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New Pest Response Guidelines

Phytophthora species in the Environment and Nursery Settings

Karen Maguylo, PhD

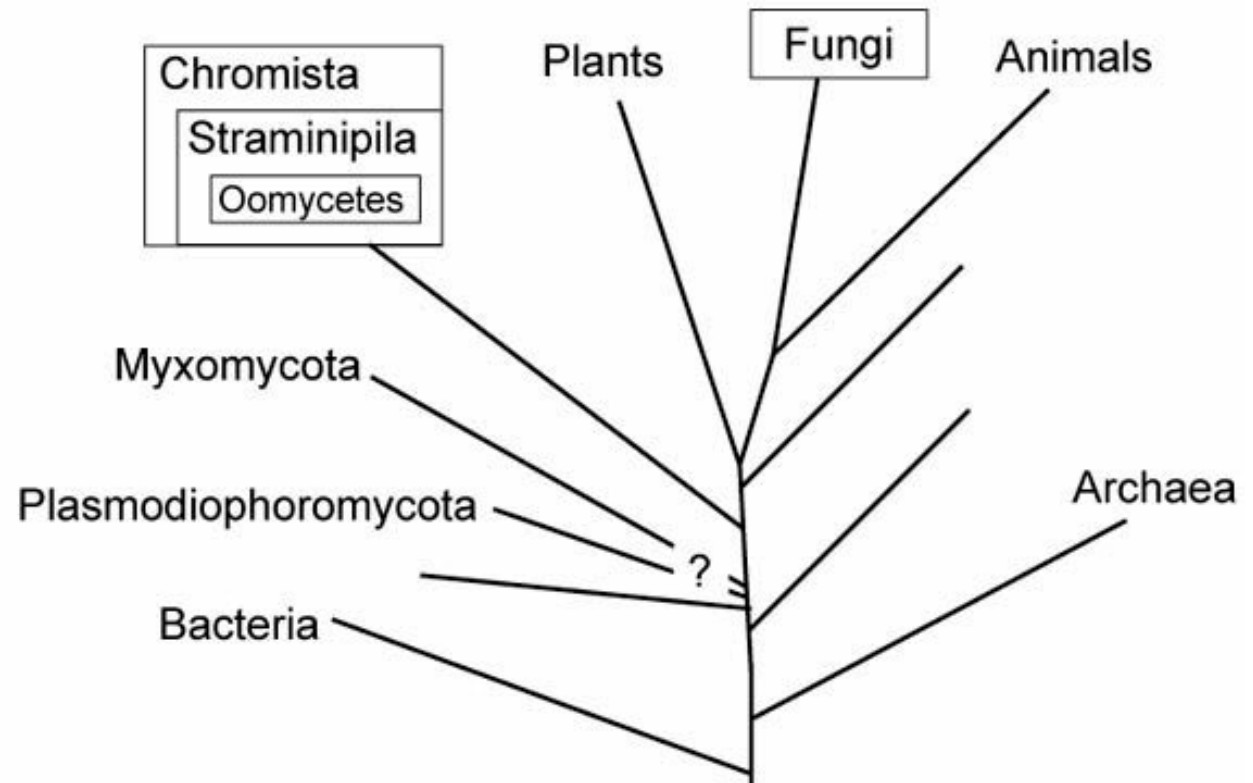


>100 species



What are *Phytophthora* spp.?

- ▶ Oomycetes
 - ▶ Fungus-like



<http://www.apsnet.org>



NPRG

- ▶ *Phytophthora alni* (subsp. *alni*, *multiformis*, *uniformis*)
 - ▶ *P. alticola*
 - ▶ *P. austrocedrae*
 - ▶ *P. boehmeriae*
 - ▶ *P. captiosa*
 - ▶ *P. colocasiae*
 - ▶ *P. fallax*
 - ▶ *P. frigida*
 - ▶ *P. gallica*
 - ▶ *P. idaei*
 - ▶ *P. iranica*
 - ▶ *P. italica*
 - ▶ *P. kernoviae*
 - ▶ *P. melonis*
 - ▶ *P. multivesiculata*
 - ▶ *P. multivora*
 - ▶ *P. pinifolia*
 - ▶ *P. polonica*
 - ▶ *P. porri*
 - ▶ *P. primulae*
 - ▶ *P. psychrophila*
 - ▶ *P. quercina*
 - ▶ *P. tentaculata*
 - ▶ *P. uliginosa*
-



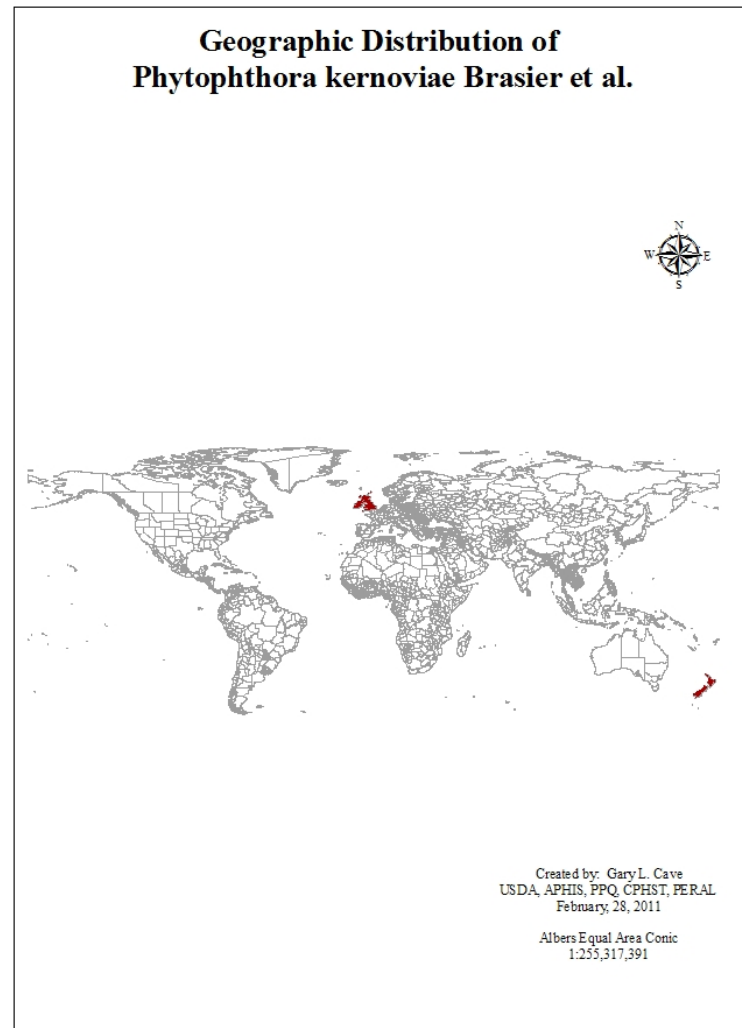
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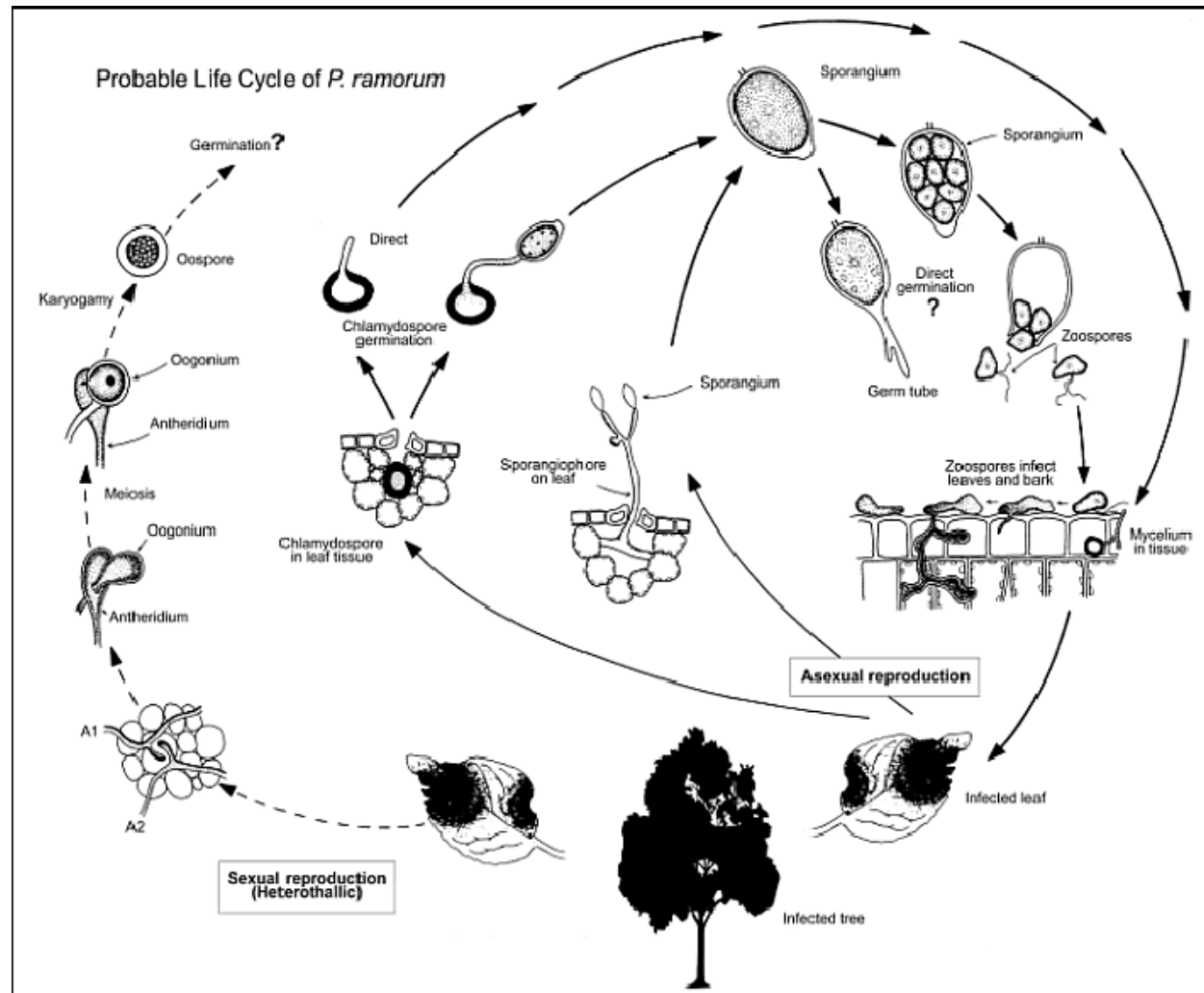


Phytophthora kernoviae - Distribution

- ▶ England
- ▶ Scotland
- ▶ Ireland
- ▶ New Zealand



Phytophthora kernoviae - Biology



Adapted from 'The disease cycle of late blight caused by *Phytophthora infestans*', G.N.Agrios, (with copyright permission Academic Press)

<http://rapra.csl.gov.uk/background/lifecycle.cfm>

Phytophthora kernoviae - Hosts

- ▶ *Annona cherimola* (cherimoya)
 - ▶ *Castanea sativa* (European chestnut)
 - ▶ *Drimys winteri* (winter's bark)
 - ▶ *Fagus sylvatica* (beech)
 - ▶ *Gevuina avellana* (Chilean hazelnut)
 - ▶ *Hedera helix* (ivy)
 - ▶ *Ilex aquifolium* (holly)
 - ▶ *Liriodendron tulipifera* (tulip tree)
 - ▶ *Lomatia myricoides* (river lomatia)
 - ▶ *Magnolia* spp. (*M. amoena*, *brooklynensis*, *cylindrica*, *delavayi*, *kobus*, *liliflora*, *mollicomata*, *salicifolia*, *sargentiana*, *sprengeri*, *stellata*, *wilsonii*)
 - ▶ *Magnolia x soulangeana*
 - ▶ *Michelia doltsopa* (sweet michelia)
 - ▶ *Pieris formosa* (Wakehurst pieris)
 - ▶ *Pieris japonica* (Japanese pieris)
 - ▶ *Podocarpus salignus* (willow podocarp)
 - ▶ *Prunus laurocerasus* (cherry laurel)
 - ▶ *Quercus ilex* (Holm oak)
 - ▶ *Quercus rober* (English oak)
 - ▶ *Rhododendron* spp.
 - ▶ *Rhododendron ponticum* (pontic rhododendron)
 - ▶ *Sesquiadendron giganteum* (giant sequoia)
 - ▶ *Vaccinium myrtillus* (bilberry)
-



Symptoms – *Fagus sylvatica* - beech



Similar to *P. ramorum*



Lesions up to 12 m
Girdling



Foliage lesions on *Magnolia* spp.



UGA5110023

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Symptoms - *Rhododendron* spp.



UGA5110061
www.invasive.org

necrosis



shoot dieback

www.forestry.gov.uk



UGA5110060
www.invasive.org



Survey

03. Survey

Phytophthora spp.

Phytophthora species	Hosts	Symptoms	Survey Specifics	Baits used	Media used for culturing	Key Reference(s)
<i>Phytophthora kernoviae</i>	<i>Annona cherimola</i> (cherimoya), <i>Castanea sativa</i> (European chestnut), <i>Drimys winteri</i> (winter's bark), <i>Fagus sylvatica</i> (beech), <i>Gevuina avellana</i> (Chilean hazelnut), <i>Hedera helix</i> (ivy), <i>Ilex aquifolium</i> (variegated holly), <i>Liriodendron tulipifera</i> (tulip tree), <i>Lomatia myricoides</i> (river lomatia), <i>Magnolia</i> spp. (magnolia), <i>Michelia doltsopa</i> (sweet michelia), <i>Pieris</i> spp. (pieris), <i>Podocarpus salignus</i> (willow podocarp), <i>Prunus laurocerasus</i> (cherry laurel), <i>Quercus</i> spp. (oak), <i>Rhododendron</i> spp., (rhododendron), <i>Sesquiadendron giganteum</i> (giant sequoia), and <i>Vaccinium myrtillus</i> (bilberry).	Leaves: Leaf blights (blackening of leaf petiole, leaf tip, leaf base), necrotic lesions, dieback, wilting. Rhododendron leaves often fall within a few weeks of infection. Stem: Bleeding bark cankers, can girdle/kill trees, dieback. Bleeding cankers may be sunken or demarcated by black lines.	Direct plating of symptomatic tissue (necrotic inner bark or leaf lesions). Brown and Brasier (2007) recommend attempting to isolate from the xylem if discoloration is present.	Rhododendron 'Cunningham's White leaf disks (Benson <i>et al.</i> , 2008)	SMA + MRP (Elliot <i>et al.</i> , 1966), PARPH	Brasier <i>et al.</i> (2005) Beales <i>et al.</i> (2006)

Common Symptoms associated with *Phytophthora* spp.

- ▶ Leaf blight
 - ▶ Stem canker
 - ▶ Root rot
 - ▶ Leaf spots
 - ▶ Twig blight or dieback
 - ▶ Lesions
 - ▶ Internal discoloration
 - ▶ External discoloration
 - ▶ Defoliation
 - ▶ Production of abnormal exudates
 - ▶ Chlorosis
 - ▶ Abnormal leaf discoloration
 - ▶ Plant death
-
- ▶ Visual inspection
 - ▶ Soil Sampling

lesions of foliage of magnolia



necrosis of rhododendron leaves



bleeding lesion on tru of European beech



Wilting of rhododendron

Diagnosics and Identification

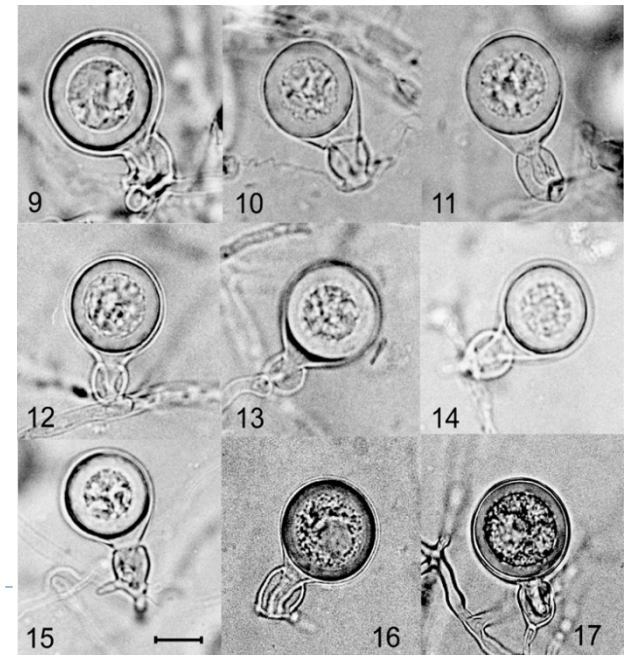
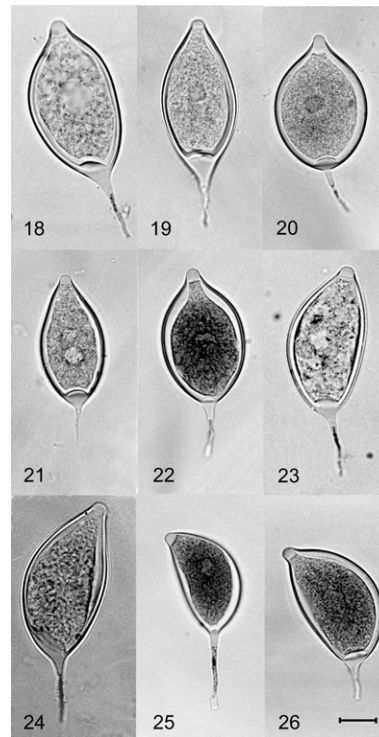
04. Pest Diagnostics & Identification

Phytophthora spp.

<i>Phytophthora</i> spp.	Main hyphae	Sporangia	Chlamyospores	Heterothallic vs. Homothallic	Oogonia	Oospores	Antheridia	Growth Characteristics *
<i>Phytophthora kernoviae</i>	Hyphae sometimes denticulate or tuberculate.	Sporangia occasional on CA, common on plugs immersed in soil water or soil leachate; sympodial sporangiophores. Sporangia papillate, caduceus, from regular ovoid or limoniform to distinctly asymmetrical or 'mouse-shaped' with one rounded and one flatter side. Most have a conspicuous vacuole. Sporangia length x width range of means 38.5-45.5 x 22.5-27 µm. Length-breadth ratio: average 1.5 µm. Sporangial pedicels range of means 8.6-14.1 µm.	No chlamyospores observed.	Homothallic	Oogonia, diameter range of means 23.5-25.5 µm; often with tapered stalks.	Plerotic, diameter range of means 21.1-22.5 µm; wall thickness averages about 3.5 µm.	Amphigynous. Length/width range of means 11.5-12.5 x 10-10.8 µm.	On CA-largely submerged in darkness. On exposure to light, small central patchy arial mycelium. Diurnal light, alternating rings of arial mycelium. Maximum growth temperature 26 °C, optimum at 18 °C.

Diagnosics and Identification

- ▶ Serological
 - ▶ Can not differentiate from *P. ramorum*
- ▶ Morphological
 - ▶ Symptoms are not characteristic
- ▶ Molecular
 - ▶ 2 diagnostic procedures developed

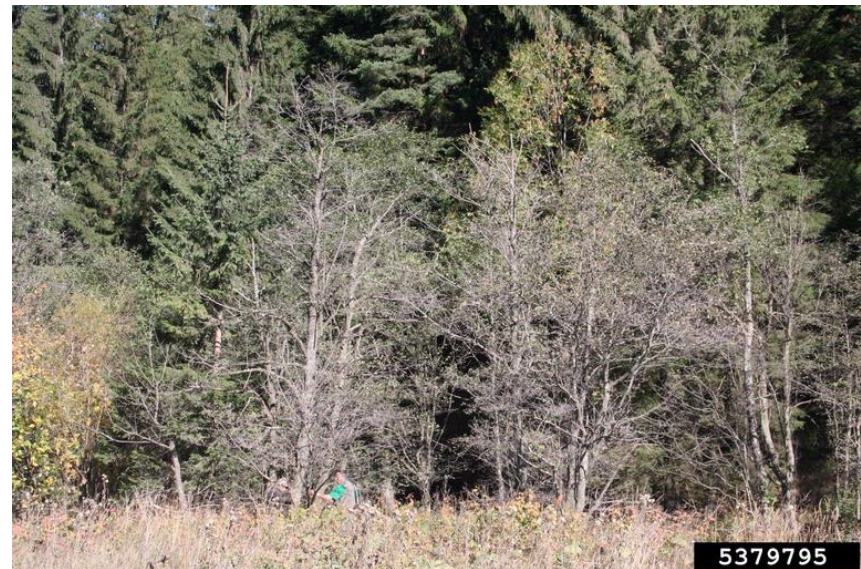


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Phytophthora - Control

- ▶ Exclusion
- ▶ Eradication
- ▶ IPM
 - ▶ Biological control has not been investigated
- ▶ Chemical
 - ▶ none for *P. kernoviae*
 - ▶ Fungicides?
- ▶ Cultural
 - ▶ for *kernoviae*, burning, or other plant destruction



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Phytophthora - Pathways

- ▶ Introduced in 3 ways:
 - ▶ Movement of infected plant material
 - ▶ Natural environmental movement of spores
 - ▶ Transmission of non-plant pathways to plant material



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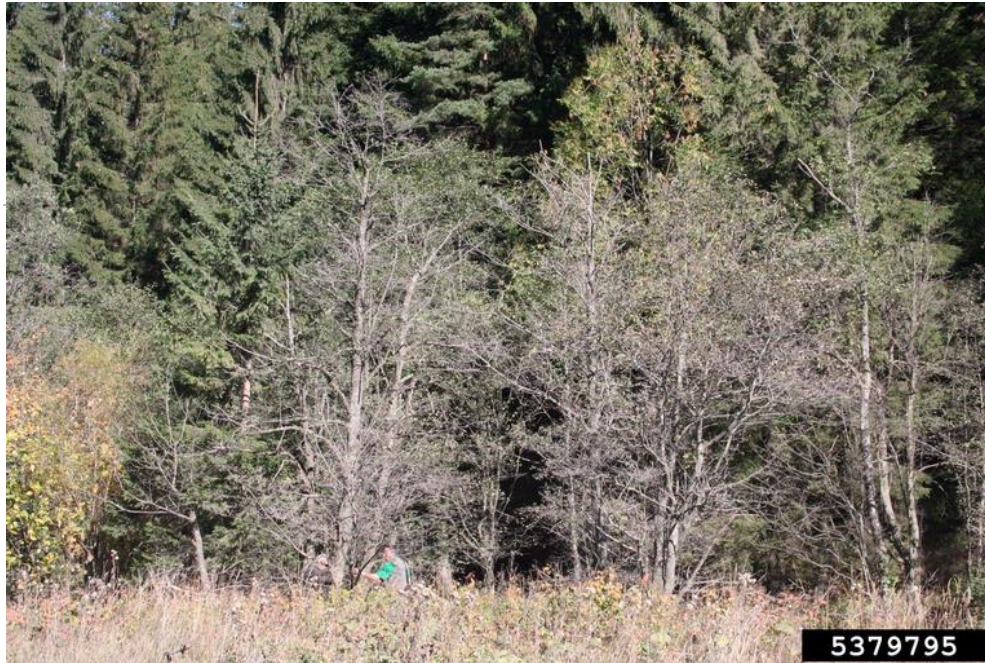
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Research Needs

- ▶ Little information available for most of the phytophthora:
 - ▶ Life cycle
 - ▶ Biology
 - ▶ Economic Importance
 - ▶ Ecological Importance
- ▶ What is necessary to develop targeted surveys
- ▶ *P. kernoviae*
 - ▶ Host range
 - ▶ Biology and epidemiology
- ▶ Determination of the susceptibility of North American alder to *P. alni*
- ▶ Determination of ecology and ecological importance of *P. alni* in North America
- ▶ Elucidation of the biology and life cycle of *P. alni* under field conditions, including the role of the oospore in the biology and survival of *P. alni*
- ▶ Determination of the importance of *P. alticola* and *P. frigida* as tree pathogens in the Phytophthora complex association with collar rot of cold-tolerant Eucalyptus species
- ▶ Clarification of the economic importance and the ecological importance of *P. boehmeriae* on hosts other than cotton





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THANKS