The Honey Bee’s Needs: Nectar and Pollen

Annie Deutsch
UW-Extension
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Outline

• Introduction to bees
• Bee nutrition
• Pollen and nectar to a plant and bee
• Plant selection
What is a bee?

- Order: Hymenoptera
  - Ants, bees, wasps
  - Immatures: grub-like
  - Adults: 6 legs, 4 wings
- Vegetarian
  - Provision nests with pollen
- Great pollinators!
  - Pollen sticks to feather-like hairs

Slide adapted from: Dr. Hannah Gaines Day
Bees: distinguishing characteristics

<table>
<thead>
<tr>
<th><strong>Bees</strong></th>
<th>vs.</th>
<th><strong>Wasps</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Robust</td>
<td></td>
<td>Slender</td>
</tr>
<tr>
<td>Hairy</td>
<td></td>
<td>Smooth</td>
</tr>
<tr>
<td>Flat rear legs</td>
<td></td>
<td>Slender legs</td>
</tr>
<tr>
<td>Feed on nectar and pollen</td>
<td></td>
<td>Predators</td>
</tr>
</tbody>
</table>

Slide credit: Dr. Christelle Guédot
Social behavior of bees

- Solitary (majority of species)
- Social (only 10%)
  - Honey bees (NOT native)
  - Bumble bees

Slide credit: Dr. Hannah Gaines Day
How many bees are there?

• ~20,000 species worldwide
• ~4,000 species native to North America
• ~500 species native to Wisconsin

Slide credit: Dr. Hannah Gaines Day
Smallest North American bee (Perdita minima) on largest female carpenter bee
The Honey Bee

*Apis mellifera*: the “honey-bearining bee”

Honey bees account for 84% of all insect pollination

- 7 species of honey bees
- Western honeybee, *Apis mellifera* only species in North America
- Non-native, introduced in 1600s
- Social colonies founded by single queen
- Colonies are perennial
- Hive with typically 30 to 50,000 workers

Slide credit: Dr. Christelle Guédot
The Honey Bee

General characteristics:
• Medium size, medium build
• Abdomen black and orange-brown stripes

Specific characteristics:
• Pollen baskets (corbicula) on hind legs
• Long(ish)-tongued

Adapted from slide by Dr. Christelle Guédot
http://www.nhm.ac.uk/natureplus/blogs/diptera-blog/tags/bees?fromGateway=true
Honey Bee Nutrition

Nutritional requirements of a honey bee:

• Carbohydrates (sugars)
• Protein
• Lipids (fats)
• Vitamins/minerals
• Water
Worker Bee Nutrition

- Food: pollen converted into bee bread/royal jelly
  - All nutrients ➔ development

- Food: nectar converted into honey
  - High in sugar ➔ energy

Bees need nectar AND pollen to survive
What is Pollen and Nectar (to a plant)?

• Pollen = male gamete - must be moved to the female part of the flower for fertilization

• Nectar = “reward” to pollinators
What is Pollen and Nectar (to a bee)?

**POLLEN**
- Main source of protein for bees
  - Especially important for young bees
- Also contains fats, minerals, and vitamins
- Brood rearing is reduced when colony has a low protein intake\(^1\)

**NECTAR**
- Bee’s main source of carbohydrates
- Also contains essential minerals like calcium, copper, potassium, magnesium, and sodium
- Hygienic behavior increases with nectar flows\(^1\)

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\(^1\)Somerville, Doug. 2005. *Fat Bees, Skinny Bees*
Quality Matters!!

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<tr>
<th>POLLEN</th>
<th>NECTAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Protein levels vary - may be similar within plant genera</td>
<td>• Sugar concentration can vary from 5-75%</td>
</tr>
<tr>
<td>• Ideal: &gt;25% protein(^1)</td>
<td>• Ideal: &gt;20% sugar(^2)</td>
</tr>
</tbody>
</table>

Not everything that is blooming provides bees with pollen and/or nectar

Plant selection

Variety, variety, variety!!

- Attractive flower colors and shapes (to a bee)
- Select range of plants that flower at different times in the summer
- Plant in clumps
- Plant within a reasonable proximity to hive
- Remember, not all plants have equivalent resources or equivalently accessible resources
- Avoid toxic plants (rare in America)
<table>
<thead>
<tr>
<th>Trait</th>
<th>Bat</th>
<th>Bee</th>
<th>Beetle</th>
<th>Bird</th>
<th>Butterfly</th>
<th>Fly</th>
<th>Moth</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>White, green or purple</td>
<td>Bright white, yellow, blue, or UV</td>
<td>White or green</td>
<td>Scarlet, orange, red or white</td>
<td>Bright red and purple</td>
<td>Pale, or dark brown, purple</td>
<td>Pale red, purple, pink or white</td>
<td>Pale green, brown, or colorless</td>
</tr>
<tr>
<td>Nectar guides</td>
<td>None</td>
<td>Present</td>
<td>None</td>
<td>None</td>
<td>Present</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Odor</td>
<td>Strong and musty; emitted at night</td>
<td>Fresh, mild, pleasant</td>
<td>None to strongly fruity or foul</td>
<td>None</td>
<td>Faint but fresh</td>
<td>Putrid</td>
<td>Strong sweet; emitted at night</td>
<td>None</td>
</tr>
<tr>
<td>Nectar</td>
<td>Abundant; somewhat hidden</td>
<td>Usually present</td>
<td>Sometimes present</td>
<td>Ample; deeply hidden</td>
<td>Ample; deeply hidden</td>
<td>Usually absent</td>
<td>Ample; deeply hidden</td>
<td>None</td>
</tr>
<tr>
<td>Pollen</td>
<td>Ample</td>
<td>Limited; often sticky, scented</td>
<td>Ample</td>
<td>Limited</td>
<td>Limited</td>
<td>Limited</td>
<td>Limited</td>
<td>Abundant; small, smooth</td>
</tr>
<tr>
<td>Flower Shape</td>
<td>Bowl shaped; closed during day</td>
<td>Shallow; with landing platform; tubular</td>
<td>Large and bowl-shaped</td>
<td>Large, funnel-like; strong perch support</td>
<td>Narrow tube with spur; wide landing pad</td>
<td>Shallow; funnel-like or complex with trap</td>
<td>Regular; tubular without a lip</td>
<td>Regular and small</td>
</tr>
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Photo credits © Merlin Tuttle, Tom Eisner, Edward Ross, Arla Altman, Chris Carvalho, Paul Growald
## Nectary Calendar

<table>
<thead>
<tr>
<th>Latin Name</th>
<th>Specialist Nectary</th>
<th>Generalist Nectary</th>
<th>Hummingbird</th>
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<tbody>
<tr>
<td><em>Acacia angustissima</em> and <em>hirta</em></td>
<td>•</td>
<td>•</td>
<td></td>
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<tr>
<td><em>Acer spp.</em> (Maple)</td>
<td>•</td>
<td>•</td>
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<td><em>Achillea spp.</em> (Yarrow)</td>
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<td>•</td>
<td>•</td>
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<tr>
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<td>•</td>
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<tr>
<td><em>Alnus</em> spp. (Alder)</td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td><em>Allium</em> spp. (Onions etc.)</td>
<td>•</td>
<td>•</td>
<td></td>
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<tr>
<td><em>Amelanchier spp.</em></td>
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<tr>
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### Approximate Flowering Times

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Early Season/Spring Plants

Trees/Shrubs

• Pussy willow
• Hawthorn
• Basswood
• Maple
• Chokecherry
• Plum/cherry
• Raspberry

Herbaceous plants

• Lanceleaf coreopsis
• Penstemon
• Wild Lupine
• Virginia waterleaf
• Siberian squill
• Brassica spp.

• Early figwort
• Phacelia
• Fireweed
Mid-Season/Summer Plants

Trees/Shrubs

• Leadplant
• New Jersey tea
• Prairie rose

Herbaceous plants

• Butterfly milkweed
• Mints
• Clovers (not red clover)
• Joe Pye weed
• Wingstem
• Bergamot
• Hyssop
• Coneflowers
• Beebalm
• Vetch
• Sunflower
• Jewelweed
Late Season/Fall Plants

Herbaceous plants

- Aster
- Goldenrod
Plants to avoid:

- *Rhododendron* spp.
  - Rhododendron
  - Azalea
- *Astragalus* or *Oxytropis* spp.
  - Locoweed
- *Kalmia* sp.
  - Laurel
- *Aesculus* spp.
  - California buckeye

Avoid Pesticide Drift

Welcome to FieldWatch™ 2016

Communication + Cooperation + Collaboration = Successful Co-existence

This site is a voluntary communication tool that enables crop producers, beekeepers, and pesticide applicators to work together to protect specialty crops and apiaries through use of mapping programs. It is not a substitute for any state regulatory requirements.

For more resources and information, please visit FieldWatch, Inc.

www.fieldwatch.com; www.beecheck.org
Additional Resources

Xerces Society- http://www.xerces.org/

www.ScientificBeekeeping.com

Planting guide packet– email me adeutsch@co.door.wi.us

Summary

- Bees need a balanced diet: pollen AND nectar
- Provide a variety of plants that bloom throughout the summer
- Adequate nutrition allows bees to reproduce and stay healthy
- When there is surplus of honey, we can benefit
Examples of protein content of pollen:

Good protein source: >25% protein

- **Asteraceae** spp. (asters, daisies): 14.5-24.5%
- Canola (*brassica napus*): 10-27%
- Sunflower (*Helianthus annuus*): 13-18.5%
- **Pinus** spp. (pine trees): 7%
- White clover (*Trifolium repens*): 22.5-26%
- **Vicia** spp. (vetch): 24%
- Corn (*Zea mays*): 14-15%

Ref: Somerville, Doug. 2005. *Fat Bees, Skinny Bees*
Calculation Example in Pumpkins:

- 1 honey bee colony requires 44-66 lbs pollen/yr
- 1 pumpkin flower produces 0.0001 lbs (1/100th of a teaspoon) pollen/yr
  - Need 638,298 flowers to produce enough pollen
- Pumpkin plant makes ~205 male flowers during crop cycle
- Would require 3,114 plants for pollen requirement
- At their planting density they had 6,733 plants/acre
  - 1,380,265 flowers
- 1 acre of pumpkin could support ~2 honey bee colonies

Adapted from: Vidal et al. 2006. Nectar and pollen production in pumpkin (Curcubita pepo L.).