



UNIVERSITY OF ILLINOIS
EXTENSION

UNDERSTANDING, CHOOSING, AND PROTECTING POLLINATORS

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Definitions, courtesy of Wikipedia (with a few edits)

- **Pollination**: Pollination is the process by which pollen is transferred from the anther (male part) to the stigma (female part) of flowers, thereby enabling fertilization and reproduction.
- In spite of a common perception that pollen grains are gametes, like the sperm cells of animals, this is incorrect; pollination is an event in the alternation of generations. Each pollen grain is a male haploid gametophyte, adapted to being transported to the female gametophyte, where it can effect fertilization by producing the male gamete (or gametes), in the process of double fertilization).
- A successful angiosperm pollen grain (gametophyte) containing the male gametes gets transported to the stigma, where it germinates and its pollen tube grows down the style to the ovary. Its two gametes travel down the tube to where the gametophyte(s) containing the female gametes are held within the carpel. One nucleus fuses with the polar bodies to produce the endosperm tissues, and the other with the ovule to produce the embryo. Hence the term: "double fertilization".
- In gymnosperms (including conifers) the ovule is not contained in a carpel, but exposed on the surface of a dedicated support organ such as the scale of a cone, so that the penetration of carpel tissue is unnecessary. Details of the process vary according to the division of gymnosperms in question.
- Pollination, aided by gravity, wind, insects, or other animals, allows flowering plants to produce seeds and fruits.

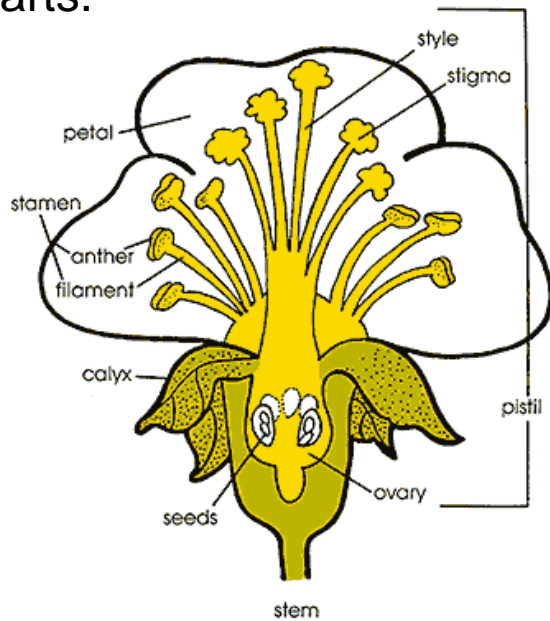
and more from Wikipedia (also with minor edits) ...

- **Pollinators** are the organisms that carry pollen from the stamen to the stigma ... they may be insects, birds, bats, or occasionally other animals.
- **Pollenizers** are plants that serve as the source of pollen for successful pollination and fertilization. While some plants are capable of self pollenization, the term is more often used in pollination management to refer to a plant that provides abundant, compatible, and viable pollen at the same flowering time as the pollenized plant. For example, most crabapple varieties are good pollenizers for any apple variety that blooms at the same time, and are often used in apple orchards for that purpose. Some apple cultivars produce very little pollen; some produce pollen that is sterile or incompatible with other apple varieties. These are poor pollenizers. A pollenizer can also be the male plant in dioecious species (where entire plants are of a single sex), such as with kiwifruit or holly.

OK, so flowers ...

- may each include male and female organs that are self fertile ... and may or may not benefit from pollen transfer from male to female flower parts by insects or other pollinators
 - Pollen transfer may be physical, by wind or gravity (think corn, beans, peaches)
- may each include male and female organs, but pollen from another cultivar or variety may be needed for successful fertilization
 - Nearly all apples and most sweet cherries, for example
- may occur separately as male and female flowers on the same plant
 - Cucurbits
- may be on separate male and female plants
 - Asparagus, kiwi, holly, and ginkgo (and detassled corn grown for seed production)

Apple flowers have male and female parts.



Male (left) and female (right) flowers occur on the same squash plant.



Pollenizers

APPLE POLLINATION CHART

Most apples are partially self fertile, and will set a fair crop in the absence of a pollinizer. If another variety is nearby, you will get a much better crop. A few cultivars, such as Gravenstein are poor pollen producers (indicated with an asterisk), and require a pollinizer to set fruit. Snowdrift Crabapple is an excellent and attractive pollinizer for mid and late season bloomers.

BLOOM TIME	VARIETY POLLINATED	POLLEN SOURCE																	FRUIT RIPENS										
		Braeburn	Criterion	Fireside	Fuji	Gala	Golden Delicious	Golden Sentinel	Granny Smith	Gravenstein	Honeycrisp	Idared	Jonagold	Liberty	Lodi	Melrose	Northpole	Pink Pearl		Red Delicious	Red Fuji	Red Jonathan	Red McIntosh	Red Rome Beauty	Red Spy (Northern Red Spy)	Scarlet Sentinel	Scarlet Surprise	Spitzenberg	Yellow Newtown
mid	Braeburn	■																											late oct to nov
late	Criterion		■																										october
mid	Fireside			■																									october
mid	Fuji*				■																								sept to oct
mid	Gala					■																							september
mid	Golden Delicious						■																						mid sept to late oct
mid	Golden Sentinel - columnar							■																					early to mid sept
mid	Granny Smith								■																				october
early	Gravenstein*			■																			■						august
mid	Honeycrisp									■																			late sept to late oct
early	Idared										■																		mid to late oct
late	Jonagold											■																	mid sept to late oct
early	Liberty												■																early oct
early	Lodi													■															july
mid	Melrose														■														mid to late oct
mid	Northpole - columnar															■													
early	Pink Pearl*																■												late aug to sept
mid	Red Delicious																	■											late sept to mid oct
late	Red Fuji																		■										october
mid	Red Jonathan																			■									october
early	Red McIntosh																				■								september
late	Red Rome Beauty																					■							late sept to mid oct
late	Red Spy (Northern Red Spy)																						■						late oct
mid	Scarlet Sentinel - columnar																												mid to late sept
mid	Scarlet Surprise																										■		early sept
	Spitzenberg																												late oct
	Yellow Newtown																												
early	Yellow Transparent																												early july to early aug

* = this variety requires a pollinizer to set fruit

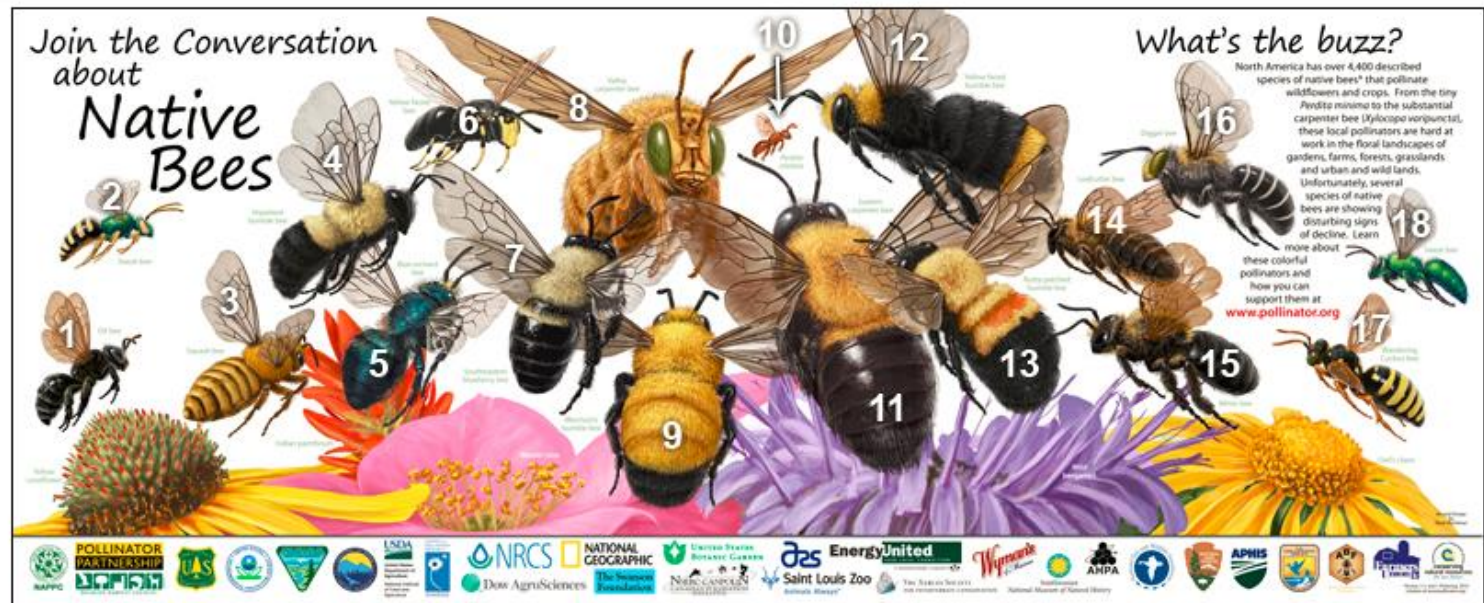
HOW TO USE THE POLLINATION CHART-

1. Select the variety to produce fruit from the **left** side of the chart.
2. Potential pollen parents are listed across the **top** of the chart.
3. If the **intersecting** square is **white**, the variety **will be** pollinized.
4. If the **intersecting** square is **shaded**, the variety **won't be** pollinized.

Insect-aided pollination ...

- may occur without management
 - If the result of wild honey bees, it's not really “natural” ... honey bees are not native to North American but instead imported by European immigrants
 - Insect pollinators include bees, wasps, butterflies, moths, flies, beetles, and other insects that visit flowers for pollen or nectar
- may be managed
 - Honey bees
 - Bumble bees, orchard mason bees (blue orchard bee, hornfaced bees), and leafcutter bees ... are sometimes cultured
 - Squash bees, digger bees, and carpenter bees may be conserved





1. *Macropis nuda*.
2. *Agapostemon texanus*. US sweat bee
3. *Peponapis pruinosa*. Squash and gourd bees
4. *Bombus impatiens*. The Impatient Bumble Bee
5. *Osmia lignaria*. The Blue Orchard Bee
6. *Hylaeus sp.*
7. *Habropoda laboriosa*. The Southeastern Blueberry Bee
8. *Xylocopa varipuncta*. The Valley Carpenter Bee
9. *Bombus morrisoni*. Morisson's bumble bee
10. *Perdita minima*.
11. *Xylocopa virginica*. Eastern Carpenter Bee
12. *Bombus vosnessenskii*.
13. *Bombus affinis*.
14. *Megachile sp.* Leafcutter bees
15. *Andrena cornelli*. Miner bees
16. *Anthophora centriformis*. Digger bees, or anthophorids
17. *Nomada sp.* The Wandering Cuckoo Bee
18. *Augochorella pomoniella*. Sweat bees

Bumble bees ... wild and managed pollinators.

Bumblebees can be used in high tunnels and greenhouses to pollinate strawberries, brambles, tomatoes, and other crops. Biobest and Koppert's are the major suppliers.



Orchard Bees.com

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Nesting Tubes



Orchard mason bees are indigenous to North America, and their role as pollinators is crucial to our indigenous plant life. Keeping mason bees is a low cost way to improve our natural environment. They are easy to maintain, and delightful to watch.

While the importance of honeybees to our food supply has been well publicized by the media, the role of native pollinators such as the orchard mason bee and the bumble bee to our ecology is less widely recognized.

We are dedicated to increasing the cultural and environmental awareness of orchard mason bees (*Osmia lignaria*), bumble bees (*Bombus*), and our many other native bee pollinators.

We have been doing business in Portland, Oregon area for 114 years. We have a large store where you can see all our bee products, and bee educational material. Our [online store](#) provides everything you could want to cultivate healthy and productive orchard bees.

Our store hours are: 9:00 am to 6:00 pm. Monday through Friday. and



Orchard mason bees are active as adults only in the spring/early summer.

Orchard mason bees



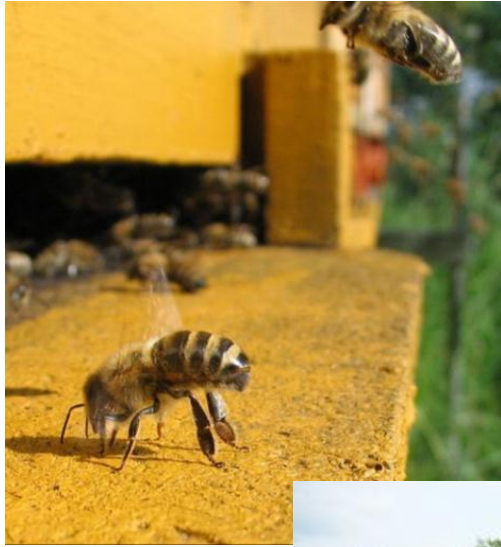
Use “straws” ... not just drilled boards ... to culture orchard mason bees and leafcutter bees so that you can examine brood for parasitism and disease. Not all brood cells will be alive or healthy, and sometimes the best decision is to destroy a colony.

Squash bees ... nest in ground. They look similar to honey bees but with fuzzier legs that lift dry pollen from squash blossoms, and male bees have a yellow spot on their face that resembles a nose.

They begin foraging (visiting cucurbit flowers) at or before dawn. Male and unfertilized female squash bees spend the night in flowers that have wilted during the day. In the morning, they chew their way out and start foraging and mating. Because they nest 5 to 20 inches below the soil surface, conservation tillage and no-till practices allow their survival.



Honey bees



Using bees for pollination

	Honey bee hives/A	Alternatives
Apples	1.2	250 orchard mason bees/A
Blueberries (bees augment yield and size)	4	1-4 bumble bees or southeastern blueberry bees / bush
Muskmelon	2-3	Conserve squash bees
Cucumber	2-3	
Pumpkin	1	
Squash	1	
Watermelon	1-5	

Distributors of bumble bee colonies provide recommendations for outdoor and high tunnel / greenhouse uses.

Challenges ... threats to pollinators, beekeepers, and specialty crop production

- Host plant / habitat loss
- Climate and weather
- Insecticides
 - Overall use
 - Neonicotinoids
- Parasites and pathogens
 - Varroa and tracheal mite
 - Bacteria and viruses
 - Migratory beekeeping
- Colony collapse disorder / disappearing bee syndrome