Phytophthora species associated with urban and natural environments in Vancouver and Victoria, BC

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Phytophthora – Plant Destroyer!!!

- Billion dollar losses in agricultural industry
- Large scale mortality in forests
- Many have multiple hosts
- Have been known to jump to new hosts
- Affect trade through restrictions and quarantines
Plant Destroyer ... Really?

• Many notorious pathogens are associated with human activities
  – Agriculture
  – Trade
  – Forestry

• In many cases, large scale diseases result from the movement of pathogens into new or un-natural habitats

• What is the impact of urban activities on the natural Phytophthora community structure in southwest BC?
Natural *Phytophthora* community

- Most of our knowledge of the genus is limited to species associated with large-scale disease in agricultural and forest systems.

- Recent studies suggest a diverse *Phytophthora* community in natural systems.

- Many newly described species not associated with disease.
Field Sampling

Vancouver & Victoria

Urban
- CDF
- CWH

Urban natural interface
- CDF
- CWH

Natural
- CDF
- CWH

- Leaf baiting (2011)
- Water samples (2012, 2013)
- Soil samples (2012, 2013)
- Water samples (2012, 2013)
- Soil samples (2012, 2013)
Urban, interface and natural sites

Natural site: forested area with as little urban surroundings as possible

Interface site: natural park inside urban setting

Urban site: agricultural or residential region
Soil and Water collections

- 10 sampling locations in each region
- 2012 fall and 2013 spring/summer

Meta DNA barcoding
ITS1 (metagenomics)

Soil samples

Baiting & culturing

Barcoding with ITS1 and 2
Phytophthora are a small proportion of the Oomycete community in soil.
More *Phytophthora* positive samples in urban sites

Chi-square = 29.6573. The p-value is < 0.00001
More *Phytophthora* positive samples in urban sites for all methods

**Water - baiting and culturing**
- Natural: 29%
- Interface: 52%
- Urban: 58%

**Soil - baiting and culturing**
- Natural: 3%
- Interface: 19%
- Urban: 25%

**Soil - Meta DNA barcoding**
- Natural: 25%
- Interface: 40%
- Urban: 45%
Urban sites have greater diversity
Frequency of species found

Water baiting and culturing

Soil baiting and culturing

P. gonapodyides
P. lacustris
P. chlamydospora
P. taxon Oaksoil
P. persiana - like
P. plurivora/P. citricola
P. intercalaris
P. cambivora
P. polonica
P. irrigata
P. amnicola
P. riparia
P. hydrospathica
P. gregata
P. cryptogea
P. sinningiae
P. cactorum
P. europaea/P. uliginosa
P. quercina
Unknown sp 2
P. pseudotsugae
P. multivora
P. inundata
Unknown sp 3
Unknown sp 1
P. pseudosyringae
P. gallica
P. nemorosa
P. megasperma
P. medicaginis x cryptogea
P. lateralis
P. ilicis
unknown sp 4
P. siskiyouensis
P. quercina - like
P. hibernalis
P. fragariae/P. rubi
P. erythroseptica
P. dreschleri

Urban
Interface
Natural
Frequency of species found

Water baiting and culturing

Soil baiting, culturing & DNA metabarcoding

Urban
Interface
Natural
Baiting vs DNA metabarcoding

- Largest differences between years (fall 2012 vs spring/summer 2013)
- Baiting and culturing soil did not yield a lot of *Phytophthora*
- Meta DNA-barcode better for soil
- Higher diversity in meta-DNA barcoding
Conclusions

• *Phytophthora* make up a relatively small part of the soil community

• Urban environments have a higher *Phytophthora* diversity than natural environments

• Some species found in urban environments are common crop pathogens

• Some invasive species may be moving into natural environments
Implications

• Increase our understanding of *Phytophthora* species and the native *Phytophthora* community

• This may help in detection, tracking, monitoring and managing outbreaks

• Possible early detection of invasive species

• Evaluate effectiveness of current quarantine measures
Thanks!!!

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