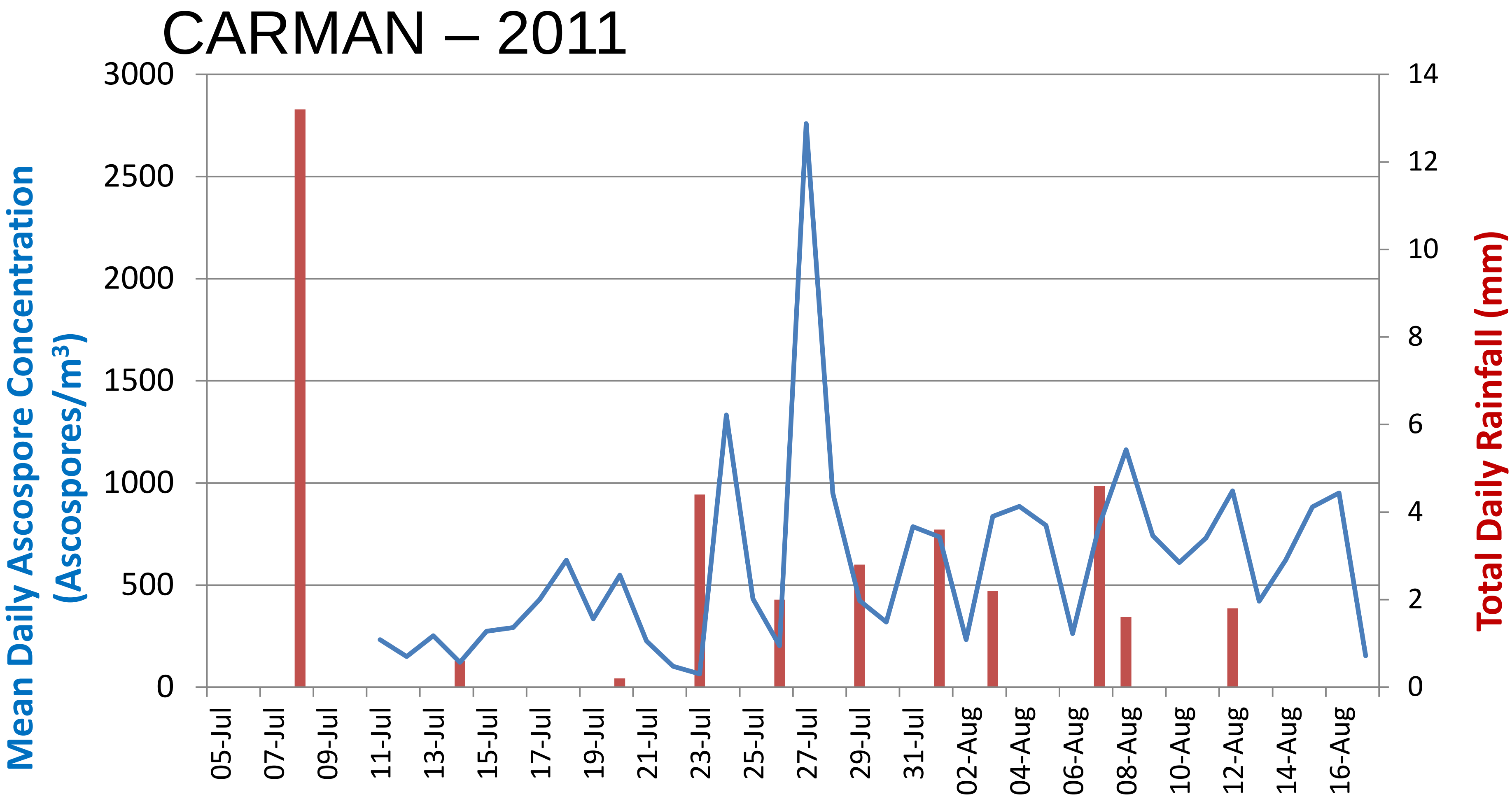
	Winnipeg 2011	
	Misted	Non-Misted
Leaf Area Index	3.2	3.0
Plant Counts (plants/m^3)	133.1	148.3
Relative Humidity (%)*	78.2	76.6
Leaf Wetness*	32.9	24.4
Air Temperature (°C)*	20.6	20.8
Soil Temperature (°C)*	20.4	20.4
Ascospore Concentration (ascospores/m^3)	628	705
Percentage of Infection (%)	6	14

Potential Relationships between Weather Variables and Ascospore Dispersal

Mean Daily Ascospore Concentrations
Carman and Winnipeg Overlay (2011)

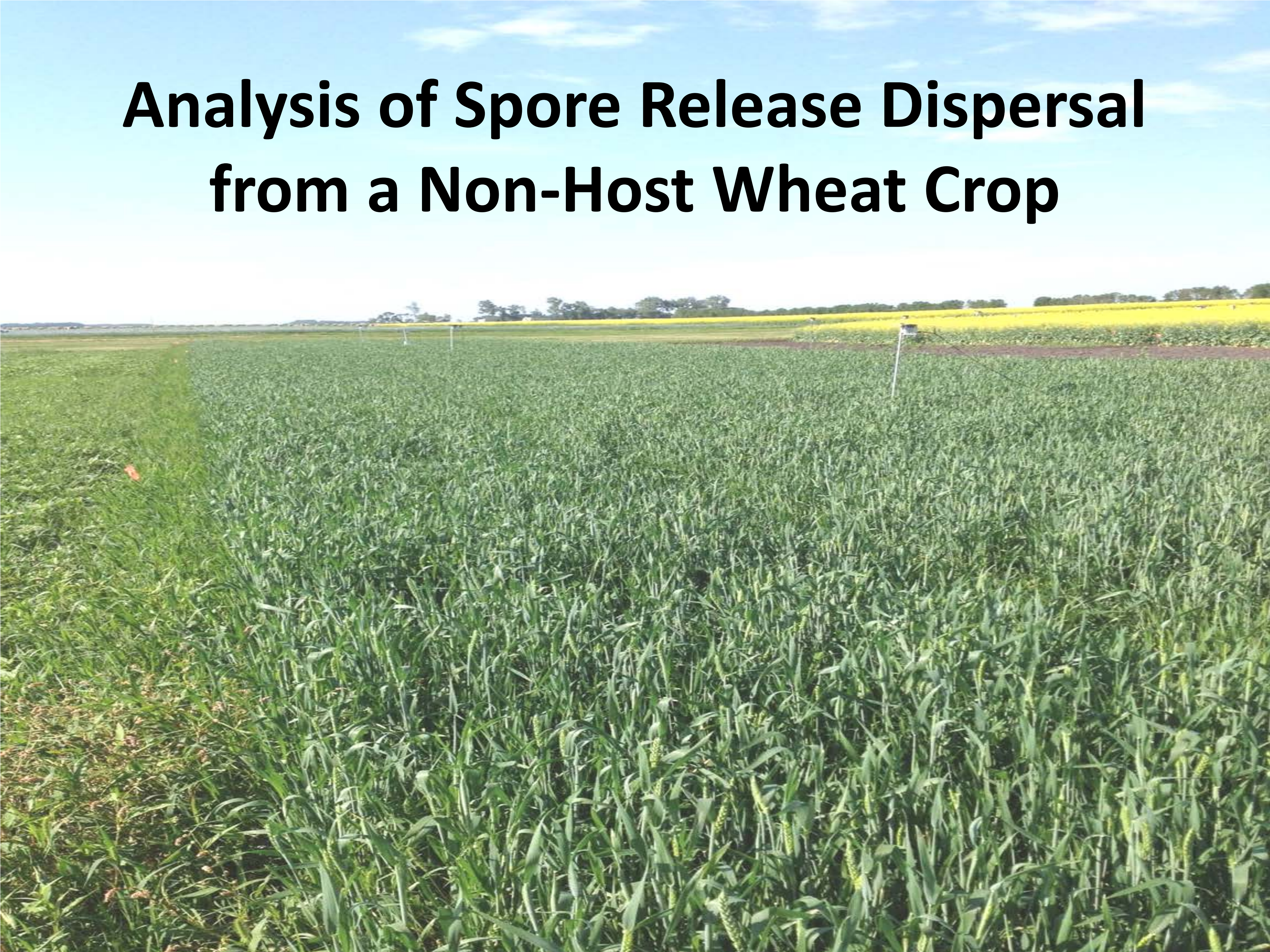


Precipitation on Ascospore Concentrations

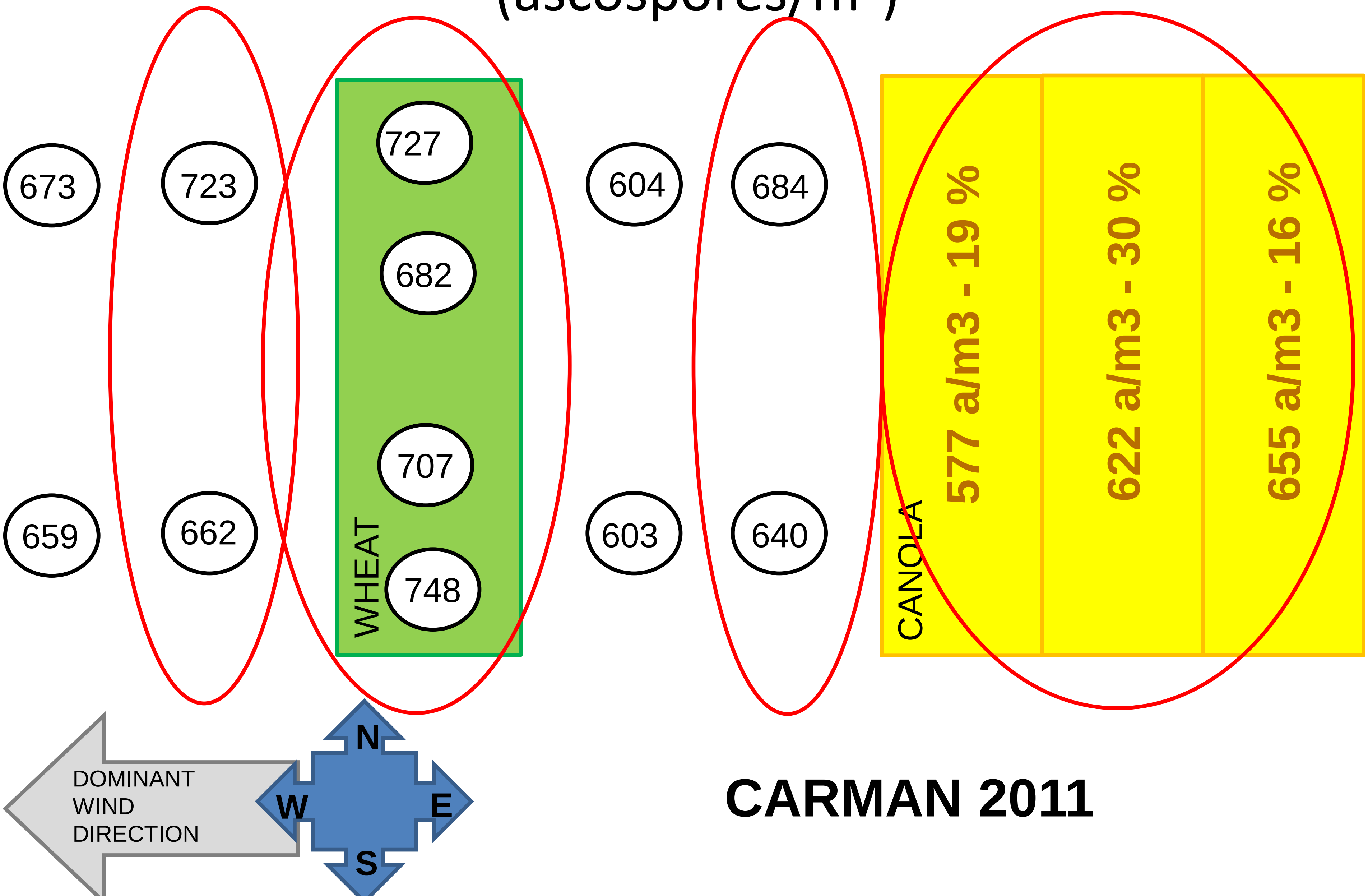


- *Qandah and Mendoza (2011)*: ascospore release during elevated periods of RH followed by rapidly decreasing RH

Analysis of Spore Release Dispersal from a Non-Host Wheat Crop



Wind on Mean Ascospore Concentrations (ascospores/m^3)

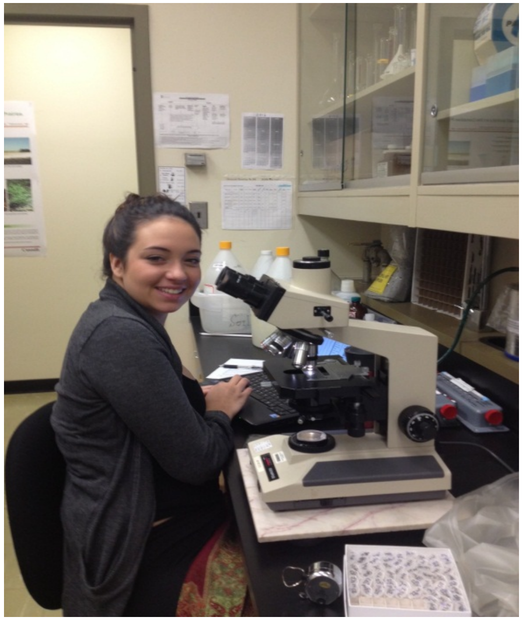


CARMAN 2011

Interpretation

- Canopy density and misting
- Crop rotations
- Weather forecasting and fungicide use

Brenleigh Ramm



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Fungicides Used

- Lance
- Vertisan
- Astound
- Iprodione
- Proline
- Quadris
- Serenade
- Biological control agent: Contans

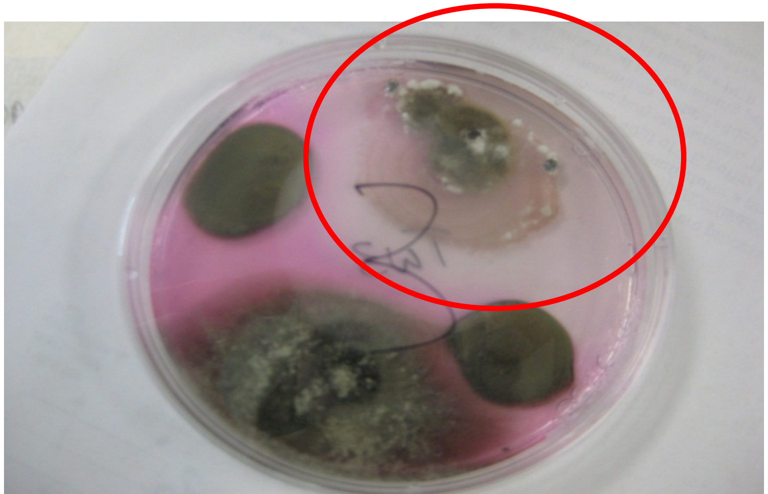
Petal Sampling

2011

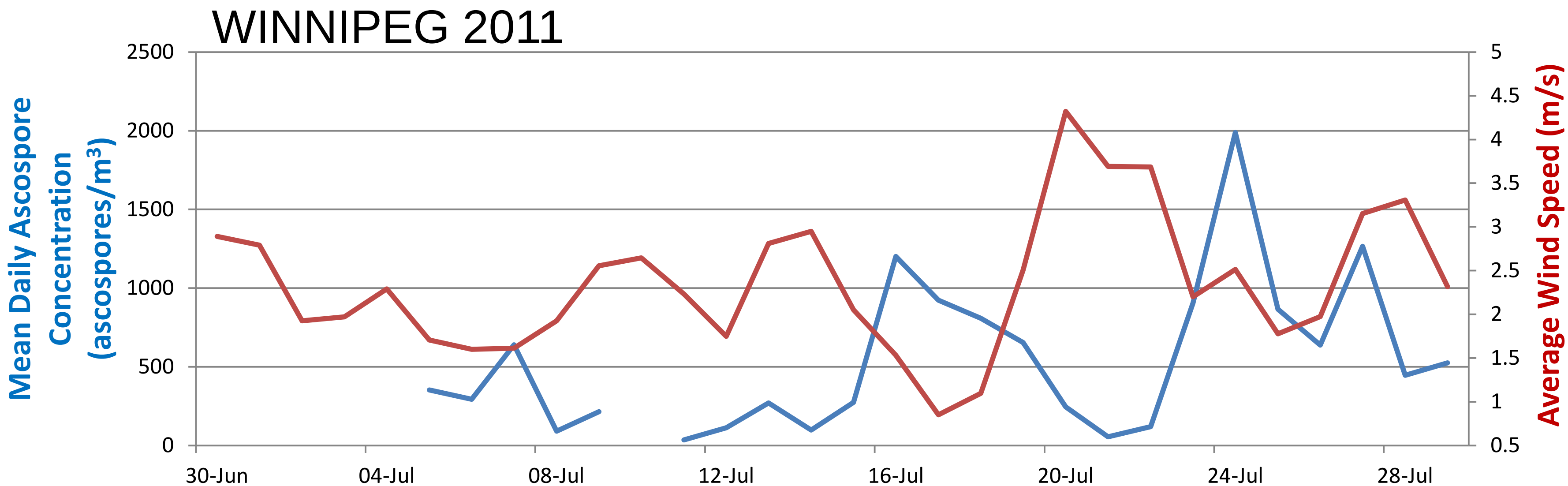
- Rose Bengal Agar
- Sampled twice
  - 30% bloom
  - 70% bloom

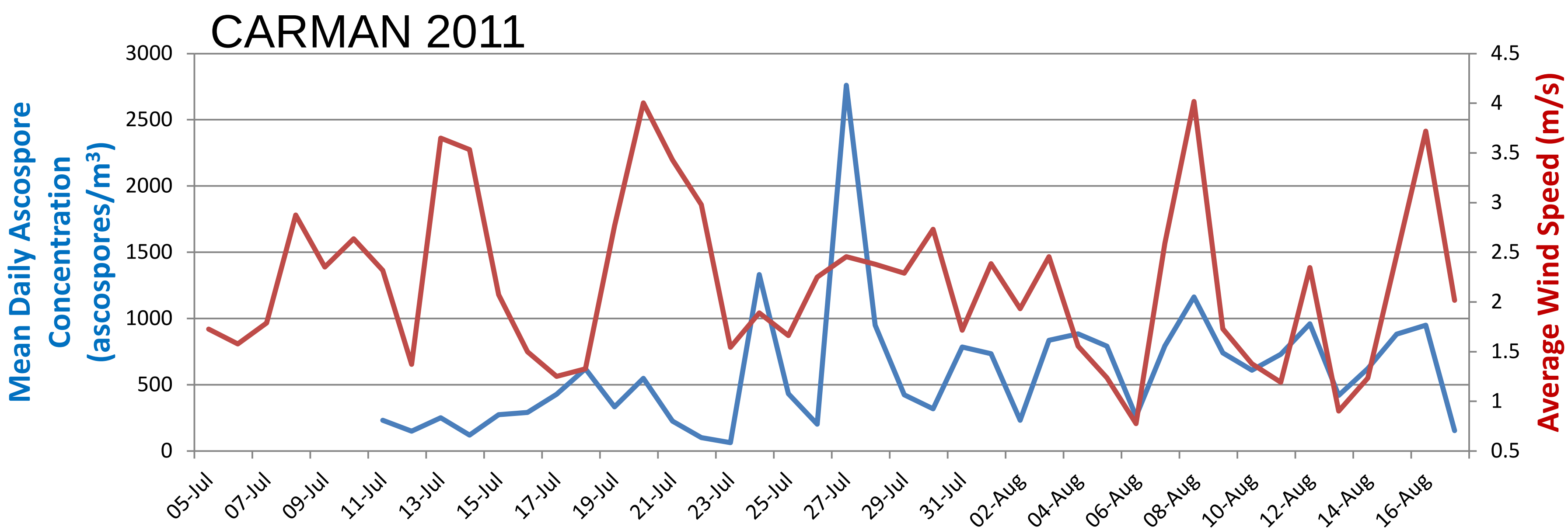
2012

- Semi- selective media
- Sampled 3 times
  - 20% bloom
  - 30% bloom
  - 70% bloom



Wind Speed on Ascospore Concentration





Wind Speed on Ascospore Concentration

CARMAN 2012