

# The Insects That Visit Penstemon Flowers

Sarah Kimball

Department of Ecology and Evolutionary Biology,  
University of Arizona, Tucson, AZ 85721

Paul Wilson

Department of Biology, California State University,  
Northridge, CA 91330-8303

The shape and color of penstemon flowers are the result of adaptations to attract pollinators. Diverse flower types reflect differences in animal pollinators. For about four-fifths of penstemon species (the ones with white, blue, or purple flowers), the principal pollinators are bees and the wasp *Pseudomasaris vespoides*. The remaining fifth of penstemon species have red or pink flowers adapted to hummingbird pollination, with some of these also retaining the bees as co-pollinators. In addition to the animals that the flowers seem adapted to, there are a number of other insects that sometimes visit penstemon flowers, such as the long-tongued flies called *Oligodranes*. There are also many generalist flower visitors occasionally observed on penstemons, such as hawkmoths. The hummingbirds visiting penstemon can be identified with field guides, but the insect visitors are usually more difficult because there are many more insect species and few field guides mention the flowers visited by each species. The goal of this article is to introduce some of the major groups of insects commonly observed visiting penstemon flowers (see photographs in Plate 9).

Animal pollinators visit flowers to gather food in the form of nectar, pollen, or both. From the perspective of the animal pollinators, the act of removing pollen from the anthers of one flower and depositing it on the stigma of another flower is merely a

by-product of foraging for food. Hummingbirds, for example, forage for nectar and inadvertently transfer pollen from one flower to another on their foreheads. For the flowers, pollination is a necessary service provided by animal visitors. The shape of flowers is often matched well to the principle pollinators to ensure that pollen will be removed and deposited with each visit. Flower visitors that collect nectar are usually better for the flower, because no pollen is eaten. Some floral visitors, like bumblebees, actively collect pollen to feed to their developing young. Balls of pollen are often visible on the legs of foraging bumblebees. This pollen is a loss to the flowers. In our descriptions of each pollinator group, we mention whether each animal typically collects pollen and/or nectar from the penstemon flowers. To aid in identification, we will also mention the color and approximate size (usually relative to a honey bee) of each insect. While observing animal visitors, it can be interesting to note the effectiveness of each animal at transferring pollen from one flower to another.

**Honey Bees (*Apis mellifera*)—Color:** black and yellow and hairy. **Size:** honey bee size! Honey bees were introduced to humanized landscapes in the New World primarily to pollinate crop plants, but also for the production of honey. While honey bees did not visit penstemons prior to human settlement, they are now frequently observed collecting pollen and occasionally nectar from penstemon in both gardens and natural settings. Honey bees live in large colonies with a caste system consisting of a fertile queen bee, male drones, and infertile female workers. The worker bees actively collect pollen and roll it into balls carried in pollen baskets on their legs. Worker bees return pollen to the hive, where it is fed to their developing young.

***Pseudomasaris vespoides*—Color:** shiny black and yellow (few hairs). **Size:** longer than a honey bee. This wasp provisions its larvae with pollen, almost like a bee. The species is specialized on penstemons; other species of *Pseudomasaris* use other plants. When a female enters a penstemon flower, she rubs her back against the anthers. Some penstemons (e.g. *Penstemon leatus*)

have raspy teeth on the anthers so that, when an animal rubs against them, pollen is vibrated out gradually onto the animal's back. Male *Pseudomasaris* also visit flowers, and can be distinguished from females by their very long antennae and a hook under the abdomen.

**Metallic colored *Osmia***—**Color:** metallic dark blue, bright green, or purple. **Size:** varies greatly, from much smaller (approx. 1/4" long) to nearly the size of a honey bee (approx. 1/2" long). Among the metallic colored *Osmia*, species richness is high and species identification is nearly impossible, but a number of species rely heavily on penstemons and may be described as penstemon specialists. For many penstemon populations in the montane West, *Osmia* are the most frequent visitors. They visit flowers of many sizes, from species that are large enough to accommodate the thorax of bees as large as bumblebees to species with flowers that fit snugly around an *Osmia*. Female *Osmia* often pause between flowers, land on the ground, and groom the pollen from their backs into a brush on the bottom of their abdomens. Such pollen-bearing brushes are called "scopae".

***Hoplites***—**Color:** some metallic and colored, others black with white stripes. **Size:** varies greatly but proportionally thinner than a honey bee. Several species of *Hoplites* are occasional visitors of penstemon. They tend to be more slender than *Osmia*, although not in all cases. One species that is a probable penstemon specialist is as broad as *Osmia*. It is slightly smaller than the most common metallic blue *Osmia*, and is black with white stripes. Other species of *Hoplites* can be metallic and colored, but they are longer and proportionately narrower than the familiar metallic blue *Osmia*.

***Megachile***—**Color:** mostly black and hairy. **Size:** about the same size as a honey bee, with more of a pointed abdomen. This is a genus of bees that are more robust than the typical metallic blue *Osmia*, but shorter and more angular than a honey bee. Females of the bee family Megachilidae, including *Osmia*, *Hoplites*, and *Megachile*, all carry pollen under the abdomen.

**Anthophorine bees**— **Color:** gray or black, sometimes with orange at the end of the abdomen or tan thoraces. **Size:** body slightly shorter than a honey bee, but just as wide. There are a number of different genera of Anthophorine bees that can be found at penstemon flowers. Some have long gray fur (e.g. *Diadasia*), others are black with a little orange on the end of the abdominal segment, and others have yellow segments almost like a bumblebee. Many of them are quick fliers and hard to catch. We assume that these bees are not particularly specialized on penstemons, and common species have been observed foraging on a wide variety of flowers.

**Bumblebees**—**Color:** black and yellow and very hairy. **Size:** much wider than a honey bee. Females of the genus *Bombus* carry moistened pollen in baskets on their hind legs. The hind legs have a shiny spot where the pollen wad is placed and long bristles at the margins of the shiny spot. At low frequency, one also encounters *Psytarus*, bees that look like *Bombus* but with hairy legs. *Psytarus* are nest parasites that do not carry pollen. Instead, they lay their eggs in the nests of *Bombus*, exploiting the brooding instinct of their host. *Bombus* often work penstemon flowers for nectar without bothering to collect pollen. At some penstemons in some ecological settings, a few individual *Bombus* may take to actively collecting pollen, which they do by turning upside down, grasping the anthers, and buzzing the pollen out onto their bodies. *Bombus* may also be observed cutting a slit into the base of a narrow penstemon flower, removing nectar without contacting the anthers. This behavior is known as "nectar robbing."

**Carpenter bees**—**Color:** metallic black, some with a tan thorax front. **Size:** slightly larger than most bumblebees. *Xylocopa* are very large bees that are metallic black (except for males in some species, but you're unlikely to see male *Xylocopa* at flowers). *Keckiella brevifolia* and less exclusively *Penstemon grinnellii* are frequented by *Xylocopa*. Carpenter bees visit many other penstemons as well, though they are often nectar robbers, removing nectar without providing the service of pollination.

***Ceratina***—**Color:** olive-black metallic. **Size:** thinner than a honey bee. These are about the width of a metallic blue *Osmia* but longer and flatter, and not nearly so deliberately industrious in the way they probe the flowers and groom between visits. They are somewhat metallic but more with an olive-black cast than the familiar blue of the *Osmia* bees most commonly found at penstemon flowers. The abdomen of a *Ceratina* is ob-oval, widest and almost rounded at the end, whereas *Osmia* have abdomens widest toward the waist.

**Sweat bees**—**Color:** black often with tan hairs. **Size:** varies, but most are much smaller than a honey bee. The genera *Lasioglossum* (including *Dialictus*), *Halictus*, and *Mexalictus* are all members of the sweat bee tribe. They are common but usually not abundant visitors at penstemon flowers. They usually visit flowers upside-down, collecting pollen from the anthers with their mouths and legs. They are known by the way they carry pollen at the base of their hind legs, dry and granular, amongst long curved hairs. Some of the larger *Lasioglossum* have striped abdomens. Close observation of the tongue reveals it to have an elbow-like joint.

***Hyaleus***—**Color:** cream-colored face and black or black and cream body with relatively little hair for a bee. **Size:** tiny; less than 1/4" long. These small bees visit penstemon flowers upside-down, collecting pollen. They are found in mountain ranges at altitudes greater than 10,000 ft. These bees swallow collected pollen, carry it internally, and regurgitate it in their nests.

***Oligodranes***—**Color:** black and white. **Size:** about 1/4" long body, 1/8" long tongue. These long-tongued flies collect nectar. Note that, unlike bees, flies have only two wings. The other two have been modified into small, vibrating structures called halteres, which assist with balance. The rather short abdomen of *Oligodranes* is black with white stripes. On cool mornings, one can sometimes find *Oligodranes* sleeping in penstemon flowers.

***Bombylius***—**Color:** black and gray or black and tannish-yellow. **Size:** body larger than *Oligodranes*, with approx. 5/8" long tongue.

These "bee-flies," or flies that look like bees, have a thorax and abdomen covered in long but not too dense, golden or gray hairs on a cuticle that is a flat non-metallic black. Bee-flies hover with great precision as they move from flower to flower. The wings are darkly pigmented at the leading edge and clear toward the rear. (Comparing two of the more common species, in *Bombylius major* there is an abrupt change between the two colors, whereas in *Bombylius lancifer* the pigmentation fades gradually.) Bee-flies are not specialized on penstemons, and penstemons are not specialized on them. However, bee-flies are a common sight, especially in California, visiting various flowers, including penstemons.

***Eulonchus***—**Color:** blues, greens, coppers. **Size:** shorter than a honey bee but just as wide, like a bottle fly with a side butt. These flies have a tongue that is even longer than that of a *Bombylius*. The tongue can be folded back between the legs, but *Eulonchus* often hold the tongue downward between adjacent flowers. Students of flies find the rear lobe of the wing to be shockingly large. Compared to a *Bombylius*, the hairs are shorter and the cuticle is metallic with a blue, green or purple sheen. Also, the abdomen is reminiscent of a balloon, while the head seems on the small side. *Eulonchus* appear "clownish," whereas *Bombylius* appear more elegant.

**Syrphid flies**—**Color:** shiny black and yellow. **Size:** in some species, body and wings longer than a house fly but more slender. Syrphid flies lick up pollen when they aren't just wasting energy hovering around flowers trying to make up their minds. They are often yellow and coppery striped. They have short tongues, and many of the smaller forms most likely to be seen at penstemon flowers have rather flat abdomens. The syrphid flies that visit penstemons are not particularly hairy. We suppose they are not very effective at transferring pollen from anthers to stigmas.

**Hawkmoths**—**Color:** mostly shades of brown with white stripes on forewing and pinkish-peach stripes on hindwing. **Size:** smaller than a hummingbird. *Hyles lineata* is the common hawkmoth of the west. Abundance varies greatly from year to year. In good

hawkmoth years, they can be observed visiting almost every flowering plant, including penstemons. Although they are most active at dawn and dusk, they may be observed visiting flowers throughout the day at higher altitudes. In years without many hawkmoths, one can look at penstemons all summer and not observe a single hawkmoth. We believe that there are no penstemons specifically adapted to moths.

**Butterflies**—**Color:** varies greatly. **Size:** varies greatly.

Occasionally one finds a butterfly at a penstemon flower, and there are a few species of penstemons with fairly narrow vestibules that one might imagine are adapted to butterfly or moth pollination (*P. tubaeformis*), but so far these have proven to be more frequently pollinated by bees. We do not picture any particular butterfly here because they seem so accidental that we do not wish to encourage people to think of them as a clientele for penstemon flowers.

**Beetles**—**Color:** those that visit penstemon are usually dark gray.

**Size:** varies greatly, but those that visit penstemon are often smaller than 1/4" long. Some beetles in certain habitats go to practically any flower, including penstemons. Melyrid beetles are particularly popular in the hills of California. The beetles are not particularly prone to flying between flowers compared to all the above animals, and if they contact stigmas at all, it is likely in the process of going to the anthers in search of pollen to eat. Probably they are inconsequential pollinators, and no penstemons seem adapted to any beetles.

## Summary

Hopefully, this guide will serve as a useful starting point for learning to identify insect visitors to penstemon flowers. Observing and identifying the floral visitors can be an interesting activity, and you may encounter some unusual visitors. For example, we have observed the golden-mantled ground squirrel drinking nectar out of *Penstemon newberryi* in California's Sierra Nevada. The squirrel apparently found penstemon nectar to be a delicious treat! While you are observing insects, try to note pollen-collecting versus

nectar-collecting visitors, and attempt to note which visitors are likely providing a service to the flowers by transferring pollen from one flower to another. As mentioned earlier, some bees that are too large to enter certain species have been known to cut a hole in the base of the flower in order to reach the nectar without providing any pollination service. This phenomenon, known as nectar robbing, occurs in many other plant species as well. Much less is known about the taxonomy and habits of insect pollinators than is known about penstemons, so careful observation of these animals is greatly needed.

*Acknowledgements:* We are grateful to Jim Hogue for a great deal of help over the last decade identifying insects. Several taxonomic specialists have also identified penstemon pollinators for us, including T. Griswold, R. Brooks, and the late R. Snelling.

### **Entries Into the Technical Literature**

Crosswhite, F. S., and Crosswhite, C.D. 1966. Insect pollination of *Penstemon* series *Graciles* (Scrophulariaceae) with notes on *Osmia* and other Megachilidae. *American Midland Naturalist* 76: 450-467.

Kimball, S. 2008. Links between floral morphology and floral visitors along an elevational gradient in a *Penstemon* hybrid zone. *Oikos* 117: 1064-1074.

Thompson, J. N. 2005. *The geographic mosaic of coevolution.* University of Chicago Press.

Torchio, P. F. 1974. Mechanisms involved in the pollination of *Penstemon* visited by the masarid wasp, *Pseudomasaris vespoidea* (Cresson). *Pan-Pacific Entomologist* 50: 226-234.

Wilson, P. Castellanos, M.C., Hogue, J.N., and Armbruster, W.S. 2004. A multivariate search for pollination syndromes among penstemons. *Oikos* 104: 345-361.



Plate 9: Common pollinators of plants in the genus *Penstemon* (photographs by Paul Wilson).