

Honey Bees KEEP OUT!

Larry Connor

Structural, temporal, familiar, and engineering isolation keeps honey bees away from these flowers.

Most beekeepers ponder the reasons one species of plant produces flowers that prove to be highly attractive to honey bees while another species – one that appears very attractive – does not attract any honey bees at all. The second species may be covered with other bees, wasps, moths, beetles and an entire range of potential pollinators. With some effort it is possible to decode these differences, and find out why the first species is worked by honey bees and the second is not.

As an undergraduate entomology student at Michigan State in the mid-60s, I learned from one of my professors the following lesson: a good entomologist is also a good botanist. While it makes sense, it's not easy. Bees can discriminate between varieties or cultivars of the same species of agricultural crop or selected horticultural cultivar. So to paraphrase my professor: a good beekeeper is also a good bee botanist.

The coevolution of flowering plants and animal pollinators began over 100 million years ago. There were plenty of insects around at the time, and the selection pressure to associate specific pollinators to flowering plant species was high. Some plants only have one insect pollinator, and if the pollinator is destroyed by human or natural efforts, the flower species dies. This is abundantly clear in the orchid bees, where a rapid proliferation of new species – both floral and bee – developed as new habitats were forming in South America due to the movement of the earth's geological plates. There are an estimated 4,000 bee species in

North America, and one explanation for so many species is the movement of the earth's plates and the uplifting of mountains. The repeated Ice Ages clearly had isolating effects that increased the number of species. The vast majority of the world's bees are solitary species – single bees living alone to build, provision and lay an egg one cell at a time.

This may seem somewhat abstract until you look at common plants that grow in your bee territory every year and yet the bees never or only rarely touch them. If we take some time, and dissect a few flowers, we can learn more about the role of floral structure and how it affects bee visits.

Flowers Honey Bee Rarely Visit

Most of us are familiar with common **Evening Primrose** (*Oenothera biennis* in the eastern part of the country, *O. rydbergii* in western regions), a tall woody herb that often grows as either single stems or sometimes has stems branched like a candelabra. It is found in open areas, along roadsides open fields and disturbed areas. A biennial (blooming in the second year), the flowers are bright yellow and cup shaped, 1.25 to 1.5 inches (3-4 cm) across. In Connecticut the evening primrose starts to bloom in June and continues until either drought or frost shuts it down, usually in September. It has indeterminate flowering, meaning it will continue to produce new flowers as long as the plant is healthy and has the nutrients and water to support growth. Once the plants have finished blooming the flower stems persist into

the Winter, shaking seeds out of the very distinctive seed capsules. This is a variable genus, and other species can be found throughout the country, differing in flower size and color of



Stem end of a four-foot common evening primrose in Connecticut. The western and eastern species are very similar, and the genus is quite large. Most share the same flower structure. These are moth-pollinated flowers, with a long calyx ending in the ovary that develops into a seed capsule. Bees cannot collect nectar from these flowers, but they can collect pollen.



Close up of the floral structure of the common evening primrose. There are four yellow petals, a single stamen terminating in five pistils, and eight anthers, that appear to have given up their pollen.



Stemless white evening primrose in Idaho. A close relative to the common evening primrose species. There is no stem; the leaves and flowers arise from a woody carrot like root.

the petals. In years of looking, I have yet to see a honey bee on the flowers of this plant. It didn't make sense to me, since the flowers appear to be very attractive and open during the evening and into the morning hours, and remain open on cloudy days, when the bees could gather pollen and nectar.

A relative of the Evening Primrose is the perennial **Moon-Rose or Stemless White Evening-Primrose** (*Oenothera cepitosa*) that grows between 3000-7500 ft., and can bloom anytime between April and September in open, dry spaces, often clay flats and roadways in the Rocky Mountains. It is also called the tufted evening primrose or sometimes sandlily; there are related species in different habits and parts of the country. It is unique because it lacks a stem. The leaves and flowers all come out of the ground from a well established, thick woody, carrot-like, root system. The flowers are white when they appear in the evening and turn pink the next day (I have found no explanation for the color change). The flower is cup shaped, about 1.5 to 2.0 inches across (4-6 cm), with four petals and what appears at first glance to be a flower stem. It is not a stem; this plant is stemless. On inspection, the structure is actually part of the floral tube or calyx, and the ovary is located two to four inches (5-10 cm) from the stigma and style. The pollen must be placed on the stigma of the flower and germinate, growing down the flower this considerable distance.

When you see a floral structure like this, you should know that bees are unable to obtain nectar from the nectary located at the bottom of the calyx because their tongues are not long enough to reach. Instead the flowers are visited and pollinated by night-flying creatures with very, very long tongues, primarily moths. The most likely culprits are sphinx moths, whose larvae feed on the leaves of the plant. It is a very tight system for insects and plants living in very dry, steppe-like conditions with an annual rainfall of three to four inches. I saw the plants growing on a gravel roadbed going into the mountains

near the tallest peak in the state, Mt. Borah, 12,662 feet (3,861 meters). (We had gone to this area because it was the site of the October 28, 1983 magnitude 7.3 earthquake that lifted Borah Peak seven feet from 12,655 feet to its current elevation of 12,662. My brother and I ended up sitting in the middle of the road taking photos of these fascinating flowers).

Bees do visit these flowers for pollen. A small bee, probably a ground nesting *Halictus* spp., remained on the flower as I took photos; systematically working the anthers to harvest the pollen. The bee also worked the mouth of the long corolla tube to collect pollen that had been placed there by some moth pollinator. Indeed, when I cut the floral tube to reveal the long pistil, I found pollen along the outside of the tube where it is doing neither bee nor plant any good at all, since most moths feed only on nectar. The *Halictus* bee also removed pollen from the multipart pistils, collecting pollen for her brood provisioning while robbing the flower of pollen that may or may not have already germinated. This does not concern the bee in the short term.

Flowers from which bees collect only pollen

There are many flowers with calyx's that are too long for bees to collect nectar from but provide pollen for visiting bees. Recently I noticed honey bees visiting the flowers of **Hosta** growing in a garden. These are large bell shaped flowers, but I have not observed honey bees visiting them for nectar. On this particular day, worker honey bees were actively collecting pollen from the anthers of the flowers, using a biting behavior very similar to the *Halictus* I observed on the moon-rose, mentioned above.

Honey bees collect pollen from a wide range of floral sources. While the **Hosta** was in bloom there was abundant pollen in the many fall composites, the smartweed/knotweed complex of flowers, as well as abundant goldenrod in the neighborhood. Honey bee colonies almost always collect a wide range of pollens, even if it seems logical that the bees



Stemless white evening primrose showing the newly opened flower stamens and pistils. As flowers age overnight they turn pink and sometimes red before they close (background flowers).



Field dissected primrose flower on the author's jeans. The long green structure is the stigma ending in the five-part pistil where pollen is deposited by night flying moths. The pinkish calyx protects the stigma and is often mistaken for a stem.



Close up view into the base of the stemless white evening primrose, showing the long pistil extending into the length of the Calyx (orange area in photo). The nectaries are located at the end of the calyx, two to four inches away from the anthers.



Ground nesting *Halictus* bee using her mandibles to remove pollen from the pistil of the stemless white evening primrose flower. While much smaller than a honey bee, the *Halictid* is still able to collect pollen for provisioning its nest. This bee also collected pollen in the opening of the calyx, apparently moved there by night flying pollinators, probably moths.



Honey bee approaching a common Hosta flower with the protruding white tipped pistil and the yellow, pollen laden anthers. Note the pollen basket on this pollen forager. This bee is unable to collect nectar from this flower.



A common Hosta in the garden has a flower corolla and calyx that is too long for the bee's tongue. That does not prohibit the forager to collect pollen from the anthers, using behaviors similar to the Halictus bee working the primrose flowers.



Male carpenter bee (*Xylocopa*) uses its strong mouthparts to separate the flower structure this Wisteria. Male carpenter bees have a yellow mark on their "face."



Tiger swallowtail butterfly shows the long tongue it uses to probe flowers like this zinnia. Night flying moths have similar mouthparts; often longer. They visit night-blooming flowers with extremely long calyxes that often produce a perfumed odor.

concentrate on abundant sources. This probably reflects a nutritional balance the bees have to achieve to be successful as a colony over time; it is better to have 20 to 200 different pollens stored in a hive than just one or two. Some of those minor pollen sources may help balance the colony's nutritional needs. In the pollen collection studies I have reviewed, the times when bees collect primarily one or two pollen sources is when there is little else available. Two examples: in Michigan after the main pollen/nectar flow was done in agricultural areas, the bees collected a very large percentage of pollen from corn tassels (a potential hazard if insect controls are applied). And in October, when most other flowers have finished blooming, an abundant supply of **Aster** pollen was stored, undoubtedly because it was the only thing still available.

Wisteria and Carpenter Bees

Living in an older part of New Haven in an area of homes built on average a century ago, there are well established flower gardens. A large **Wisteria** (*Wisteria* spp.) vine is on the side of the house, and the dominant bee species on this flower are the carpenter bees (*Xylocopa* spp). There are both native and Asian Wisteria vines growing in the country, and I do not know which species this is, although it seems identical to most I see in established locations, parks and in the wild.

A member of the Pea family, the beautiful wisteria flower has a simple mechanism for nectar presentation. There is no long floral tube. Instead, the flower offers nectar near the surface of the flower, but the petals must be moved slightly to reach that nectar. This not a problem for robust carpenter bees, because they are larger in size and have short mouthparts. I have not found heavy pollen foraging on Wisteria and do not know how much is produced; and the seed set is always light in spite of heavy floral visits from dozens of foragers.

The carpenter bees are some of the largest we have in North America. They may be confused with bumble

bees (*Bombus* spp.), but are often more metallic and less hairy in appearance. The mouthparts are the best way to determine species if you have any doubt; the carpenter bees have extensive jaw like mandibles for chewing holes and tunnels in wood for their nest site. There are two common species in the eastern part of the United States: *Xylocopa virginica* and *Xylocopa micans*.

Why don't honey bees visit these flowers? I suspect that while it may be due to a limited nectar production, flower size and strength are more of an issue. But the carpenter bees are very aggressive foragers, and may keep other bee species away from the flowers. The carpenter bee and the wisteria flower have been a team for thousands of years, if not much longer. Honey bees visit some members of the Pea family, but not all; this may be one of those plants the honey bees will forage when nothing else is bloom, but when the Wisteria blooms in May and June, the bees are given a wide range of flowers to visit, perhaps another Pea family member, the black locust trees.

Conclusion

These flowers show us a few key ways flowers work to keep unwanted pollinators from visiting them. The evening primroses have **structural isolation mechanisms** that restrict pollinators to long tongued pollinators. They also have **temporal isolation** by blooming from late afternoon to early morning, so the pollinators must fly at night, like the moths. This may be an adaptation to the harsh environment in which some of the species live, but certainly not all. Other plants, like Wisteria, have evolved close relationships with a dominant pollinator species, the Xylocopids. Finally, some bee species are restricted to pollen foraging; something that benefits both the bee and the flower, even if the bee was not "engineered" as the primary pollinator. **BC**

To learn about the first Southern New England Beekeeping Assembly November 18 cosponsored by Dr. Connor and Wicwas Press, contact www.sneba.com. Contact Dr. Connor, email abeebooks@aol.com.