Best Management Practices Workshop for Nurseries: Steam Sanitation and Disease Identification

Phytophthora Symptom Identification

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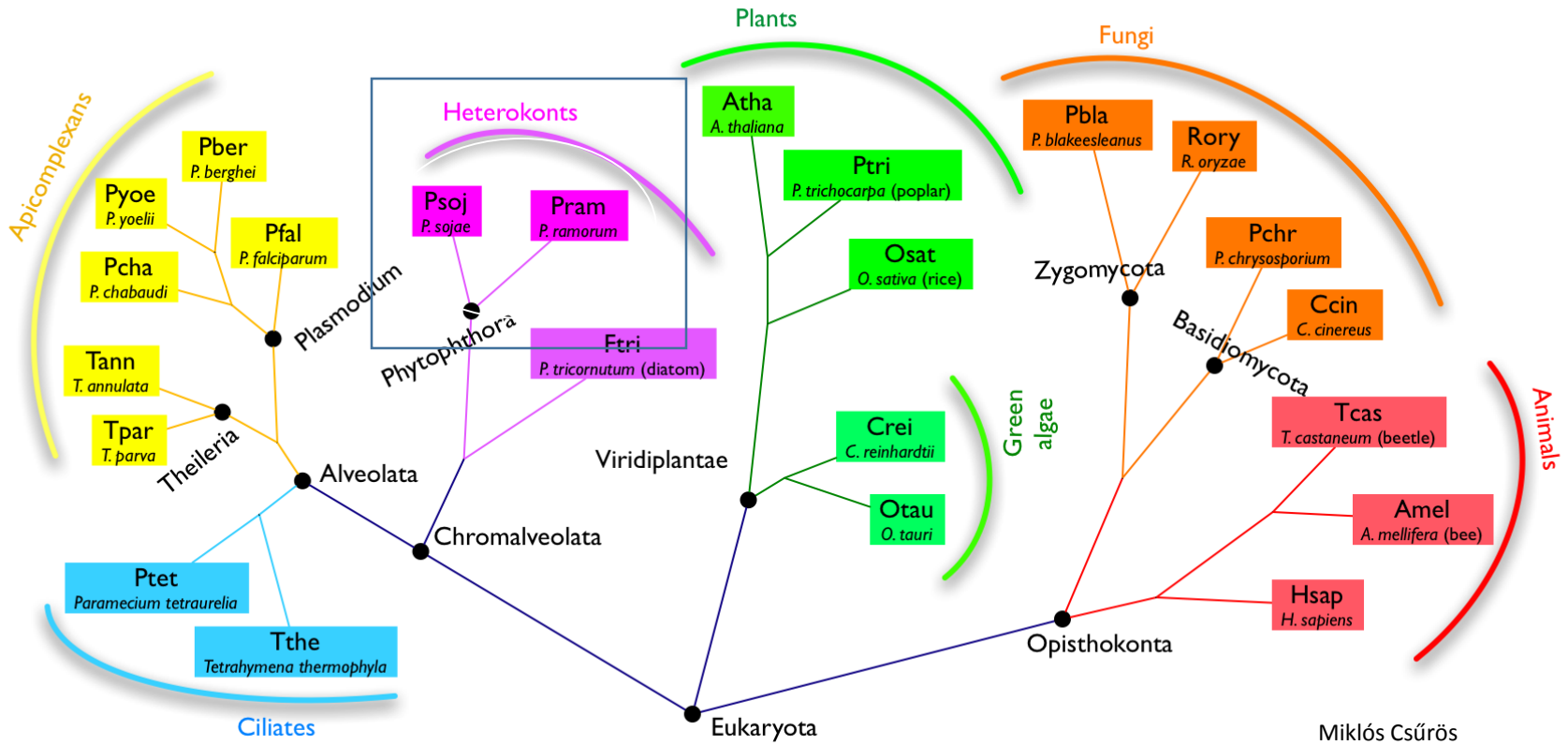
Phytophthora is not a fungus



Miklós Csűrös
University of Montreal

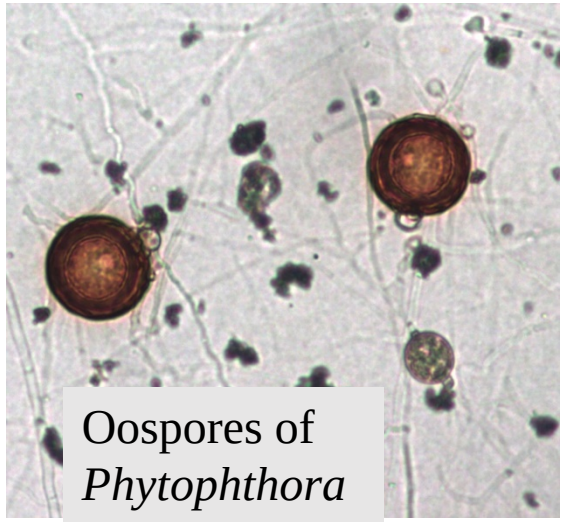
- Oomycetes (aka “water molds”) were once considered to be fungi
- Fungi and Oomycetes have similar growth forms – convergent evolution
- Control agents for fungi may not work for Oomycetes and vice-versa

Phytophthora and *Pythium* spore stages

Sporangia containing swimming zoospores (*P. ramorum*)

Chlamydospores

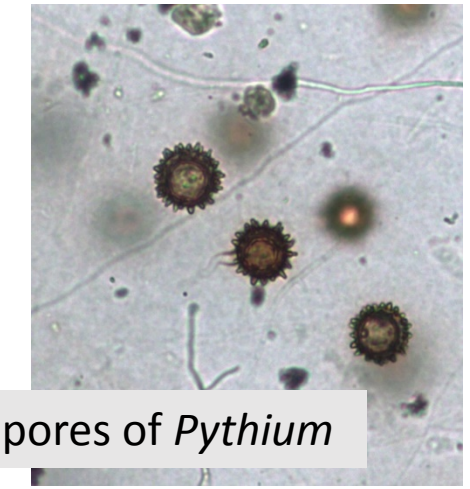
Sexual stage



Oospores of *Phytophthora*

Sporangia (*Pythium*)

Phytophthora and *Pythium are* microscopic and species can be identified by spore stages and/or DNA sequencing



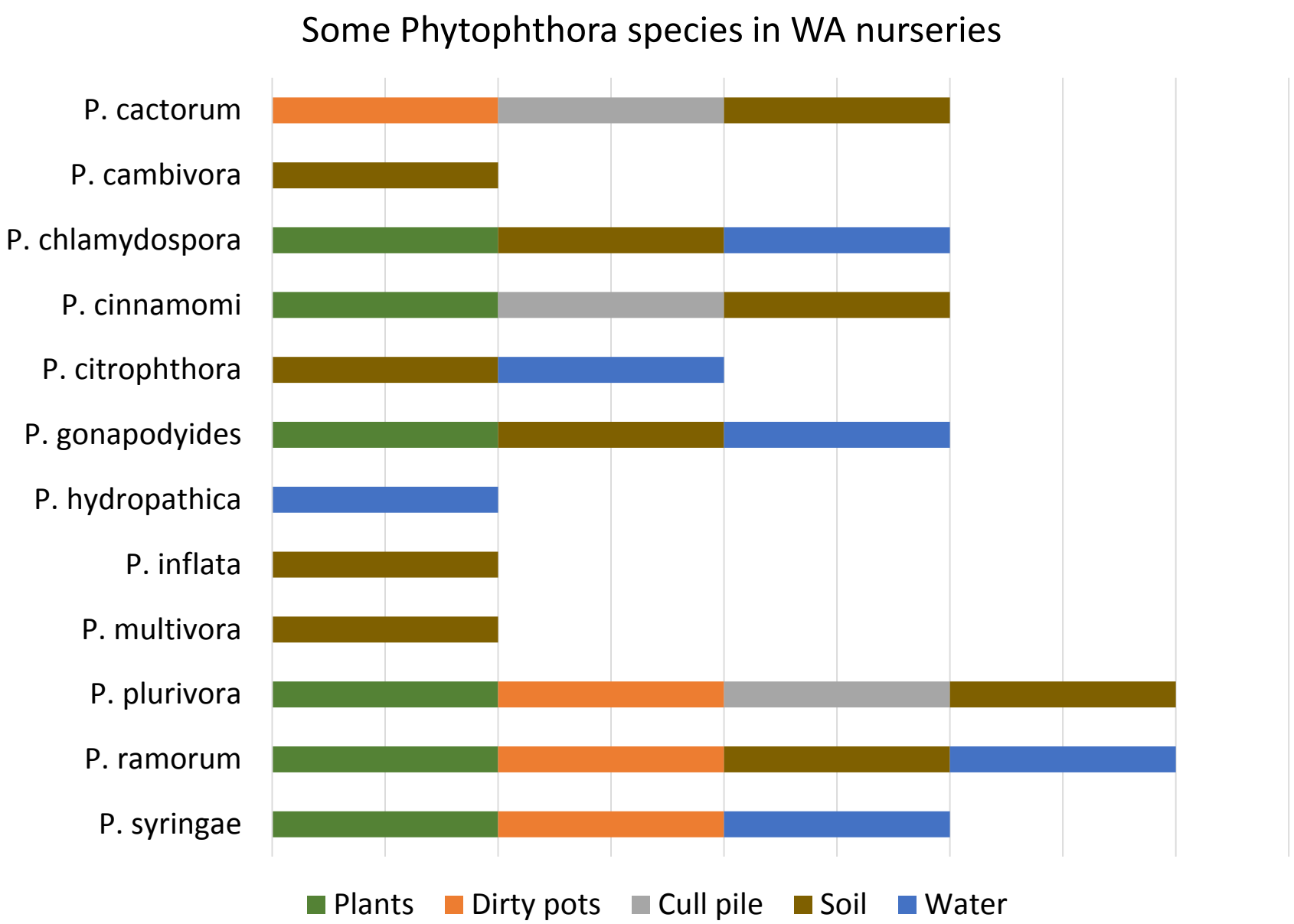
Oospores of *Pythium*

Where to find *Phytophthora*

Damage caused by *Phytophthora* spp.

Root disease on Fraser fir seedlings. (Photo – K. McKeever, WSU)

P. ramorum foliar blight on *Vaccinium* at a nursery


Some Phytophthora species in WA nurseries
P. cactorum
P. cambivora
P. chlamydospora
P. cinnamomi
P. citrophthora
P. gonapodyides
P. hydropathica
P. inflata
P. multivora
P. plurivora
P. ramorum
P. syringae
Plants
Dirty pots
Cull pile
Soil
Water

Phytophthora root disease

Several species including

P. cinnamomi

P. cactorum

P. cambivora

P. lateralis

P. plurivora

Chestnut seedlings killed by *P. cinnamomi* root disease from reused potting media in warm greenhouse.

Aquatic *Phytophthora* spp

Common in waterways

Weak pathogens

- *P. chlamydospora*
- *P. lacustris*
- *P. gonapodyides*

Any *Phytophthora* species can be detected using immunostrips, not all are aggressive pathogens.

Aerial *Phytophthora* spp.

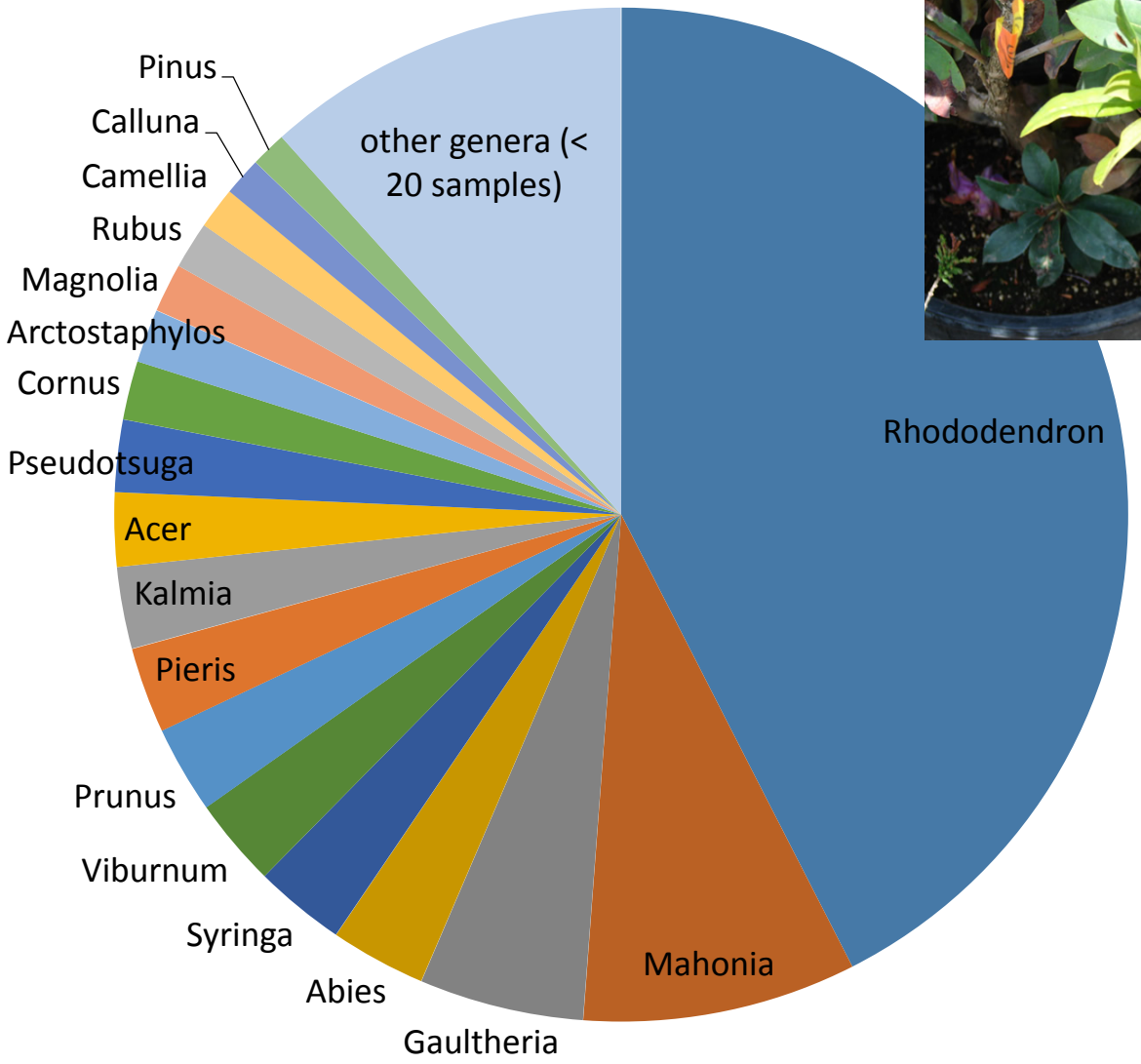
- *P. cactorum*
- *P. chlamydospora*
- *P. hibernalis*
- *P. ilicis*
- *P. plurivora*
- *P. pseudosyringae*
- *P. ramorum*
- *P. syringae*

P. ramorum on *Pieris japonica*

Phytophthora species isolated from foliar samples of host material taken during nursery surveys.

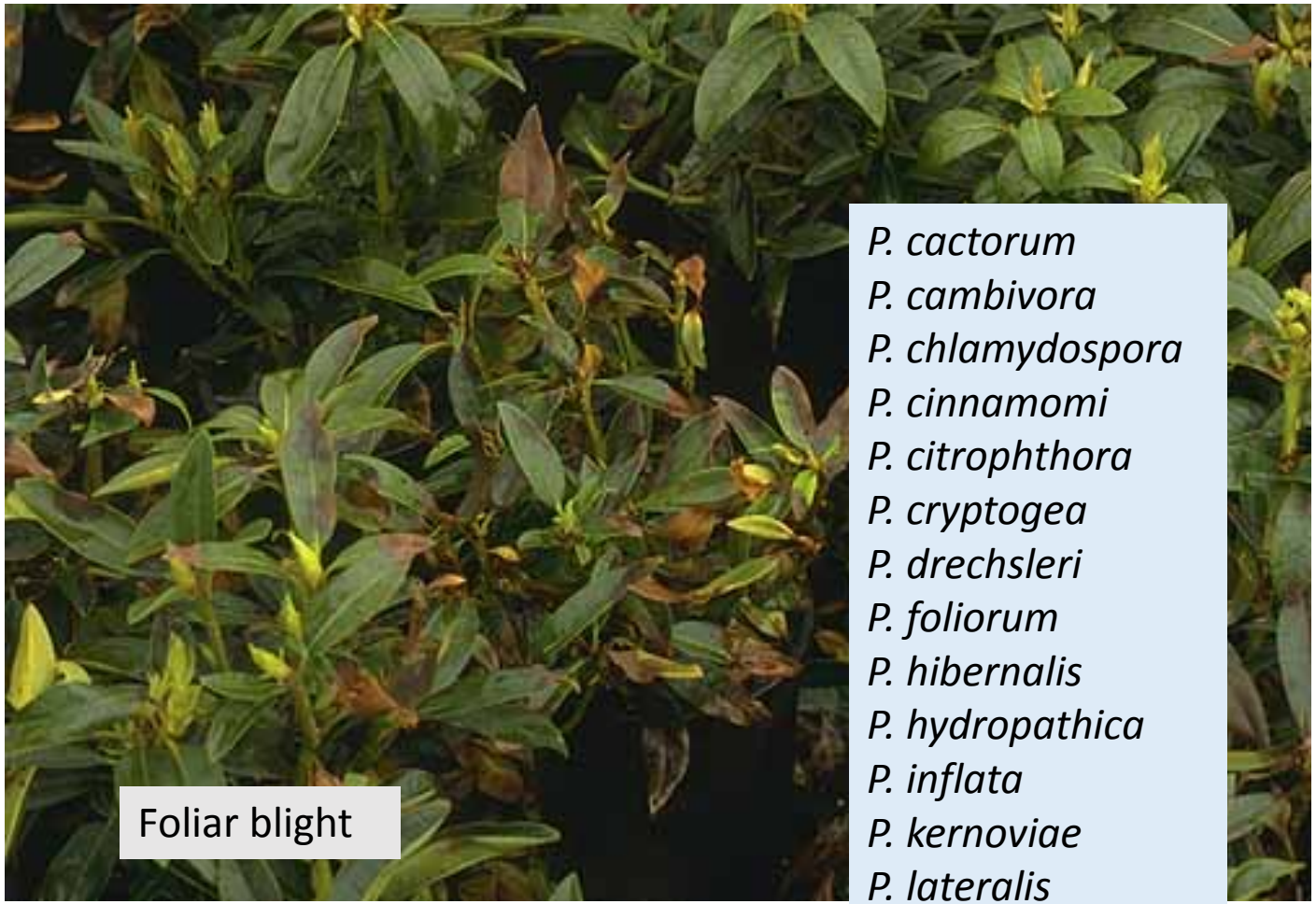
Arbutus		*P. gonapodyides*		
Kalmia				*P. syringae*
Rhododendron	*P. chlamydospora*	*P. gonapodyides*	*P. plurivora*	*P. syringae*
Viburnum	*P. chlamydospora*		*P. plurivora*	

Genera of plants positive for *Phytophthora* in ELISA testing of foliar samples, but negative for *P. ramorum*. Data from WSDA. Samples were collected in nursery inspections between 2011-2015.



Data from WSDA

Rhododendron



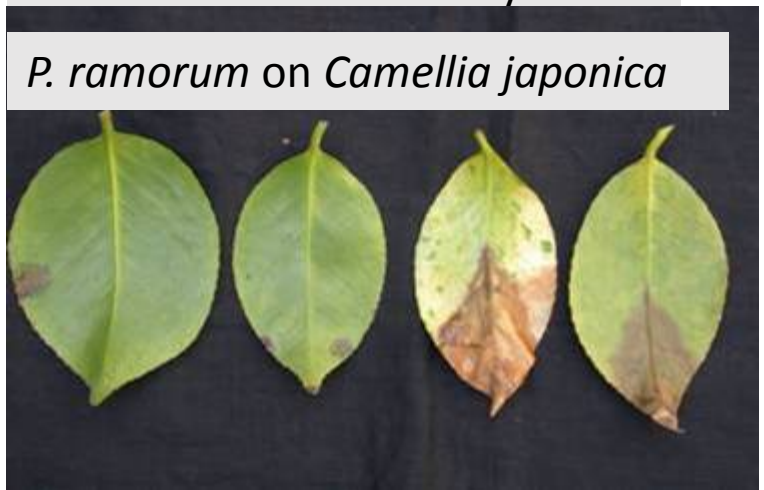
P. cactorum
P. cambivora
P. chlamydospora
P. cinnamomi
P. citrophthora
P. cryptogea
P. drechsleri
P. foliorum
P. hibernalis
P. hydropathica
P. inflata
P. kernoviae
P. lateralis
P. multivora
P. occultans
P. pini
P. ramorum
P. syringae

Camellia

P. cinnamomi
P. ramorum

Ramorum blight on *Camellia sinensis* ‘Sochi’ in nursery

P. ramorum on *Camellia japonica*



Arbutus

P. cactorum
P. cinnamomi
P. ramorum

P. ramorum foliar blight

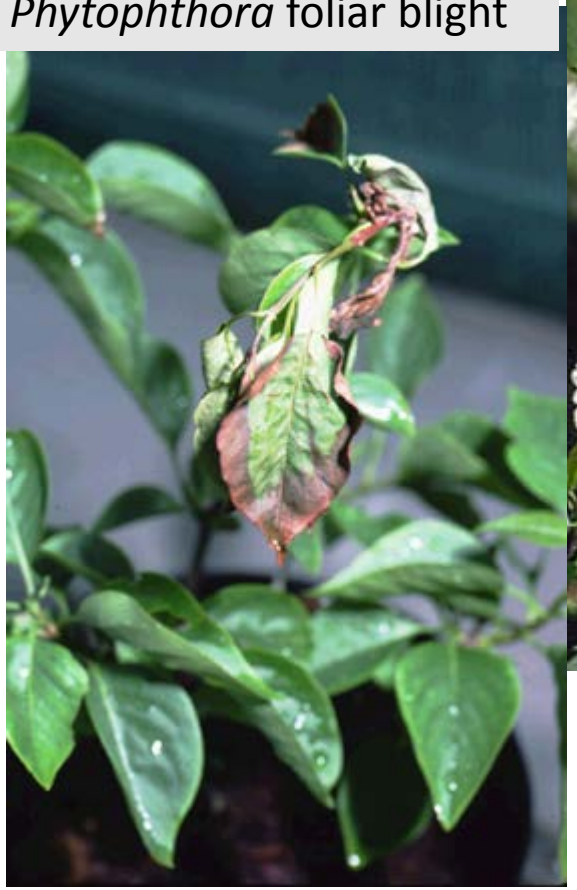
P. cinnamomi root disease

Sun scorch on thick-leaved hosts

Lilac

P. cactorum
P. citrophthora
P. inflata
P. pini
P. plurivora
P. ramorum
P. syringae

Phytophthora foliar blight



Bacterial blight

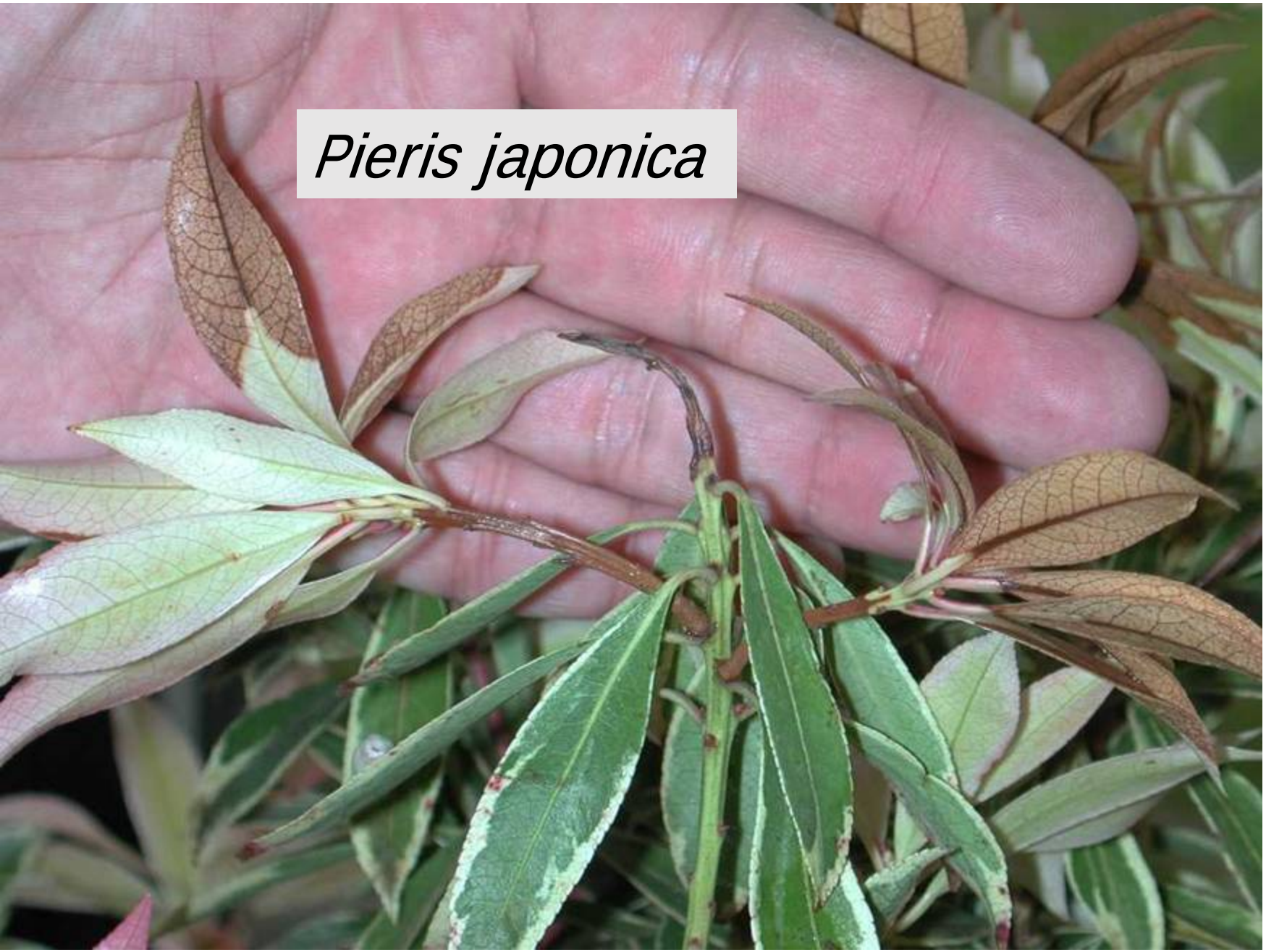
Kalmia

P. cinnamomi
P. citrophthora
P. hydropathica
P. lateralis
P. plurivora
P. ramorum
P. syringae
Py. undulatum

Fungal infection on *Kalmia*

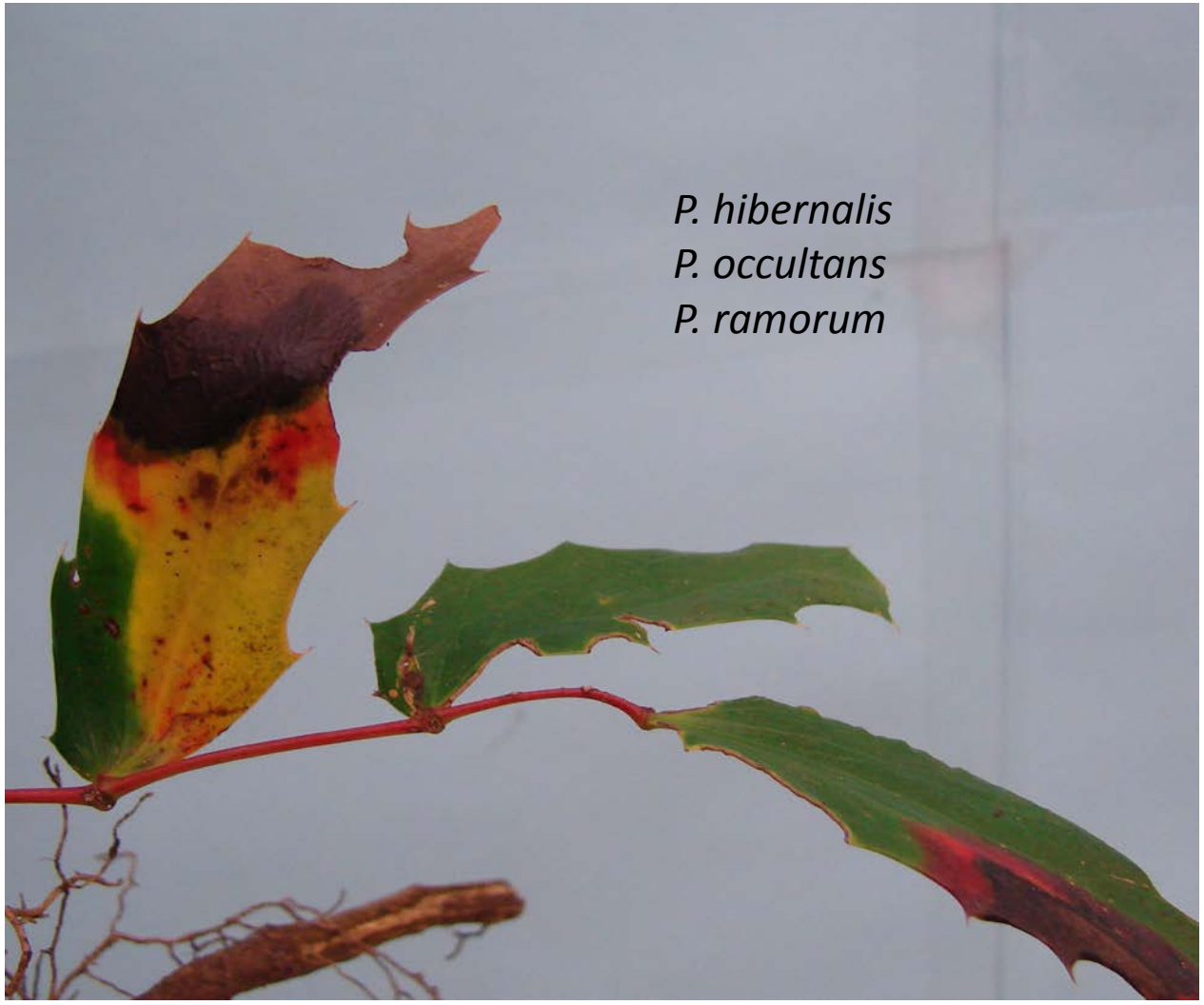
P. ramorum foliar blight on *Kalmia*

Leaves in contact with soil can pick up Phytophthora



P. cactorum
P. cambivora
P. cinnamomi
P. citrophthora
P. cryptogea
P. gonapodyides
P. hydropathica
P. kernoviae
P. multivora
P. occultans
P. pini
P. ramorum

Mahonia sp.

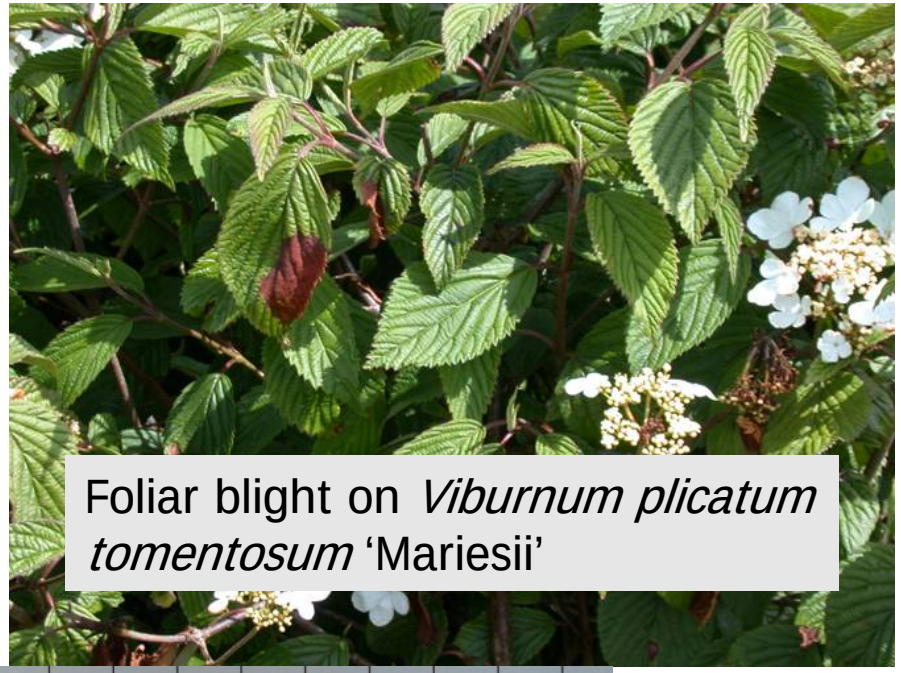


Vaccinium

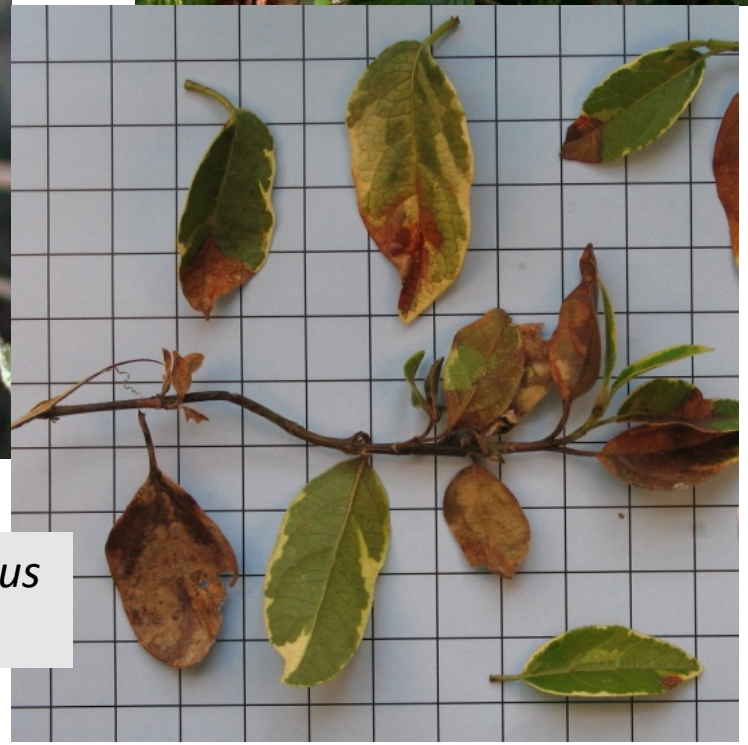
P. cambivora
P. cinnamomi
P. cryptogea
P. inflata
P. megasperma
P. plurivora
P. pseudosyringae
P. ramorum

Viburnum

Shoot dieback on *Viburnum x bodnantense* 'Dawn'



Foliar blight on *Viburnum plicatum tomentosum* 'Mariesii'



Foliar blight on *V. tinus* 'Spring Bouquet'

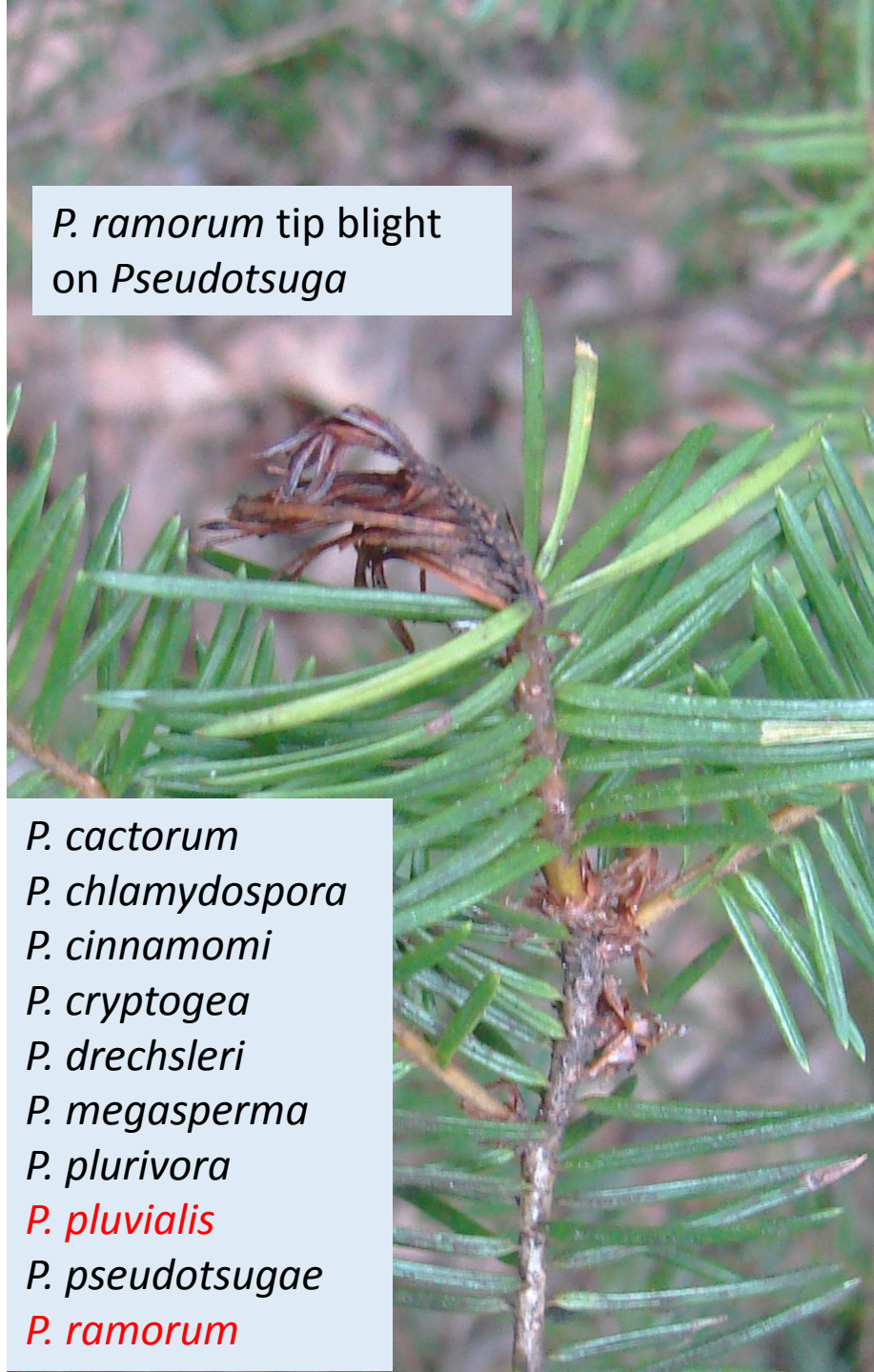
P. cactorum
P. chlamydospora
P. cinnamomi
P. citrophthora
P. drechsleri
P. hydropathica
P. plurivora
P. ramorum

Conifers

Most *Phytophthoras* cause root disease on conifers

Abies spp.

P. cactorum
P. cambivora
P. cinnamomi
P. citrophthora
P. cryptogea
P. drechsleri
P. gonapodyides
P. inundata
P. megasperma
P. niederhauseri
P. plurivora
P. ramorum



P. ramorum tip blight on *Pseudotsuga*

P. cactorum
P. chlamydospora
P. cinnamomi
P. cryptogea
P. drechsleri
P. megasperma
P. plurivora
P. pluvialis
P. pseudotsugae
P. ramorum

Symptoms of *Phytophthora* on herbaceous plants

- Damping off
- Wilting
- Water-soaked lesions
- Total plant collapse

Root and foliar symptoms of Crown Rot in Strawberry caused by *P. cactorum*

(Photo courtesy of F.J. Louws, NC State University)

Sample ID

Samples can be sent to the WSU plant clinic

http://puyallup.wsu.edu/plantclinic/

Insect identification, including pest management recommendations

Plant disease and disorder diagnosis and management

Turf and lawn problem diagnosis and management

Identification of unknown plants including weeds

Activity – Symptom ID and use of *Phytophthora* test strips

Plants will have symptoms of

Fungal leaf blight

Phytophthora

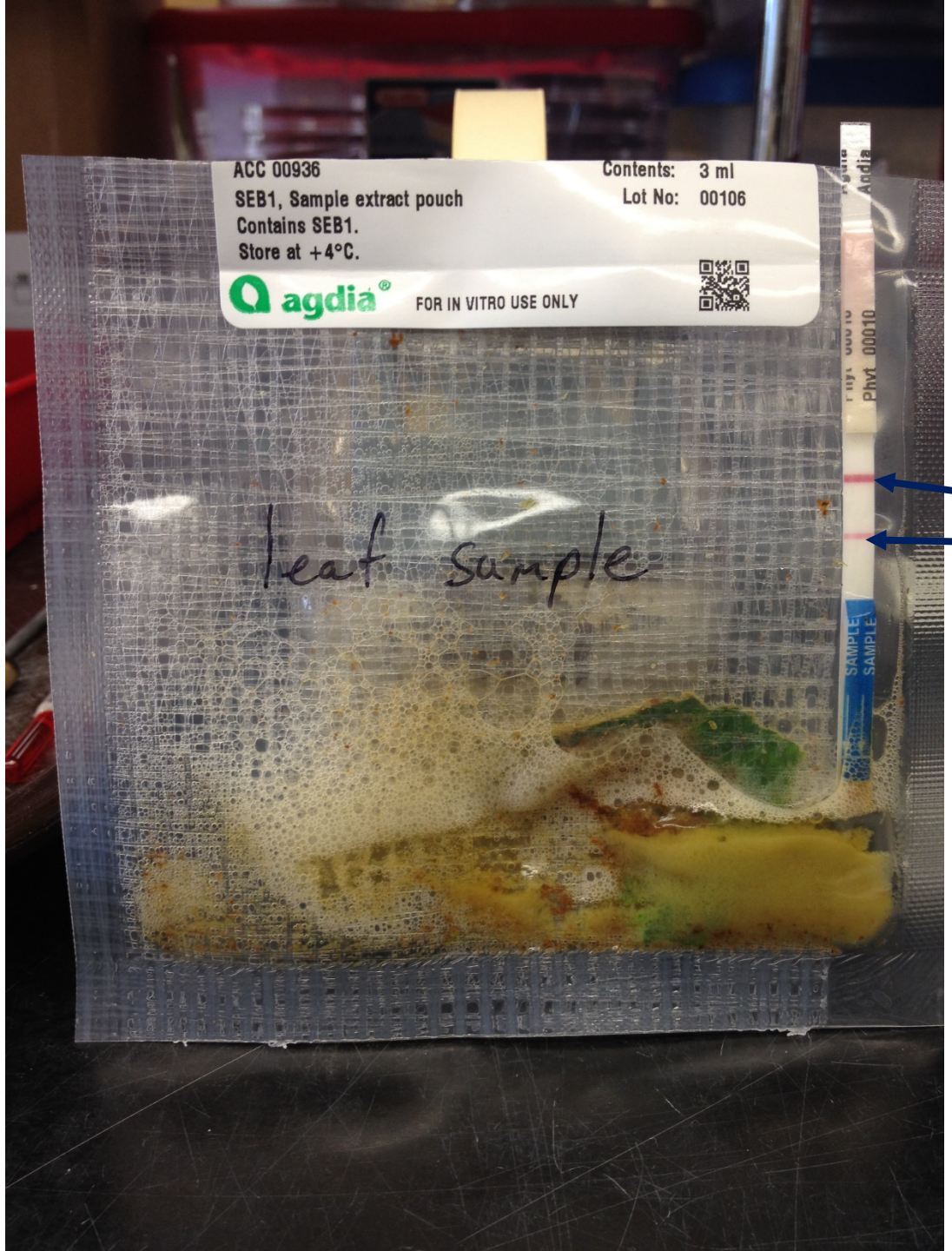
Fertilizer burn

Insect damage

????

How to use test strips – if you suspect *Phytophthora* infection:

- Prepare sample by grinding symptomatic leaf material (~1” sq) between mesh lining until brown or green in color.
- Insert test strip into channel portion of bag no more than ¼” or to white line on label. Wait 5-30 minutes.
- Remove test strip from sample and interpret results:
  - One line – negative for *Phytophthora*
  - Two lines – positive for *Phytophthora*
  - No lines – test failed



Positive result