Milkweeds: Not Just for Monarchs

Brianna Borders and Matthew Shepherd

Standing in a field of milkweed plants, John Anderson watches a monarch butterfly search for a place to lay her eggs. This sight epitomizes most people's image of milkweed: food for monarch caterpillars. This, however, is no ordinary field of milkweed, and John is not most people. The co-owner of Hedgerow Farms near Winters, California, John is at the forefront of a movement to encourage the use of locally native milkweed in restoration projects. As the obligate host plants for monarch caterpillars, milkweeds play a vital role in the life cycle of the monarch butterfly (*Danaus plexippus*). They also provide food or shelter for a diverse array of other insects, including nectar-seeking bees, flies, and butterflies, and such specialist herbivores as seed bugs, longhorn beetles, and leaf beetles. Native milkweeds are clearly worthy of wider adoption.

More than a hundred species of milkweeds (*Asclepias*) are native to North America and they can be found in deserts, plains, valleys, foothills, open woods, and wetlands. Milkweeds also grow in disturbed environments including agricultural areas, livestock pastures, ditches, and roadsides; indeed, in some areas, these marginal habitats are the only places where milkweed is regularly seen.

Milkweed is named for its milky latex sap, which oozes from damaged leaves and stems. This sap contains alkaloids and cardenolides, complex chemicals that make the plants toxic to animals. If eaten by livestock, milkweed typically causes depression or diarrhea, although it may be fatal. Fortunately, milkweed is bitter in flavor and unpalatable, and range animals will generally avoid eating it if sufficient forage is available; most milkweed poisoning results from hungry animals being concentrated in areas where milkweed is abundant.

The toxin-laden sap deters mammals, but insects have an amazing capacity to overcome the chemical defenses of plants, particularly those with which they have a shared evolution. In fact, a large number of insects eat milkweeds, often harvesting the toxins for use in their own defense; of the insects that do this, monarchs are the best known. Their caterpillars sequester the toxins and store them in their tissues, giving them a bitter taste. They have boldly colorful warning—aposematic—markings, which serve as a reminder to birds and other predators. Other milkweed-feeding insects, including milkweed bugs, milkweed longhorn beetles, and milkweed leaf beetles, sequester and store the milkweeds' toxic chemicals to aid their own defense, and like monarch caterpillars, generally have aposematic markings.

Large milkweed bugs (*Oncopeltus* spp.) feed only on milkweeds and closely related plants. Although these bugs will feed on young leaves, flowers, and developing pods, a seed diet provides for optimal growth and reproduction, and for

this reason adults lay their eggs close to developing pods. Small milkweed bugs (*Lygaeus* spp.) feed on seeds as nymphs but they can develop on plants other than milkweeds. As adults, they are not strictly herbivorous, and will scavenge insects trapped in milkweed flowers, feed on monarch butterfly pupae, and even engage in cannibalism.

Milkweed longhorn beetles (*Tetraopes* spp.), so-named for their prominent antennae, feed exclusively on milkweeds and close relatives. They are generally host-specific—there are thirteen species of milkweed longhorn beetles in the United States and each prefers a different species of milkweed.

The milkweed leaf beetle (*Labidomera clivicollis*) overcomes milkweed's defenses by biting through veins of the leaf. The sap drains from the outer part, and the beetle can feed in relative safety on the drained area beyond the cuts.

The relationship between milkweeds and insects is not one-sided. Milkweeds are entomophilous, meaning that they depend on insects for their pollination. Milkweed pollen does not occur as free grains, but instead is contained in pairs of waxy sacs—pollinia—that are located within vertical grooves on the flowers, called stigmatic slits. Each pollinium contains several hundred grains of pollen. An insect that visits a flower to obtain nectar may leave with a pair of pollinia affixed, the result of coming into contact with a corpusculum, a pollinia-bearing gland located at the top of a stigmatic slit. (Insects may accumulate strings of corpuscula and pollinia from repeated flower visits. In Robert Woodson's extensive monograph on the *Asclepias* species of North America, he reported an instance of a single honey bee carrying forty-five corpuscula!) Pollinia most commonly become attached to an insect's legs but they can also be borne on the mouthparts or on any barbed or hairy surface of an insect's body. Fertilization occurs when pollinia are transferred by the insect into the stigmatic slits of another milkweed flower.

Although milkweeds have a very specialized pollination mechanism,

Bright markings warn predators that the large milkweed bug (*Oncopeltus fasciatus*) tastes bad. Photograph by Bryan E. Reynolds.

they do not require specialist insects to activate it. Any insect that is large enough to remove and transport pollinia can be an effective pollinator, and milkweeds are pollinated by a broad range of bees, wasps, butterflies, flies, and beetles, even true bugs. A review of milkweed pollination studies completed by Jeff Ollerton and Sigrid Leide revealed that whorled milkweed (*A. verticillata*) has 126 documented pollinators.

With their pollen enclosed within pollinia and inaccessible, milkweeds have only nectar with which to reward visitors. Even so, they attract a tremendous variety of insects with the abundant, high-quality nectar that is readily accessible in the hoods of their flowers. Many of the nectar-seeking insects inadvertently end up as pollinators, while others bring benefits in other ways. In a recent study by David James of Washington State University, milkweed—in this case, showy milkweed (*Asclepias speciosa*)—attracted the highest number of beneficial insects of any of the forty-three species of native flowers being studied.

Insects whose adults visit milkweeds for nectar include ichneumon, braconid, and mymarid wasps, all of which are parasitoids (meaning that they lay eggs on or in a host insect; once hatched, their offspring then consume the host), and thus natural predators of crop or garden pests. The closely related ichneumon and braconid wasps typically parasitize aphids or the soft-bodied larvae of such insects as butterflies, flies, and beetles, while mymarid wasps parasitize insect eggs. Syrphid flies are also attracted to milkweeds: the adults drink the nectar and their highly mobile larvae prey directly on aphids.

Milkweeds support a diverse community of insects that visit to drink nectar or feed on the plant itself—or on the other visitors. Photograph by Bryan E. Reynolds.

Fewer milkweed plants for its caterpillars to eat is one reason for declines in monarch butterfly (*Danaus plexippus*) populations. Photograph by Bryan E. Reynolds.

One conspicuous insect that can frequently be seen nectaring on milkweed in California and the desert Southwest is the tarantula hawk wasp (*Pepsis* spp.). As their name suggests, these wasps hunt tarantulas, not for themselves—as adults they eat only nectar—but to supply the nests of their offspring.

Like many native plant species, milkweed populations are being lost at a rapid rate due to urban and suburban development and agricultural intensification. Despite their native status, unique beauty, and value to the monarch butterfly as well as to a tremendous range of pollinators and other beneficial insects, milkweeds are often perceived as crop weeds or a threat to livestock and eradicated from agricultural areas, rangelands, and roadsides.

Loss of milkweeds is believed to be one of the factors (along with disturbance to and destruction of overwintering sites) that have led to the steep decline of the western population of monarchs. The butterflies spend the winter months in tree groves along the coast of California, the only U.S. state with large numbers of overwintering monarchs. Each spring, the butterflies leave the groves in search of milkweed on which to lay their eggs. Over the summer, successive generations spread out across North America west and south of the Rocky Mountains and as far north as British Columbia, with the last generation making the journey back to the California coast. Unfortunately, western monarchs are in trouble. Data collected by volunteers show that the number of overwintering monarchs has dropped by more than 90 percent since 1997.

In 2008 the Commission for Environmental Cooperation (a treaty organization of the United States, Canada, and Mexico) published the *North American Monarch Conservation Plan*, addressing the steady decline of the butterflies across their native range since population monitoring first began in 1976. Because of their migratory lifecycle (breeding in the United States and Canada, overwintering in Mexico and California), the most effective conservation strategies for monarchs are those that protect and restore habitat across their entire range. The plan cites broad national declines in milkweeds and

Butterfly weed (*Asclepias tuberosa*) has a wide distribution, but is not always the most appropriate milkweed for habitat projects. Photograph by Allen Casey.

recommends the planting of regionally appropriate native milkweed species to offset the loss and degradation of monarch breeding habitat.

Unfortunately, few commercial sources of native milkweed seed currently exist across the monarch's spring breeding range in the United States—California, the Southwest, Texas, and Florida—and, in these places, either no milkweeds are planted or those that are planted are species from outside of the region. Clearly, there is a need for sources of locally native milkweed seed. In 2010, with support from the Monarch Joint Venture and a Conservation Innovation Grant from the USDA Natural Resources Conservation Service (NRCS), the Xerces Society launched a multistate initiative to increase the availability of native milkweed seed for monarch-habitat conservation efforts. Xerces is working with the native seed industry to develop new sources of regionally appropriate native milkweed seed, and working with the NRCS to incorporate milkweeds into the agency's pollinator-habitat restoration projects.

As part of this effort, John Anderson has already produced seventy pounds of seed from narrow-leaved milkweed (*A. fascicularis*), which can be used in restoration across California. We hope that this is just the first batch of milkweed seed that will be planted to help stem the downward spiral of monarch butterflies, while at the same time sustaining the richness of insects required for a healthy environment.

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