

Wild Bees and Vegetable Crop Production



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Introduction

- Personal projects
- Importance of pollinators
- Purpose and Objective



Objectives

- Appreciation of bee diversity
- Vegetables and crops bees pollinate
- Managing and enhancing nesting habitat
- Enhancing forage resources

Bees

- Superfamily Apoidea
- "Vegetarian wasp"
- Plumose body hair
- Scopa or hind legs flattened
- 20,000 species world wide
- 4,000 species in North America

Michener 2000; Vaughan & Mader 2008

Bees

- Branched body hair



James & Pitts-Singer 2008

Social Behavior of Bees

- Most are solitary
- Some are gregarious
- A few are social
 - Primitively social
 - Eusocial
- Cleptoparasitic or cuckoo

Michener 2000

Pollination

- Act of transferring pollen
- Self-fertile, self-pollinating
- Self-incompatible
- Cross-pollination
- Fruit set and pollen grains

Delaplane & Mayer 2000

Value of Pollination

- Honey bee service
 - \$14.6 billion
 - Colony collapse disorder
- Wild bee pollination to crops
 - \$3.07 billion
 - Diverse pollination strategy
- 1/3 of our diet
 - Economic value

Tuell et al 2008 & 2009; Losey & Vaughan 2006

Benefits of Wild Bees

- Less defensive
- Some are easy to maintain
- Habitat improvements can increase populations
- Inexpensive
- Increase plant diversity



Xerces Society 2007

Bee Diversity

- 7 families of bees
 - Classified by tongue length, wing venation, how pollen is carried, etc.
- Pollination
 - Oligolectic
 - Polylectic



Michener 2000

Apidae



Honey Bees



Bumble Bees



Andrenidae



Thorp 2008

Halictidae



Variety in nest structure

Michener and Lange 1958

Megachilidae



Colletidae



Vegetables and Crops

- Alfalfa
- Apples
- Asparagus
- Cherry
- Cucumber
- Eggplant
- Muskmelon
- Peppers
- Pumpkin and squash
- Raspberry
- Strawberry
- Sunflower
- Tomato
- Watermelon

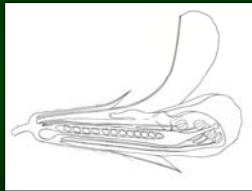
USDA-ARS Agriculture Handbook #496

Families

- Fabaceae
- Asparagaceae
- Rosaceae
- Cucurbitaceae
- Solonaceae
- Asteraceae

Fabaceae: Alfalfa

- Flower tripping
- Seed industry
– \$90 million
- Alkali bees
- Alfalfa leafcutter bee
- Honey bees



McGregor 1976

Asparagaceae: Asparagus

- Monoecious
- Cross-pollination
- Morning pollination
- Wild bees
- Honey bees



oklahomawildflowers.blogspot.com

Rocaceae

- Flower structure
- Bee pollination
- Apple
- Cherry
- Raspberry
- Strawberry



McGregor 1976

Apple

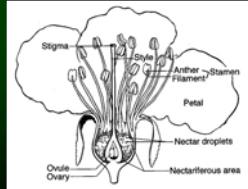
- Self-incompatible
- Orchard mason bees
- Andrenid bees
- Halictid bees
- Bumble bees
- Honey bees



T. Pitts-Singer; USDA-ARS

Cherry

- Cross-pollination
 - Sweet cherry
- Honey bees in orchard
- Wild bees



Raspberry

- Self-fertile
- Honey bees
- Bumble bees
- Other wild bees



Bradwell – buxtononline.com

Strawberry

- Self-fertile
- Early season bloom
- Honey bees
- Bumble bees
- Megachilid bees
- Halictid bees



carletongarden.blogspot.com

Cucurbitaceae

- Flower structure
- Bee pollination
- Stigma reception
- Cucumber
- Muskmelon
- Pumpkin and squash
- Watermelon



McGregor 1976

Cucumber

- Monoecious
- Cooler temperatures
- Megachilid bees
- Bumble bees
- Honey bees



gurafarm.blogspot.com

Muskmelon

- Monoecious
- Cool temperatures
- Bumble bees
- Halictid bees
- Honey bees



deadbread.com

Pumpkin and Squash

- Monoecious
- Morning pollination
- Wild bees
 - *Peponapis*
- Bumble bees
- Honey bees



Watermelon

- Monoecious
- Morning pollination
- Halictid bees
- Bumble bees
- Honey bees



Wikimedia.com

Solanaceae

- Flower structure
- Bee pollination
- Eggplant
- Peppers
- Tomato

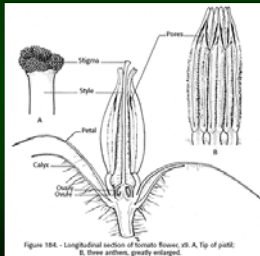


Figure 184. - Longitudinal section of tomato flower, etc. A, tip of pistil; B, three anthers, greatly enlarged.

beeculture.com

Eggplant

- Self-compatible
- Bumble bees



New World Encyclopedia

Peppers

- Self-fertile
- Leafcutter bees
- Halictid bees
- Bumble bees
- Not many other pollen/nectar source competition



ehow.com

Tomato

- Self-fertile
- Bumble bees
- Halictid bees
- Green houses



acatinthekitchen.com

Asteraceae: Sunflower

- Cross-pollination helps raise seed yield
- *Melissodes*
- *Svastra*
- Bumble bees
- Honey bees



Enhancing and Managing Habitat for Wild Bees



Enhancing and Managing Habitat for Wild Bees

- Conserve natural habitats
- Creating or conserving nesting sites
- Increase floral resources
- Reducing bee exposure to pesticides

Conserving Habitat

- Current situation
- Existing habitat
- Bee diversity increase



Vaughan & Mader 2008

Existing habitat

- Linear habitats
- Potential plant resources
- Flowers and "weeds"
- Bee flight range



Vaughan & Mader 2008

Bee Habitat

- Benefits
 - Support pollinators
 - Attract beneficial insects
 - Predators of crop pests
 - Lessen pesticide needs
 - Habitat for wildlife
 - Stabilize soil and improve water quality

Vaughan & Mader 2008

New Pollinator Habitat

- Increase available foraging habitat
- Considerations
- Design



Vaughan & Mader 2008

Design

- Size and shape
- Seed mixes
- Availability



www.stockseed.com

Nesting Sites

- Requirements
 - Bare soil
 - 70% of bees
 - Tunnels in wood
 - 30% of bees
 - Cavities
 - Social bees, 45 species
- What you can do
 - Protect from tilling, mowing, and flood-irrigation

Vaughan & Mader 2008

Ground Nests

- Maximize potential areas
- Prefer sandy or sandy loam soils
- Protected areas
- Watch activity



Vaughan & Mader 2008

Thorp 2008



Thorp 2008

Tube Nests

- Allow snags and dead trees
- Bee blocks
 - Holes 4 inches deep
 - Various diameters
 - Protected location
 - Face southeast



Vaughan & Mader 2008



Increase Floral Resources

- Importance
- Native Flowers
- NRCS efforts
- TNC efforts



Importance

- Food source
- Multiple bloom periods
 - Attract larger number of pollinators
- Close to nesting site



Native Flowers

- Establishment
 - Adapted to conditions
 - Resist pests, disease, and weeds
- Co-evolution with native pollinators
- Wildlife value
- Perennial vs. Annual
- USDA plant database
 - <http://plants.usda.gov>

Diverse Plantings

- Color, shape, size, and height
- Flowers all season
- Bloom time
 - Early (April & May)
 - Mid (June & July)
 - Late (August & September)
- Clump plants
- Grasses

Vaughan & Mader 2008

On-going Study

- Native Nebraska flowers
- Attractive plants for area
- Availability



www.bluebirdnursery.com

Flower Examples

- When looking for flowers check:
 - Perennial
 - Native
 - Bloom period
 - Sun exposure

Showy milkweed
Asclepias speciosa

Bloom: mid

Saint Mary's College of CA, 1995



New England aster
Aster novae-angliae

Bloom: late

J. Anderson, 2002



Purple Prairie Clover
Dalea purpurea

Bloom: mid



Narrow leaf purple coneflower
Echinacea angustifolia

Bloom: mid

Louis-M. Landry 2006



Joe pye-weed
Eupatorium purpureum

Bloom: mid

B. Jones



Flowering spurge
Euphorbia corollata

Bloom: mid to late



J. Beck

Maximilian sunflower
Helianthus maximiliani

Bloom: late



D. Horn

Dotted gay feather
Liatris punctata

Bloom: mid to late



S. Wasowski

Great blue lobelia
Lobelia siphilitica

Bloom: late



S. Bloodworth

Spotted beebalm
Monarda punctata

Bloom: mid to late



Shell-leaf penstemon
Penstemon grandiflorus

Bloom: early



C. Christie

Upright prairie coneflower
Ratibida columnifera

Bloom: mid



J. Abbas

Black-eyed susan
Rudbeckia hirta

Bloom: mid to late



Canada goldenrod
Solidago canadensis

Bloom: late



M. Below

Prairie ironweed
Vernonia fasciculata

Bloom: mid
to late



NRCS & TNC Efforts

- Pollinator friendly native plants
- Conservation
- Financial support



Pesticides

- Detrimental to pollinators
- Herbicides kill forage plants
- Use Integrated Pest Management strategies
- General guidelines

Pesticide Guidelines

- Consider alternative control measures
- Avoid treating when crop is in bloom
- Use insecticides that are relatively safe for bees
- Prevent drift



Questions

