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Milkweed Pollination Biology
(Asclepias spp.)

Eric P. Eldredge, Manager, Great Basin Plant Materials Center, Fallon, Nevada

Monarch butterfly (*Danaus plexippus*) conservation depends on conservation of the milkweeds that are the host plant for monarch larvae. Across much of its range in the western U.S., showy milkweed (*Asclepias speciosa* Torr.) is an important source of nectar for adult monarch butterflies and is the preferred host plant for monarch larvae (Borders, et al., 2012).

Milkweed flowers bloom in umbels (Figure 1), which are clusters of individual flowers on stems that emerge from a common point (Young-Mathews and Eldredge, 2012).

Figure 1. An umbel of showy milkweed flowers in full bloom.

Each flower has a calyx, corolla, and corona, which surround a central gynostegium. The gynostegium is formed from the fused, highly modified male (anthers and filaments) and female (stigmas and styles) floral parts. At the top of the gynostegium is a style-head, formed by fusion of the apices of two styles. The corolla is the outer and lower part of the flower and resembles petals (Figure 2). In some milkweed species the corolla is bent backwards (reflexed).

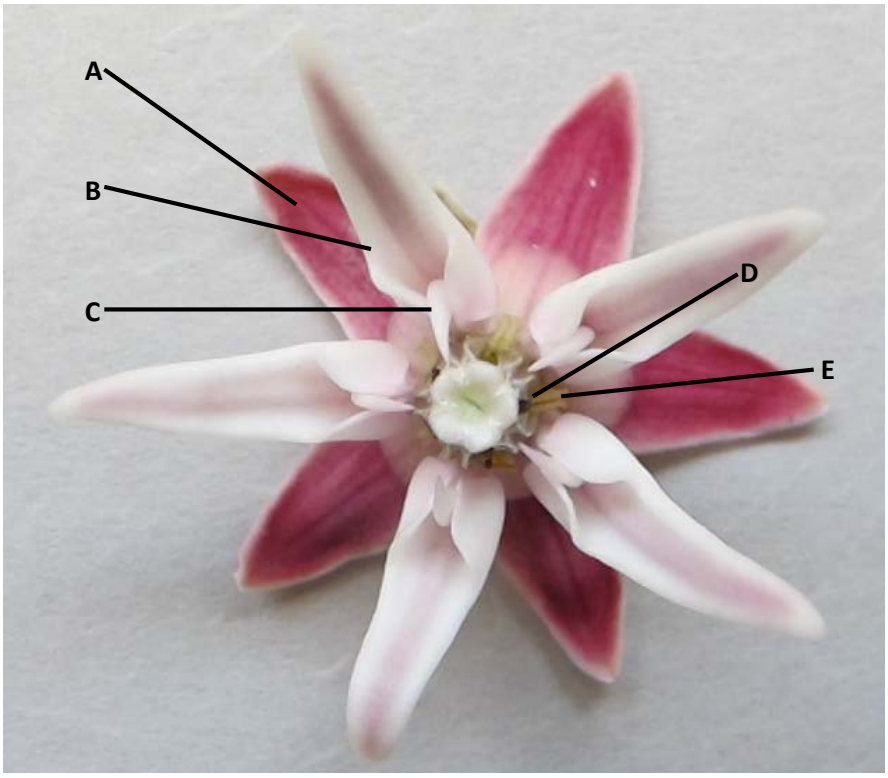

Figure 2. A top view of a showy milkweed flower showing the corolla (A), and the corona with five hoods (B), each with a prominent horn (C). A dark brown corpusculum (D) is visible at the top of three of the stigmatic slits (E).

The corona is the showy, upper part of the flower. Five hoods surround the corona and tempting pools of luscious nectar form at the base of each hood. In some species, each hood has a prominent horn. Together these slick, waxy floral structures manipulate the behavior of insects to achieve pollination.

Flowers of different species of milkweed differ in size, color, and fragrance, but all produce their pollen in waxy sacs called pollinia. The pollinia are located in two anther pouches adjacent to vertical stigmatic slits of the flowers (Figure 3). Pairs of adjacent pollinia are connected to each other by translator arms from a clamp located in the middle, called the corpusculum (Bookman, 1981). The complete structure is called a pollinarium (Figure 4). A very similar pollinarium structure also evolved in a monocotyledonous group of insect pollinated plants: the orchids. Because of their unusual structure and relatively large size, the flowers of showy milkweed require relatively large insects for effective pollination.

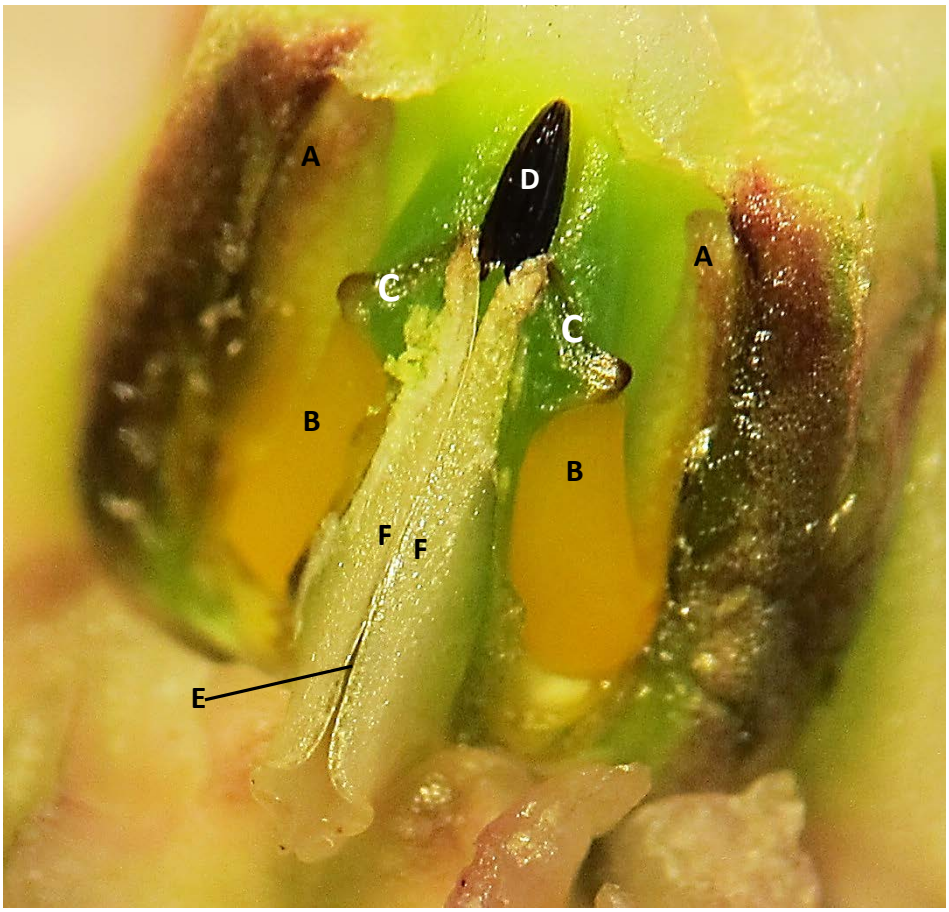

Figure 3. A magnified view of a dissected showy milkweed flower, with the anther pouch walls (AA) removed to show a pollinarium and the position of the pollinia (BB), translator arms (CC), and the corpusculum (D) at the top of the stigmatic slit (E) formed by the guide rails (FF).

Insects that visit a flower to drink nectar struggle to grasp the slippery surfaces and may accidently slip their leg, tarsus, mouthpart, or other appendage into the opening at the bottom of the stigmatic slit. This slit is formed by guide rails, which are lined with bristles that prevent the insect moving its appendage any direction but up. The top of the slit leads into the opening of the corpusculum, which has hard, sharp inside edges that taper together at the top. The corpusculum clamps firmly to the insect by pinching onto the insect's appendage. In its struggles to escape, if the insect is large enough, it can withdraw the paired pollinia from the anther pouches and fly away (Figure 5).

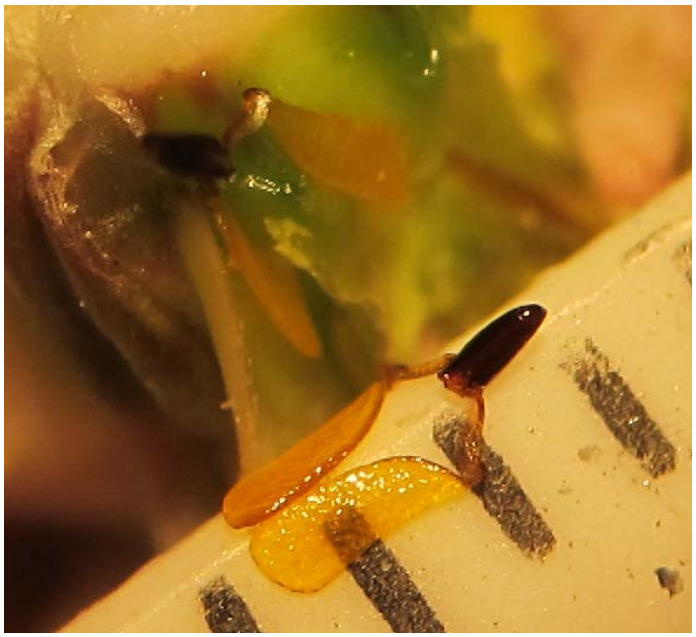

Figure 4. A pollinarium of showy milkweed on the edge of a millimeter scale, and an exposed pollinarium in the background.

Figure 5. An unidentified large wasp nectaring on narrow leaf milkweed, bearing many pollinaria attached to the hairs on its legs (at arrows).

During flight, the translator arms dry and bend to change the orientation of the pollinia (Bookman, 1981). When the insect visits another milkweed flower, a pollinium may slip into one of the stigmatic slits and be captured inside the stigmatic chamber. The insect must then break the translator arm to escape, leaving the pollinium in the stigmatic chamber where the pollen grains can germinate to fertilize the flower.

Deep inside the gynostegium, two future seedpods (follicles) have already developed the unfertilized ovules by the time the flower blooms. One follicle can be pollinated by a pollinium inserted into any of three adjacent stigmatic slits, and the other follicle is connected to the two remaining stigmatic chambers (Sage et al., 1990). After pollination occurs, the other flowers on the umbel wither and fall off.

Not all insects that visit to showy milkweed to drink nectar are large enough, strong enough, and clumsy enough to pollinate it effectively. Introduced European honeybees can pollinate showy milkweed effectively because they are so numerous. Showy milkweed provides abundant nectar for honeybees over a long bloom period. However, due to their small size relative to a showy milkweed flower, occasionally a honeybee may be trapped on the flower (Figures 6 and 7).

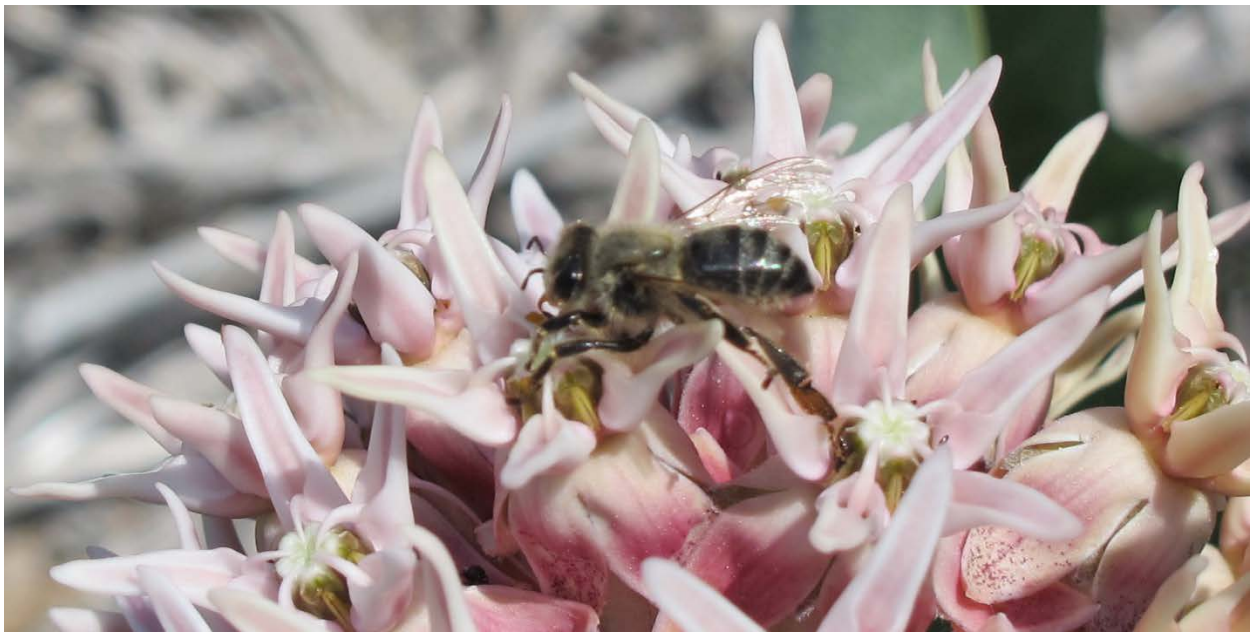

Figure 6. Some bees and smaller insects, unable to withdraw the pollinarium, may lose a limb, or be trapped on the showy milkweed umbel, like this honeybee.

Figure 7. The headless carcass of a trapped honeybee, one leg lost and still not free. A catena of corpuscula is visible to the right of her trapped tarsus (at arrow).

After insertion of a pollinium into a stigmatic slit, if the insect is strong enough to break the translator arm and escape, the broken stub is the perfect size, shape, and orientation to catch another corpusculum. This may repeat until chains (catena) of corpuscula are formed, in a process called concatenation (Peter and Shuttleworth, 2014).

More research is needed to determine if population declines in the insect species that are the most effective pollinators of milkweed (Wiemer et al., 2012) have contributed to the nationwide decline in milkweed, and consequent decline in monarch butterfly habitat.

The next time you see a milkweed seedpod (follicle) think about the hapless insect who, in exchange for a rich reward of carbohydrate, removed a pollinarium and flew to a flower on another milkweed, where a pollinium chanced to slip into the stigmatic slit. Without a sufficient diversity of pollinator species to accomplish this peculiar and elaborate pollination process, the showy milkweed populations that support the monarch butterfly could continue to decline.

Showy milkweed grows best in well-drained soil in full or nearly full sun, in pastures, meadows, forest clearings, untilled fields, roadsides, and ditch banks, from sea level to 6,250 ft. (Stevens and Anderson, 2005). Seed is routinely commercially available. Whenever possible, showy milkweed should be considered as a component in pollinator habitat plantings, such as backyard gardens, along field borders, and edges of hedgerows. Showy milkweed should be considered for roadside beautification projects when it can be planted some distance away from the flow of traffic. The flowers bloom from May through September, providing nectar to a diverse community of pollinating insects.

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