

Protecting our pollinators: the buzz behind bee disease

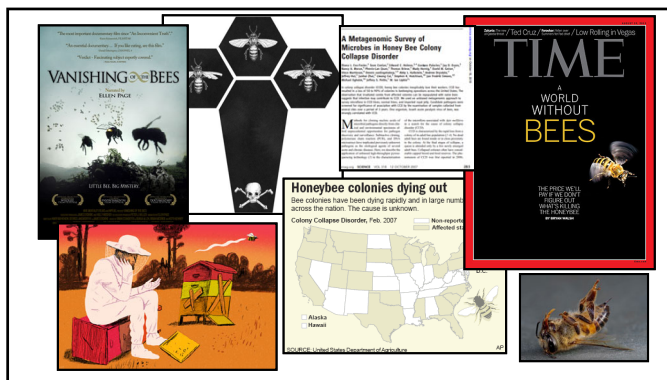
Ellen Klinger
Assistant professor
The Ohio State University



1



2



3

Today's objectives

- After this presentation you should be able to:
 - Understand the difference between social and solitary bees
 - Explain how the needs are different for social and solitary bees
 - Describe some characteristics of sick bees
 - Understand what actions you can take to help both social and solitary bees.



4

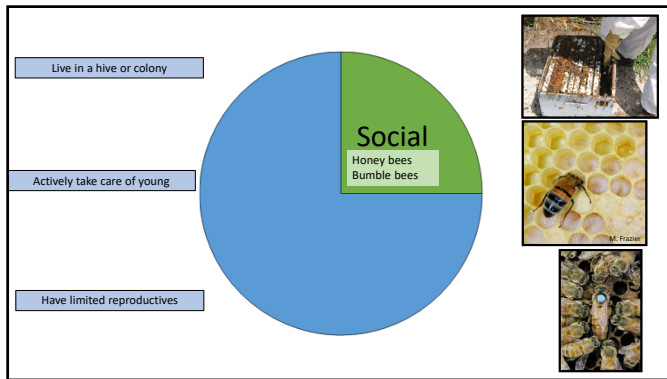
How many bees are in Ohio?

5

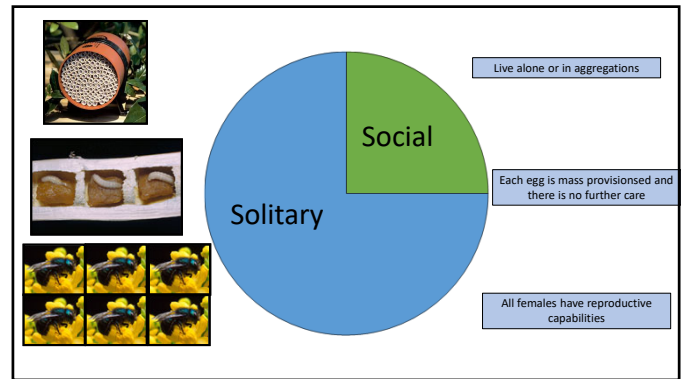


Tell me more
about these
"other" bees...

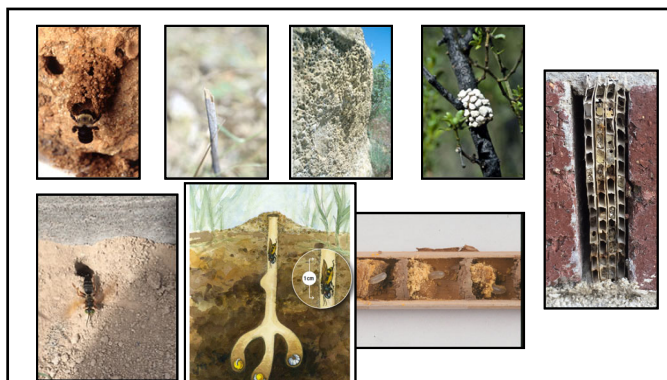
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7



8



9

Why do we want to keep bees healthy?

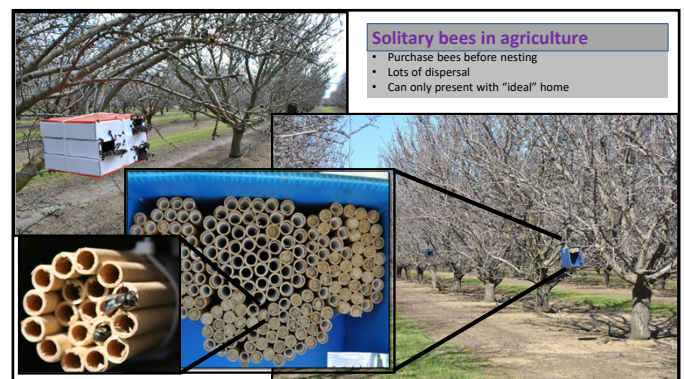
1. Preserving bees to maintain biodiversity and pollination to plants worldwide
2. Bee species can be managed for use in our agricultural systems




10


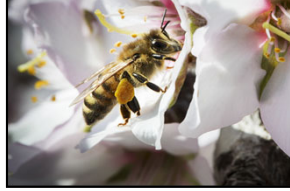


11



12

Orchard trees


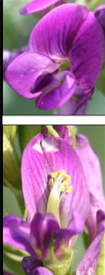

Pollinate at cold temperatures

Brittain et al., 2013

Diagram illustrating the process of pollination in orchid trees, showing the interaction between the bee and the flower's reproductive parts (stamen and pistil).

13

Alfalfa seed production

Leafcutter bees are primary pollinators

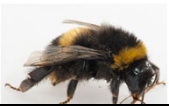

Cane, 2002

Bar chart showing the number of alfalfa flowers visited by different bee species. The Y-axis represents the 'Number of flowers' (0 to 1000) and the X-axis represents the 'Fraction of visited alfalfa flowers visited' (0 to 100%).

Species and Sex of Bee	Number of Flowers
<i>C. ligatus</i> ♀	~850
<i>A. mellifera</i> ♀	~450
<i>A. mellifera</i> ♂	~150
<i>A. mellifera</i> ♀	~100
<i>A. mellifera</i> ♂	~75
<i>A. mellifera</i> ♀	~50

14

Greenhouse crops

Unlike honey bees, bumble bees can fly in greenhouses

Banda & Paxton, 1991

Table showing the performance of different bumblebee species in greenhouse crops, including the number of visits, size of fruit, weight of fruit, and number of seeds.

Species	Method of pollination	# fruit set	Size of fruit	Weight of fruit	Number of seeds
<i>B. terrestris</i>	no pollination	60.8 ± 1.00	52.14 ± 0.96	70.54 ± 1.65	69.40 ± 10.30
<i>B. terrestris</i>	hand pollination	75.59 ± 1.04	55.80 ± 0.75	90.30 ± 1.26	91.73 ± 10.08
<i>B. terrestris</i>	hand pollination + vib	80.16 ± 1.41	58.71 ± 1.61	98.59 ± 0.52	106.80 ± 10.95
<i>B. terrestris</i>	hand pollination + vib	94.85 ± 1.38	62.05 ± 0.78	115.25 ± 1.84	126.54 ± 10.04
<i>B. terrestris</i>	hand pollination + vib	106.16 ± 1.11	65.50 ± 0.60	140.88 ± 1.24	170.58 ± 10.60
<i>B. terrestris</i>	hand pollination + vib	98.21 ± 1.31	66.73 ± 0.98	142.98 ± 0.23	143.58 ± 10.18


15



USDA logo


16

Social vs. solitary bee differences.



Social bees

- Less specific in the types of flowers they need.
- In many cases, their homes are provided by us.
- Food is gathered all season and can be adjusted depending on need.
- Many workers can get sick with little effect to colony health.



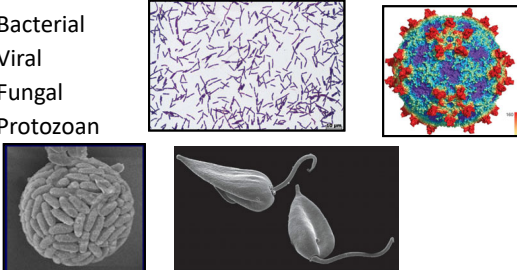
Solitary bees

- Some species can depend on only a few flower types
- When not provided by humans, bees must find the appropriate substrate that is secure long term.
- Food is gathered and provisioned at one moment in time.
- If a female bee gets sick, can be devastating for reproduction.

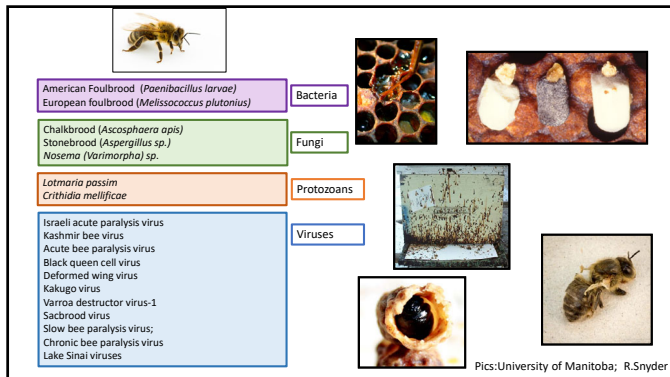
17

Diseases: what makes bees sick?

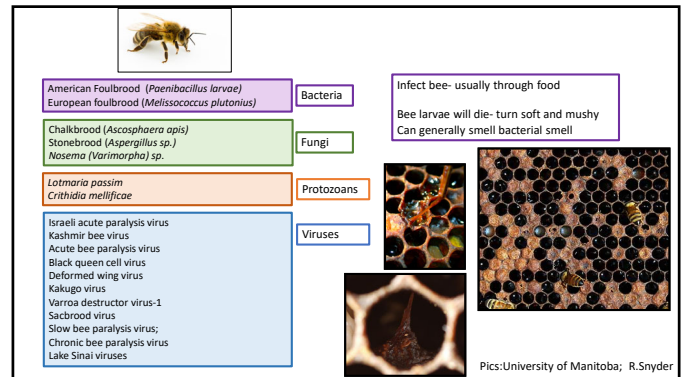
- Bacterial
- Viral
- Fungal
- Protozoan



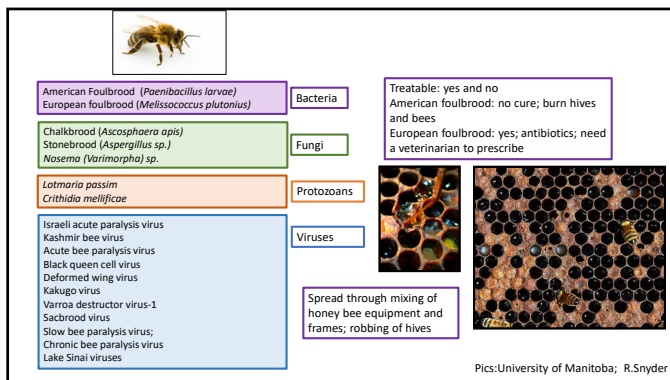
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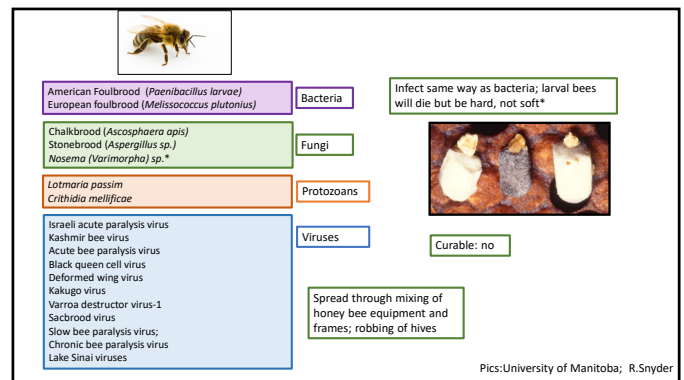
19



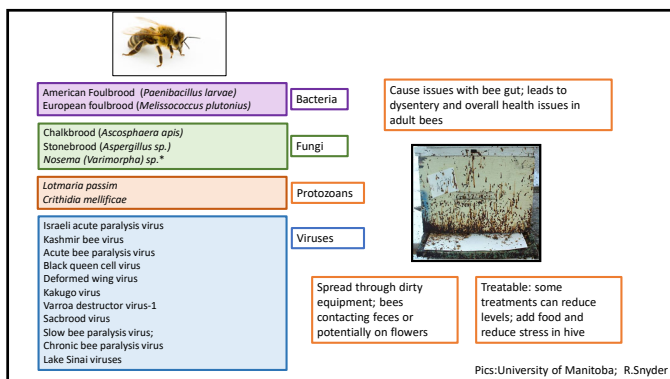
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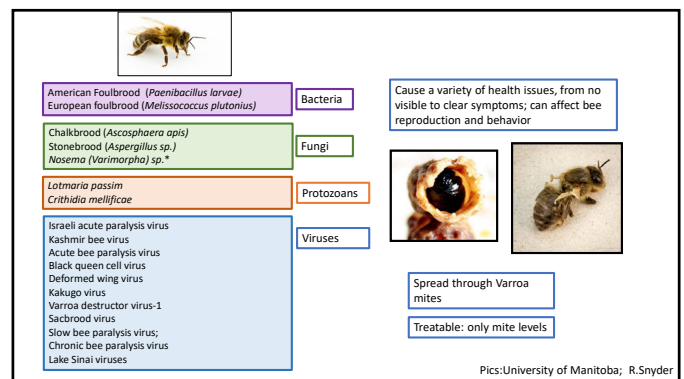
21




22



23



24




American foulbrood (*Paenibacillus larvae*)
European foulbrood (*Melissococcus plutonius*)

Chalkbrood (*Ascosphaera apis*)
Stonebrood (*Aspergillus* sp.)
Nosema sp.

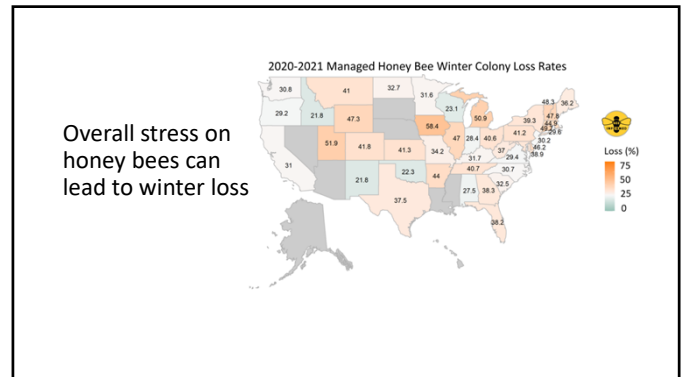
Lotmaria passim
Crithidia mellifica

Israeli acute paralysis virus
Kashmir bee virus
Acute bee paralysis virus
Black queen cell virus
Deformed wing virus
Kakugo virus
Varroa destructor virus-1
Sacbrood virus
Slow bee paralysis virus;
Chronic bee paralysis virus
Lake Sinai viruses



- Varroa mites feed on developing bees
- When they feed, they can pass viruses between bees
- Varroa mites are very resistant to pesticides



25



26

Much we don't know about diseases of other social bees

American foulbrood (*Paenibacillus larvae*)
European foulbrood (*Melissococcus plutonius*)

Chalkbrood (*Ascosphaera apis*)
Stonebrood (*Aspergillus* sp.)
Nosema sp.

Lotmaria passim
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????

Nosema sp.

Lotmaria passim
Crithidia bombii
Crithidia expoeki

Detections of honey bee viruses

27

American foulbrood (*Paenibacillus larvae*)
European foulbrood (*Melissococcus plutonius*)

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Detections of honey bee viruses

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Detections of honey bee viruses

Much we don't know about diseases of solitary bees

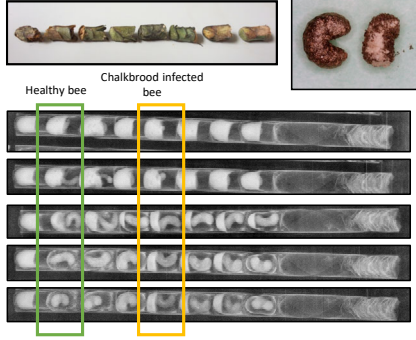
28

Alfalfa leafcutting bee

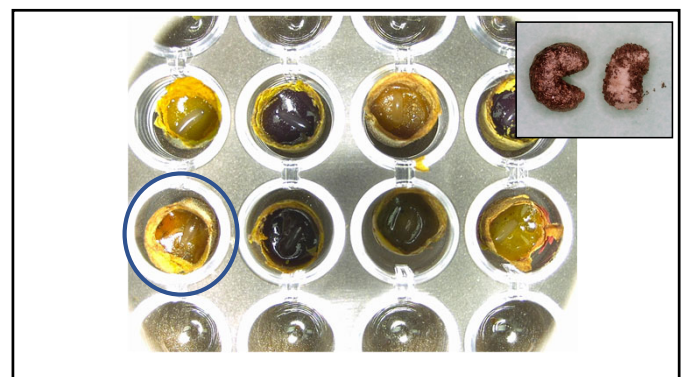
Healthy bee

Chalkbrood infected bee



Time

29



30

It's suspected that social bees are not a good "proxy" for solitary bees

- How do known diseases affect solitary bees?
- What other diseases are out there?



31

What can we do to improve bee health?

- 1. Improve nutrition: plant quality flowering plants in backyards

Plant lots of flowering plants

Plant a wide variety of flowering plants

Plant things that flower early and flower late in the season



32

What can we do to improve bee health?

- 1. Improve nutrition: plant quality flowering plants in backyards
- 2. Use minimal pesticides; and use ONLY according to the label

Spray at night if indicated

Think about how soil contamination may affect solitary bee species

The effects of pesticides for solitary bees can be dramatic as compared to social bees



33

What can we do to improve bee health?

- 1. Improve nutrition: plant quality flowering plants in backyards
- 2. Use minimal pesticides; and use ONLY according to the label
- 3. Create ideal habitat for solitary nesting bees in backyards

Maintain and preserve suitable habitat for solitary bees



Leave patches of loose soil; lighter mulch for ground nesters

Leave dead trees; pithy stems; brush piles for cavity nesters

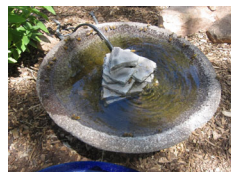
Must clean and maintain!

34

Bees need water too...



No!




Yes!

35

What can we do to improve bee health?

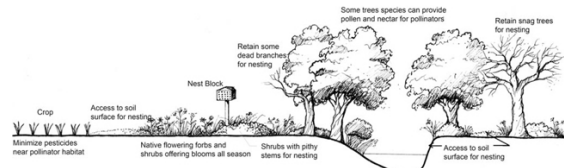
- 1. Improve nutrition: plant quality flowering plants in backyards
- 2. Use minimal pesticides; and use ONLY according to the label
- 3. Create ideal habitat for solitary nesting bees in backyards
- 4. Support local beekeepers; if you decide to start a hive, become educated about bee disease monitoring vial local beekeeping groups.



 Ohio State Beekeepers Association

36

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37

Any questions?

- <https://entomology.osu.edu/our-people/ellen-klinger-ms-phd>
- Klinger.80@osu.edu

- <https://ohioline.osu.edu/factsheet/ENT-57>
- <https://ohioline.osu.edu/factsheet/ent-80>
- <https://ohioline.osu.edu/factsheet/ent-85>



38