**Introduction**

Geographic and Local Variation in Pacific madrone (Arbutus menziesii) Leaf Blight

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- Pacific madrone is an evergreen hardwood species in western North America, occurring from southern California to British Columbia.
- Very little is known about the genetics of this species, including variation in resistance to pathogens and other adaptive traits.
- The WSU Pacific madrone seed collection contains seed from 320 families in 7 ecoregions. Using this seed collection, common garden plantings consisting of 104 half-sib families were planted at 7 locations in 2011 in CA (1 site), OR (2), WA (2), & in 2013 in British Columbia (2).
- Common garden sites are located in 4 of the 7 ecoregions where seed was collected (Figure 1).
- Assessments have been made of growth, disease, cold damage, flowering, and phenology.
- This poster summarizes variation in leaf blight in the OR & WA common gardens.

**Assessing Leaf Blight**

- Blight severity within sites varied significantly (p<0.01): Among seed sources for all years at all sites except for SO where sources only differed in 2012 (See Figure 3)
- Among half-sib families within sources also varied significantly (p<0.01) for all years and at all sites except at SF where families only differed in 2015
- Averaged across all sites, variation in blight severity among sources was not related to longitude of origin but was significantly (p<0.01) related to: Latitude of origin, with R² values ranging from 9% in 2012 to 69% in 2014
- Elevation of origin (except in 2014), with R² values ranging 13-16%
- When analyzed separately by site, variation in blight severity among sources:
- Was not related to longitude at any site, and at SO variation was also not related to latitude or elevation
- Relationships with latitude were strongest for PH (R² 48-65%) but at PV latitude was only significantly related in 2014
- The strongest relationships between seed source origin and site were at the most northern common gardens (PH & PV)

- Blight tended to be more severe at the WA sites (PH, PV) compared to the OR sites (SF, SO) (Figure 2)
- Patterns of blight severity among sites might be related to site conditions such as moisture and temperature. Typically, precipitation decreases and temperatures increase from north to south latitude, thus the WA sites would be cooler and wetter than the SF site, which would be cooler and wetter than the OR site.
- Blight variation among sites is also affected by time of assessment (winter in WA vs fall in OR) because blight progression expressions over the winter/spring 2017-2018 (See Figure 4)
- Local sources had both high and low blight severity

**Results and Discussion**

- Blight severity within sites varied significantly (p<0.01): Among seed sources for all years at all sites except for SO where sources only differed in 2012 (See Figure 3)

- Local sources had both high and low blight severity
- Blight severity varied among half-sib families within seed sources
- Among half-sib families within sources also varied significantly (p<0.01) for all years and at all sites except at SF where families only differed in 2015
- Averaged across all sites, variation in blight severity among sources was not related to longitude of origin but was significantly (p<0.01) related to: Latitude of origin, with R² values ranging from 9% in 2012 to 69% in 2014
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- When analyzed separately by site, variation in blight severity among sources:
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  - The strongest relationships between seed source origin and site were at the most northern common gardens (PH & PV)
  - Averaged across sites, trends in Figure 3 show:
    - In general, southern sources had higher blight severity than northern sources
    - Sources with the lowest blight severity were from the north: OH, CL (Oak Harbor & Clinton, WA), OR (Cornelius, OR)
    - Sources with the highest blight severity were from the south: e.g., HC, HP, LA (Humboldt County, Hopland, Los Altos, CA)
    - However, some northern sources such as PA, DE (Port Angeles, WA, Detroit, OR) had relatively higher blight severity while some southern sources such as PL, CA (Placeville & Calistoga, CA) had lower blight severity
    - The source by common garden site interaction (i.e., genotype 
      environment) was significant for all years (p<0.001)

- These results suggest:
  - Wetter, cooler conditions seem to increase blight severity
  - Sources moved the farthest north generally had more severe blight
- These sources may have been less well adapted thus more stressed and less able to resist leaf blight
- Relative blight severity of some sources was not consistent across all common garden sites
- Resistance to leaf blight might exist
- Local sources had both high and low blight severity
- Blight severity varied among half-sib families within seed sources

**Progression of Leaf Blight at Starker Forest in 2017-2018**

- Nine cameras were set up at the Oregon Starker Forest site to capture progression of blight over the winters of 2017-2018
- 1 camera = control tree scored as no blight, May 2017
- 8 cameras = trees with relatively high blight scores in May 2017
- Cameras were set up on November 17 and photographs are taken at 9 am, Noon, & 3 pm
- Photographs show the Detroit, OR source
  - Note: apical buds elongated on 27
  - Apical buds elongated May 1
  - New flush May 8

**Leaf blight variation at the Starker Forest Site in Oregon in May 2018**

- Ditylenchus albidus from Starker Forest site
- Leaf spot with ascospores (CL) and conidial (RA)
- Conidia were found on the lower leaf surface in February 2018 samples, and ascus and ascospore were observed in ascospore on the upper leaf surface in May 2018 samples

**Stemphylium sp.**

- Seed identified from madrone foliage samples using morphological and molecular techniques at the common garden sites, from southern California to British Columbia.

- Fungi identified from madrone foliage samples using morphological and molecular techniques at the common garden sites, from northern California to British Columbia.