Detection, seed transmission, and chemical control of *Hyaloperonospora camelinae* on *Camelina sativa* (L.) in Washington State

**Introduction**

- Camelina (*Camelina sativa* [L.] Crantz) is an oilseed crop in the mustard family that has great potential as a rotation crop for wheat in the low and intermediate rainfall regions of the Pacific Northwest (PNW).
- Camelina can be attacked by a number of diseases, including downy mildew.
- Both *H. camelinae* and *H. parasitica* have been reported on camelina.
- Since spring 2010, there was an increase in incidence and severity of downy mildew disease in different locations in Washington State.
- The distinction of *Hyaloperonospora* species based on morphological characteristics is laborious, time consuming and less reliable than molecular analyses.
- The incidence of downy mildew in fields with no previous history of camelina raises the question of whether the pathogen is seed transmitted or not.

**Approach**

- **Design of *H. camelinae* and *H. parasitica* specific primers**
  - ITS1-5.8S-ITS2 region of *H. camelinae* and *H. parasitica*
- **PCR assays using *H. camelinae* specific primer**
  - Samples of diseased plants were collected from 3 locations in WA State
  - DNA extraction and PCR with HC and HP primer pairs
  - Cloning and sequencing
- **Detection and transmission of *H. camelinae***
  - Seeds from infected plants were planted in cones filled with potting mix
  - Cones were maintained in a growth chamber programmed for 12°C
  - At the flowering growth stage, plants were inspected for symptoms of downy mildew
  - Leaf samples were collected from infected and healthy plants for DNA extraction
- **Effect of mefenoxam seed treatment on incidence of downy mildew**
  - Seeds from infected plants were treated with mefenoxam (3 g a.i. per kg of seed) or rinsed with 0.5% NaOCl, stirred for 5 minutes and then treated with mefenoxam.
  - Treated seeds were planted in containers filled with potting mix
  - Control containers were planted using non-treated seeds
- **Inoculation of canola with *H. camelinae***
- **Light and Field Emission Scanning Electron Microscopy (FESEM)**

**Objectives**

- The objectives of this study were to:
  - (i) identify the downy mildew pathogen of camelina in Washington State
  - (ii) develop a reliable PCR based assay to detect the presence of the pathogen in the seeds
  - (iii) determine whether *H. camelinae* is a seed transmitted pathogen
  - (iv) test the efficacy of mefenoxam as a seed treatment for controlling downy mildew of camelina

**Outcome**

- Based on PCR and sequencing, the causal pathogen was identified as *H. camelinae*
- The PCR primers consistently amplified 699 bp bands from the infected plants only
- FESEM revealed the presence of conidia and conidiophores on the seed surface and light microscopic revealed the presence of oospores in the infected leaves (Fig. 1)
- *H. camelinae*, is a seed-transmitted pathogen
- Seeds treatment with mefenoxam significantly reduced the incidence of the disease

**Figure 1.** Light micrograph of conidiophore (a) and oospores (b) of *H. camelinae* in camelina leaf tissue. Field emission scanning electron micrograph of conidiophores bearing conidia of *H. camelinae* (c), surface of camelina seed colonized by conidiophores (d), conidia of *H. camelinae* (e-f)