UNIVERSITY of GUELPH

CHANGING LIVES IMPROVING LIFE

Adapting veterinary testing protocols for honey bee diagnostics:

From mammals and birds to bees

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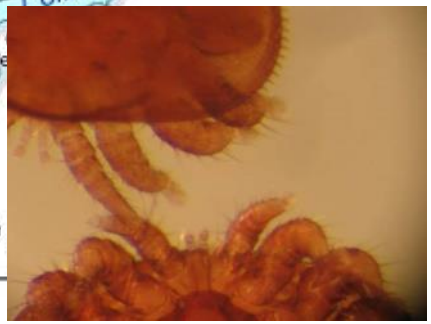
[June 6, 2017 – CAHLN]



Hudson Bay
Baie d'Hudson
Fort Severn
Peawanuck
MANITOBA
Severn R
River
Big Trout Lake
Sandy Lake
Winisk
James Bay
Baie James
Attawapiskat
Lansdowne House
Albany River
Moosonee
Moose R
ONTARIO
QUEBEC
N
Armstrong
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Kapuskasing
Cochran
Geraldton
Iroquois Falls
Timmins
Kirkland Lake
Marathon
Thunder Bay
Wawa
Chapleau
L Superior
L Supérieur
Greater Grand Sudbury
Sault Ste Marie
Elliot Lake
Espanola
Bay
Pembroke
Ottawa
Cornwall
Huntsville
Bancroft
Brockville
Parry Sound
Kingston
Owen Sound
Orillia
Belleville
Peterborough
Port Elgin
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2016 Beekeeping Industry Numbers (registered as of Dec 31, 2015)

In 2016:

- 84% of colonies were managed by commercial beekeepers
- Value of honey was $27 million

# of active beekeepers	**2,896**
# of commercial beekeepers	**282**
# of producing colonies	**97,342**
# of registered beeyards	**6,317**

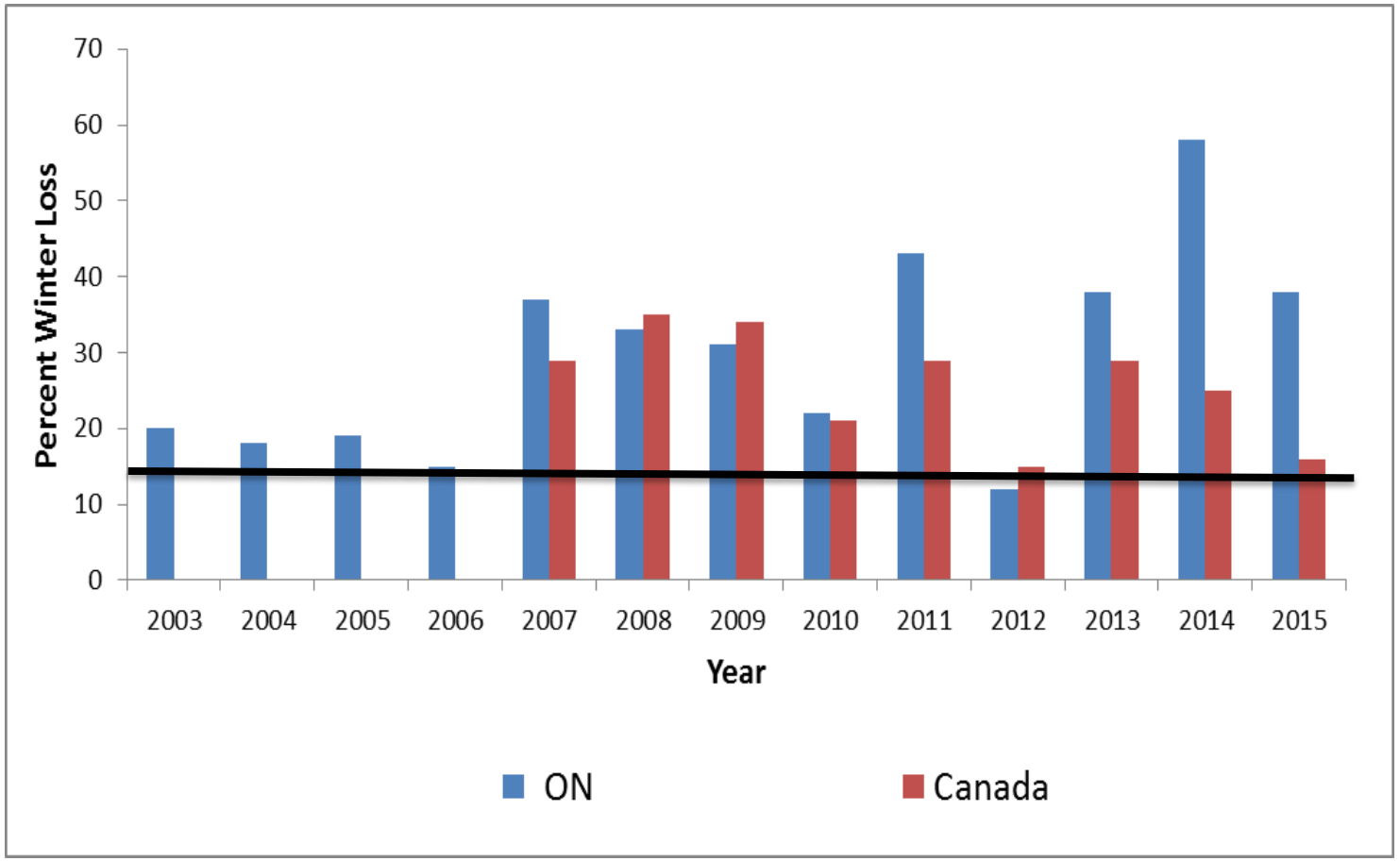
Pollination services provided by honey bees are estimated to contribute $395 million annually to Ontario's economy

Bees Act: Apiary Inspector Duties & Authorities

Duties of an Apiary Inspector

- It is the duty of an inspector when he or she considers it necessary or when so instructed by the Provincial Apiarist:
- to **inspect bees or beekeeping equipment to determine whether any pest is present or disease exists**
- to inspect books or records required by this Act

Estimated Winter Colony Mortality
(2003 to 2015)



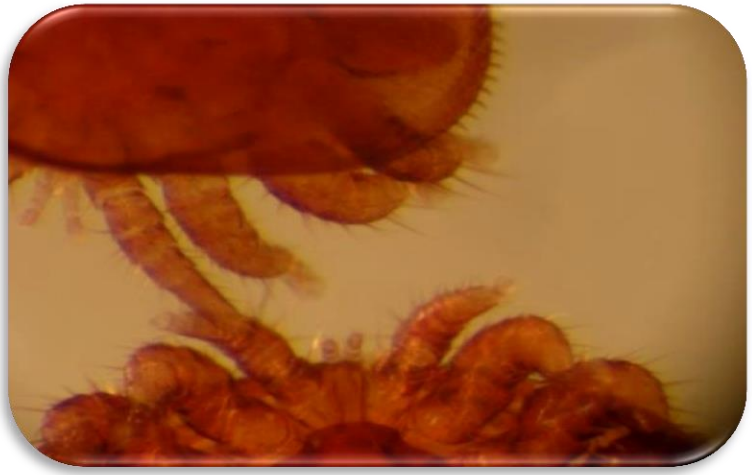
The horizontal line denotes the level of winter loss deemed sustainable by the industry (15 per cent).

Honey Bee Stressors

Pollinator Habitat and Nutrition

Pesticide Exposure

Disease, Pests and Genetics



Climate Change and Weather

Examples of Threats contributing to Honey Bee Losses

- **Brood Diseases**
  - American Foulbrood
  - European Foulbrood
- **Parasitic Mites**
  - Varroa
  - Tracheal Mites
- **Viruses**
  - DWV, IAPV, etc.
- **Fungal Pathogens**
  - *Nosema ceranae*
  - *Nosema apis*
  - Chalkbrood
- **Pesticides**
  - Foliar, seed treatments
  - In Hive Treatments
  - Insecticides, Fungicides
- **New Pests**
  - Small Hive Beetle
  - Africanized Honey bees
  - Introduction of additional mite species
  - Resistant strains

Apiary Monitoring Activities

In 2015 - 2016, we enrolled

640

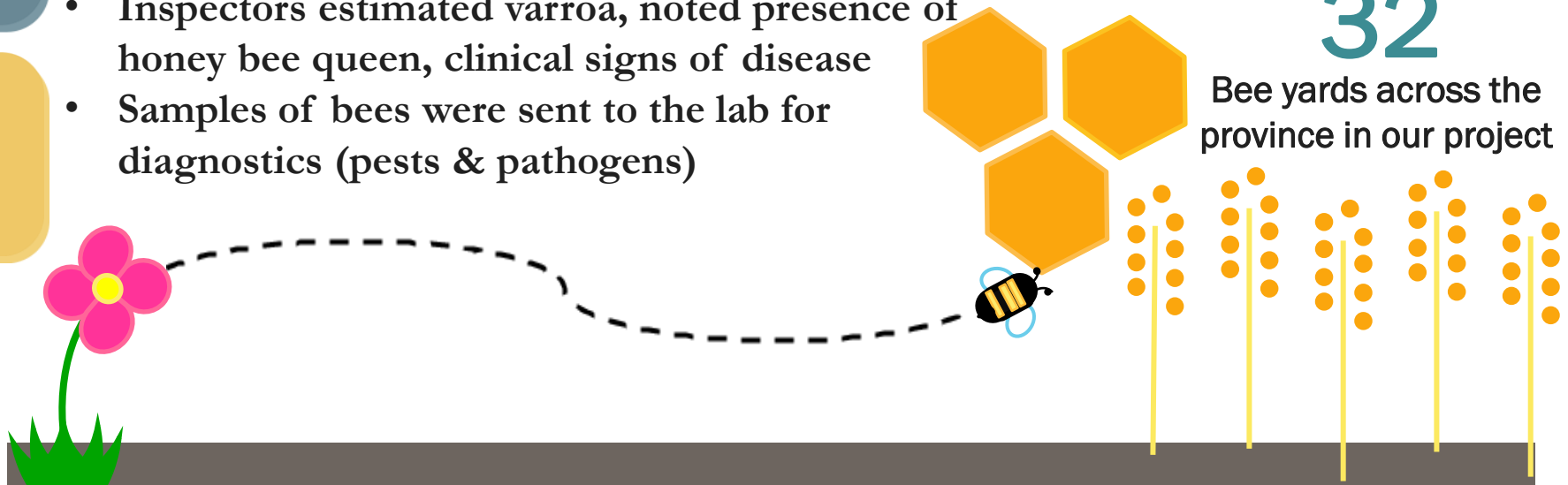
Ontario colonies in our Apiary Monitoring Project
which aimed to better understand the condition of managed honey bees

- 10 colonies in 32 yards across the province were visited 4 times/active beekeeping season
- Inspectors estimated varroa, noted presence of honey bee queen, clinical signs of disease
- Samples of bees were sent to the lab for diagnostics (pests & pathogens)

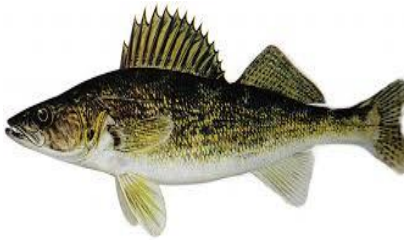
For 2017, we have enlisted another

32

Bee yards across the province in our project

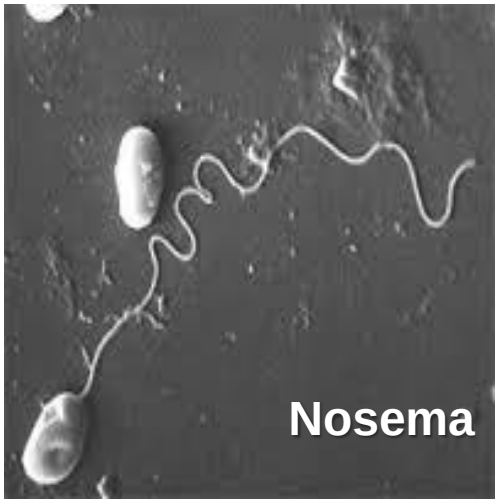


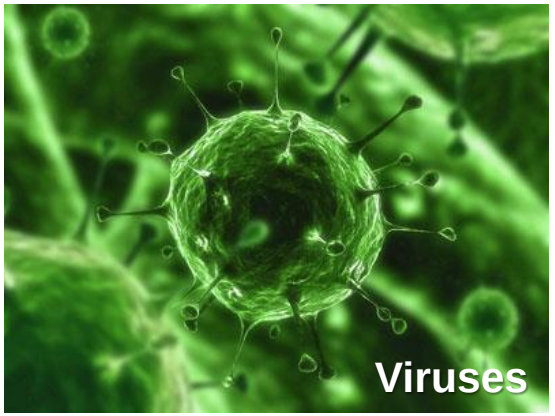
The Animal Health Lab: Who we are

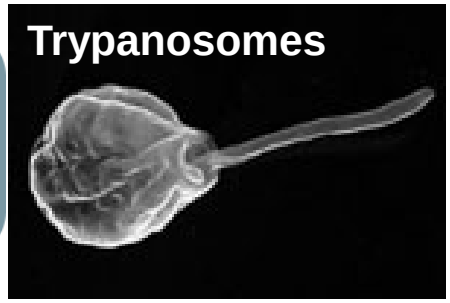


Livestock & poultry, companion animals, fish and bees.

Pathogens and pests







AHL Honey bee testing for pathogens and Pests

Viruses:

- *Acute bee paralysis virus (ABPV)
- *Black queen cell virus (BQCV)
- *Chronic bee paralysis virus (CBPV)
- *Deformed wing virus (DWV)
- *Israeli acute paralysis virus (IAPV)
- *Kashmir bee virus (KBV)
- *Sacbrood virus (SBV)

Other pathogens and pests:

- **Crithidia mellificae*
- **Spiroplasma apis*, **Spiroplasma melliferum*
- **Lotmaria passim*
- **Nosema apis* and **N. ceranae*
- Tropilaelaps mite
- *Tracheal mites
- **Small Hive Beetle**
- Varroa mite haplotype
- +American Foulbrood
- European Foulbrood

*** = quantitative**

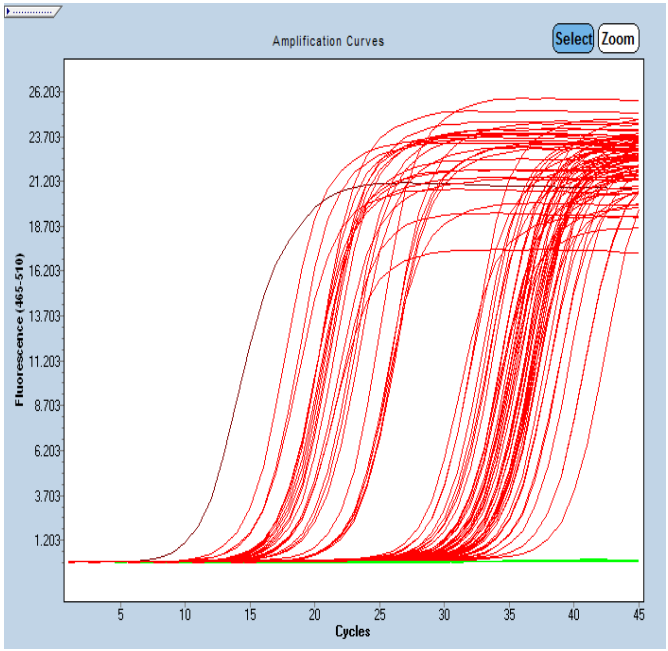
+ = antibiotic resistance testing offered

Work Flow

How do we get from here?

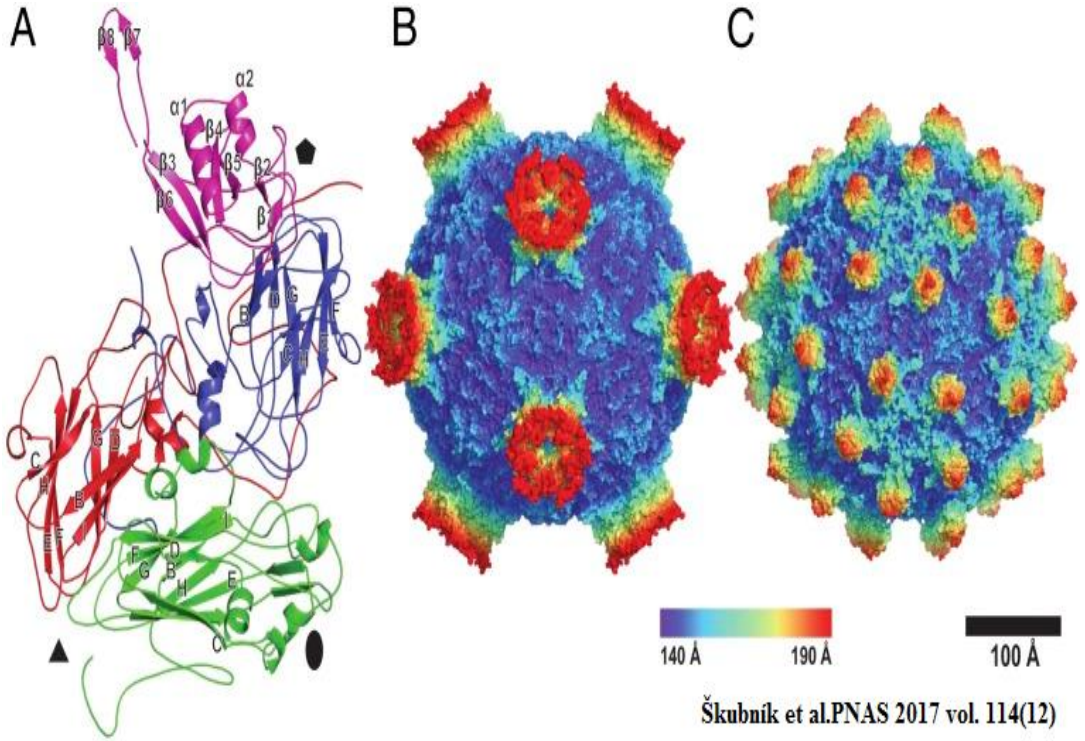
Honey bee colony

To here?



Data

Factors to consider when processing live bees



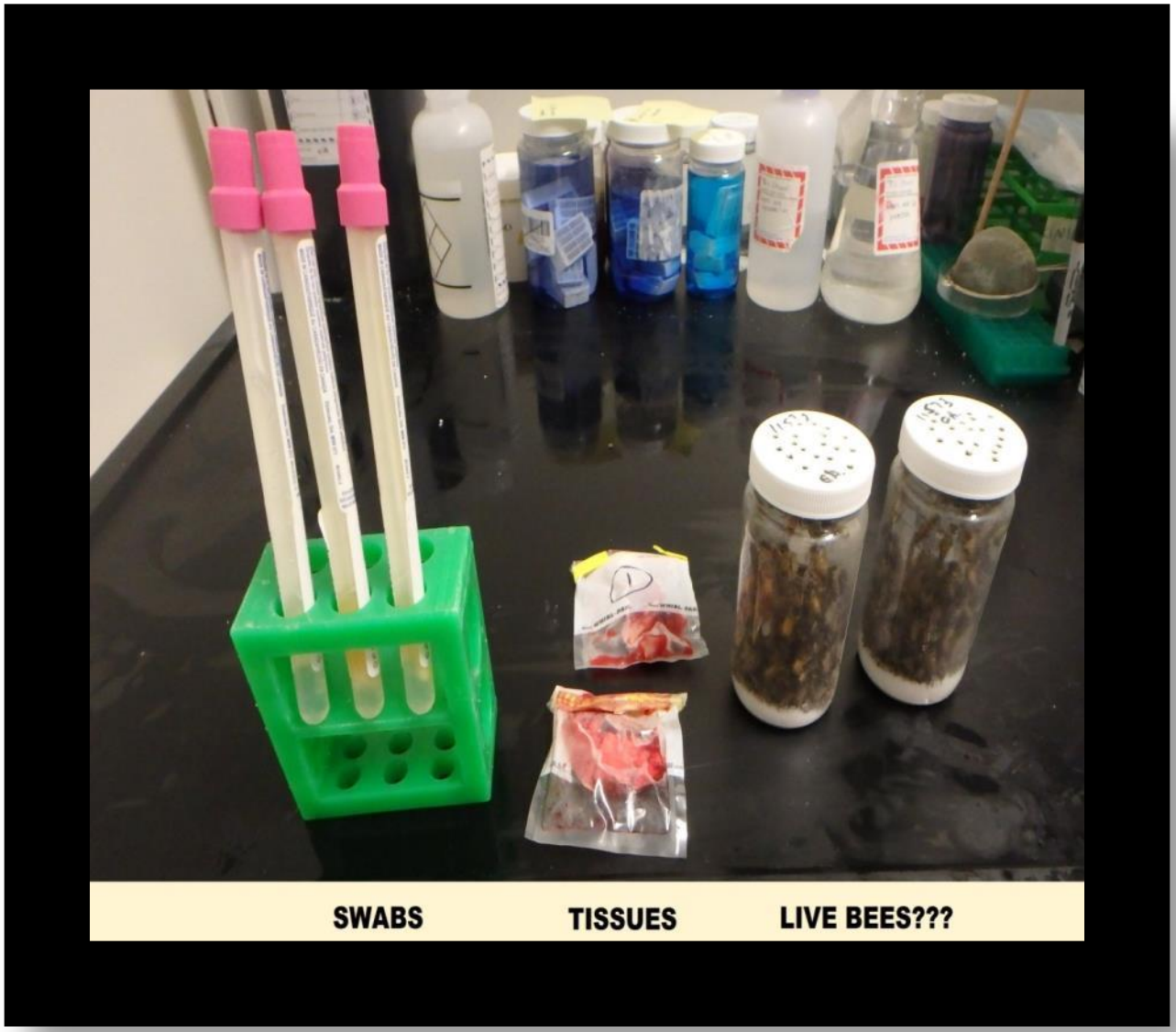
No escapees!

Need to ensure that RNA viruses are preserved for testing

Sample collection

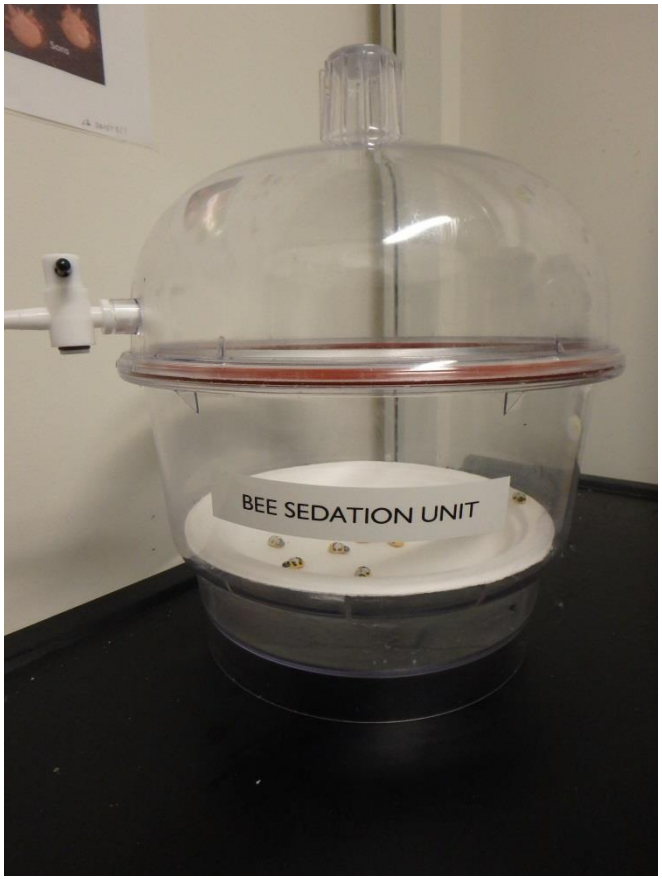
- Samples collected by provincial apiary inspectors
- Inspectors deliver samples to the lab as jars of live bees or flash-freeze bees on dry ice and ship

New sample types…

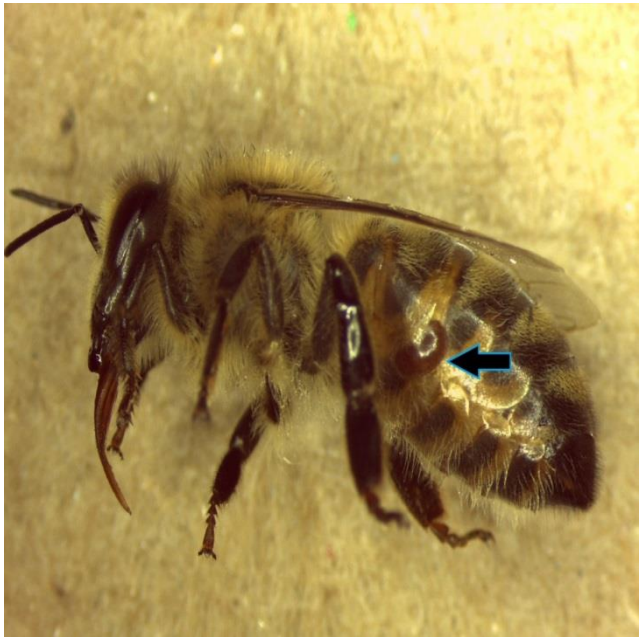


Sedating bees prior to processing

- Dry ice and CO2 used to sedate bees prior to sampling



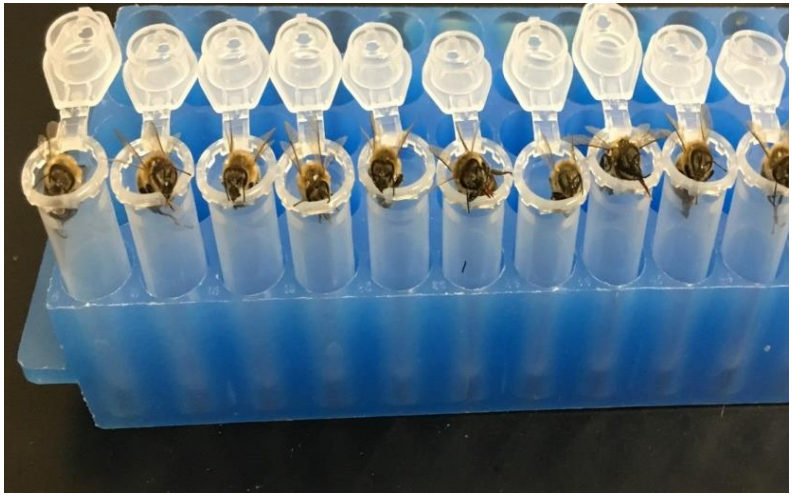
Viral transmission in bees



- Honey bee viruses are primarily vectored through the *Varroa destructor* mite
- These mites are parasitic on the body of the honey bee
- Need to ensure we are testing viral levels in the bees, and not in the mites!
- Varroa mites are removed from bees prior to processing.

Bees homogenized and NA extracted

- Sedated bees can be sampled for nucleic acid extraction



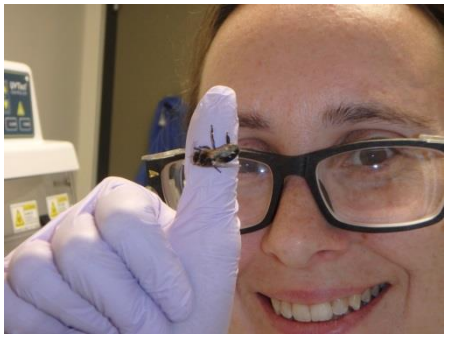
AHL Confirmation of Notifiable Pests

Small hive beetle (SHB)

Athena tumida

- Damage to hives and honey stores
- Immediate Notifiable to the CFIA
- The apiary inspection program uses AHL for the confirmation of specimens by molecular analysis
- AHL-developed qPCR for SHB

Thank you

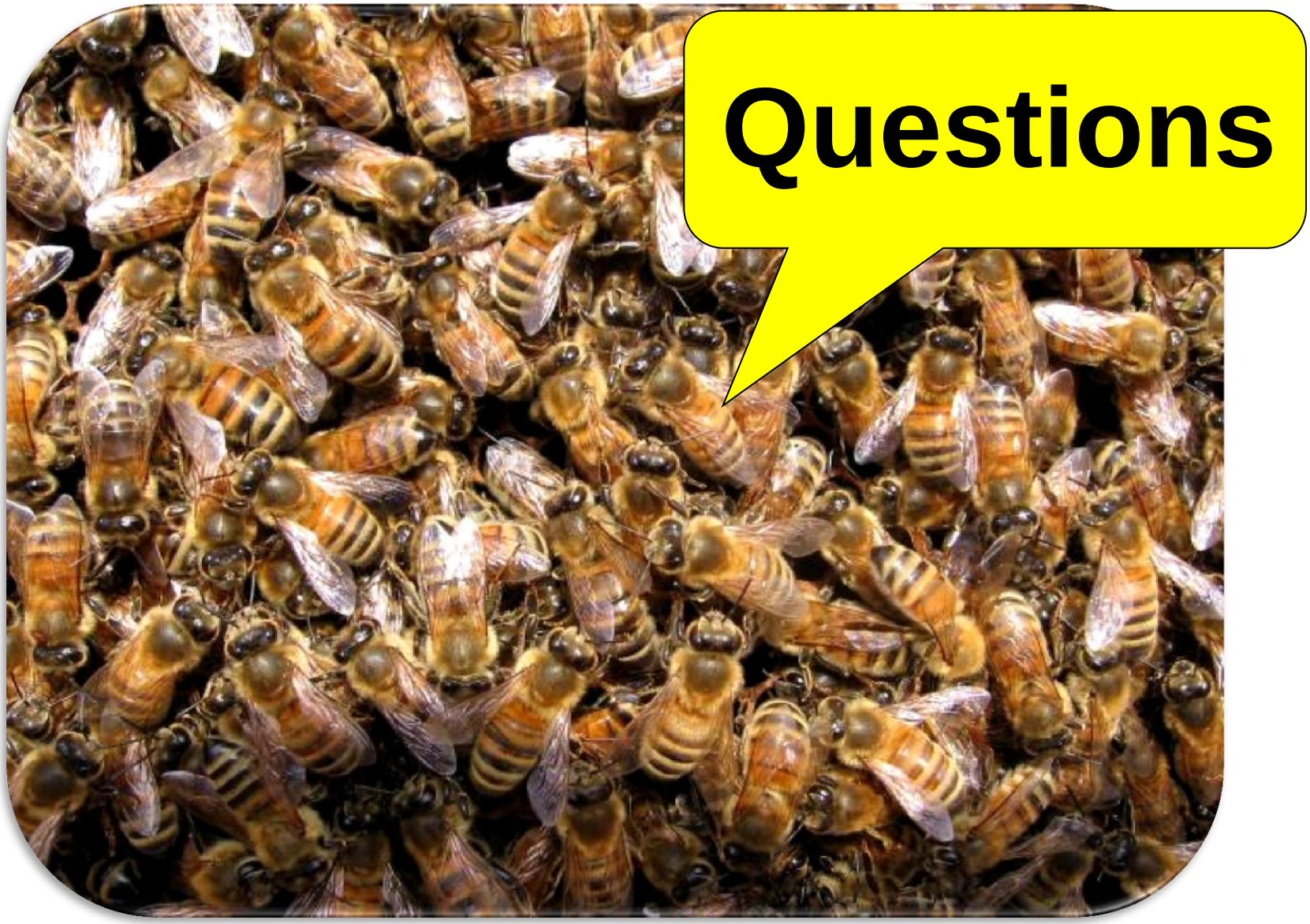


OMAFRA apiary inspectors
OBA Tech Transfer Program
DSP

Apiary Monitoring Results to Date

- We are still waiting for laboratory data from the yards sampled in 2016, but we can share preliminary findings from 2015
- Detected 7 honey bee viruses & both species of *Nosema*
- Prevalence of tracheal mites & varroa was very low
- *Tropilaelaps* spp. & Phorid flies were not detected in any of the samples tested
- Very low prevalence of brood diseases
- Prevalence of newly detected bacterial and protozoan pathogens, low levels
- Queenlessness in participating bee yards ranged from 1 to 7.5%

OMAFRA will continue monitoring activities in 2017


Questions