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# Monitoring Pathogens Using Bees and NGS

Dr. Jonathan Griffiths

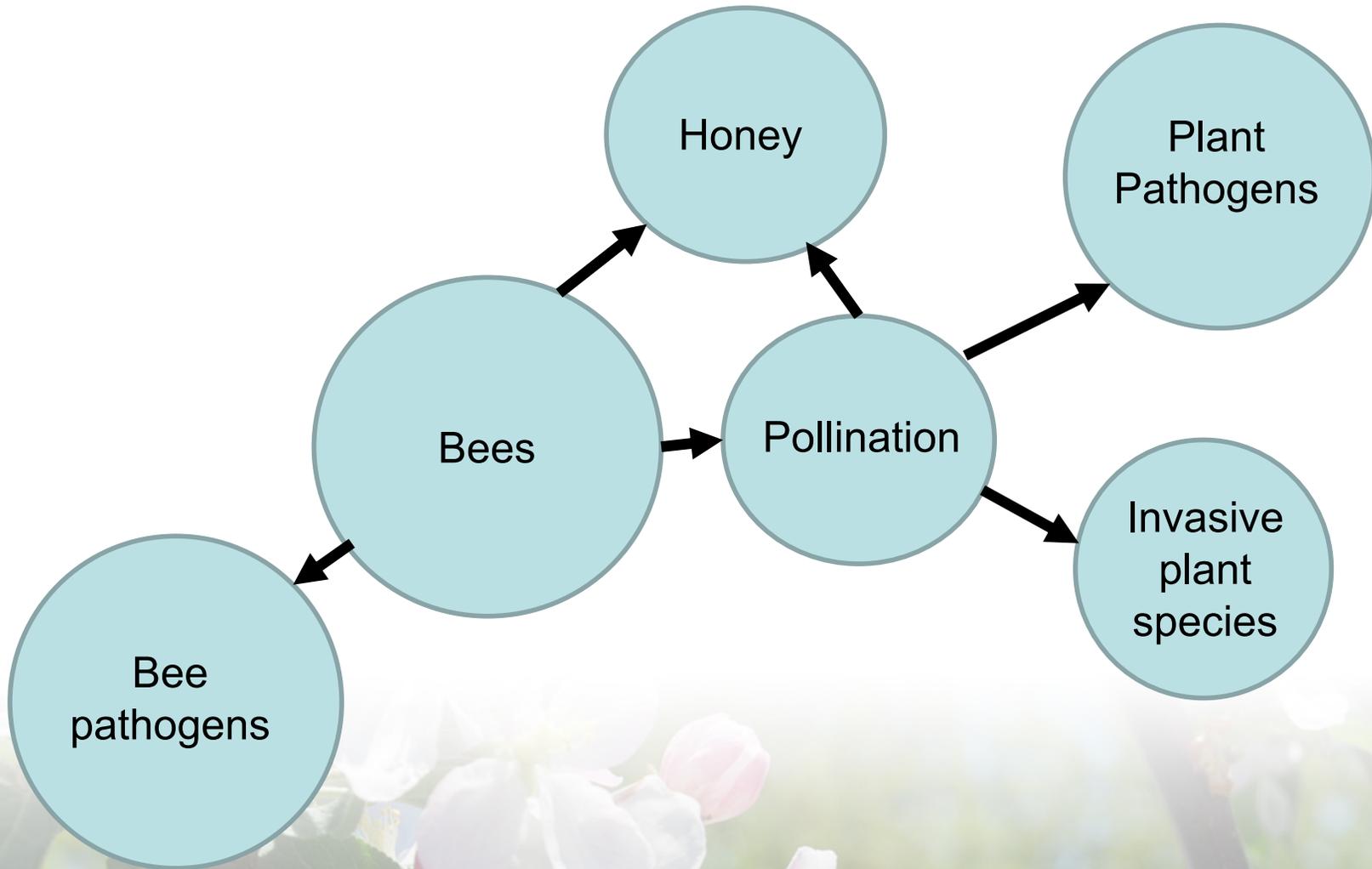
Canada 

# Crops in the Niagara Region

- Apples
- Stone fruits
- Grapevines
- Greenhouse tomatoes
- Commonalities:
  - Have Pathogens
  - Pollinated by Bees



# Bees are a Nexus of Agriculture



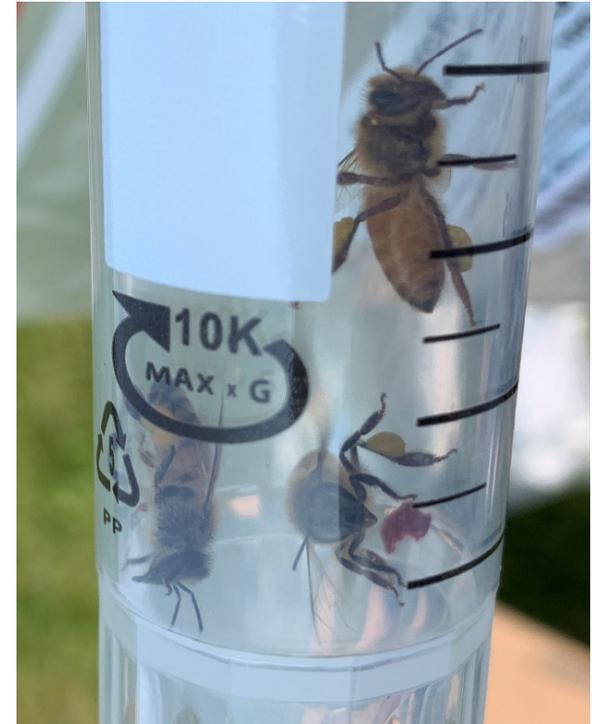
# Bees are Excellent Workers

- Bumblebees and Honey bees
- 40000-60000 worker bees
- Travel several kilometers
- Multiple foraging trips per day



# Sampling Bees to Monitor Plant Viruses

- Bees visit flowers, collect pollen
- Return to hive
- Pollen pellets, whole bees
- DNA/RNA extraction and sequencing



# NGS for Pathogen Monitoring

- Sequence reads
- Remove plant/bee sequences
- Virtool
- 16S rRNA, ITS, cpn60 for targeted sequence ID of fungal and bacterial pathogens

**Virtool**

Viral infection diagnostics using next-generation sequencing.

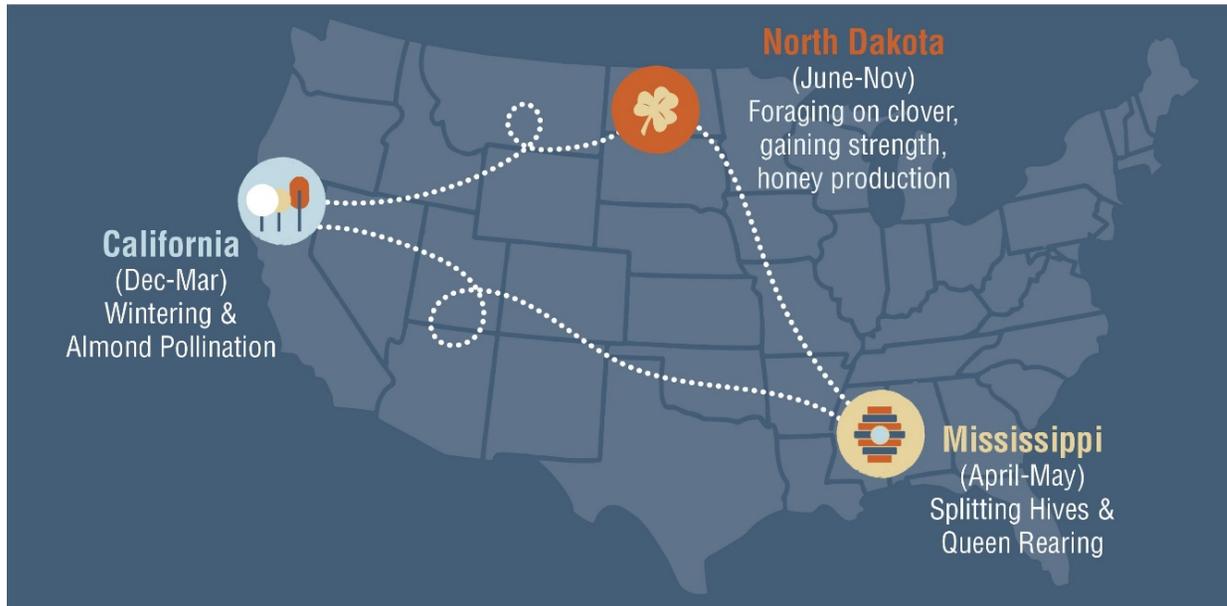
# Plant Viruses Transmitted by Bees

- Blueberry shock, Blueberry leaf mottle, Raspberry bushy dwarf, **Raspberry ringspot**
- **Cherry leaf roll**, **Prunus necrotic ringspot**, Prune dwarf, **Plum pox**
- Pepino mosaic virus, Tomato brown rugose fruit, Cucumber green mottle mosaic
- Tobacco ringspot virus
- Israeli acute paralysis virus

Card et al., 2007; Roberts et al., 2018



# Commercial Pollination could Vector Plant Disease



# Ideal Outcomes of this Approach

- Create a pathogen profile
- Identify emerging pathogens
- Identify regional threats
- Development of an early warning system
- Better understanding of the pollination ecosystem



# So long and thanks for all the bees

- Mike Rott, CFIA
- Marta Guarna, AAFC
- Guillaume Bilodeau, CFIA
- Graham Thurston, CFIA
- Sarah Jandricic, OMAFRA
- Lauren Vanderlingen



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