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Propagating Native Milkweeds for Restoring Monarch Butterfly Habitat[©]

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The number of monarch butterflies, charismatic nomads of North America, is rapidly declining. Milkweeds (*Asclepias* spp.), which are the sole food source for monarch caterpillars, have also experienced a decline throughout the breeding range of this butterfly. Milkweeds can be grown from seeds or vegetatively from root cuttings or rhizomes. Seed germination is often improved with stratification and plants are easily grown with standard propagation methods. However, some species require adjustments to the substrate to reflect unique soil conditions of their natural habitat. We encourage you to grow and outplant milkweeds to create habitat for monarch butterflies and help restore their populations.

THE POPULATION CRASH OF MONARCH BUTTERFLIES

The causes behind the decline in pollinators are many, but most can be related either directly or indirectly to human activity. Habitat loss is always near the top of the list — habitat destruction or fragmentation into small, disperse patches threatens all types of insect pollinators (Mader et al., 2011). Monarch butterflies (*Danaus plexippus*) are, however, an interesting example of pollinator decline because, unlike many other organisms that rely on one specialized habitat, adult monarchs are generalists that thrived all across North America — that is, until recently.

With its large size and striking orange and black coloration, the monarch butterfly has been considered the most well-known butterfly in the world (Commission for Environmental Cooperation, 2008). The monarch is a tropical butterfly that readily recolonizes much of temperate North America through annual migrations. Indeed, their long-distance migrations from breeding areas to overwintering sites in Mexico and California are among the most unique and spectacular biological phenomena in the world (Luna and Dumroese, 2013).

Like many school children, we learned one of our first biology lessons from rearing monarch caterpillars and watching their magical transformation into beautiful butterflies. In fact, in southern Kansas where Tom grew up, monarchs were so common that he remembers wishing he could find some other butterflies to collect for his Boy Scout merit badge. Unfortunately, things have changed. Surveys taken at overwintering sites confirmed our observations that monarch populations have recently experienced a major collapse and, what is more alarming, is how quickly this occurred. Population levels of the eastern and western groups have crashed during the past two decades (Fig. 1). From 1999 through 2010, the eastern monarch group plummeted 81% (Pleasants and Oberhauser, 2013). Similarly, annual surveys of the western group overwintering on the California Coast have revealed a nearly 90% decline during the last decade (Jepsen et al., 2010).

Although adult monarch butterflies are generalists, feeding on nectar from a wide range of flowers, their caterpillars are specialists, requiring tender leaves of milkweed plants (*Asclepias* spp. [*Asclepidaceae*]) to complete that portion of the life cycle. Flockhart et al. (2015) asserted that the loss of milkweeds, especially in the Midwestern United States, is one of the major causes for the decline in monarch butterfly populations. Therefore, growing and outplanting milkweeds is a simple and easy way to assist this beloved butterfly.

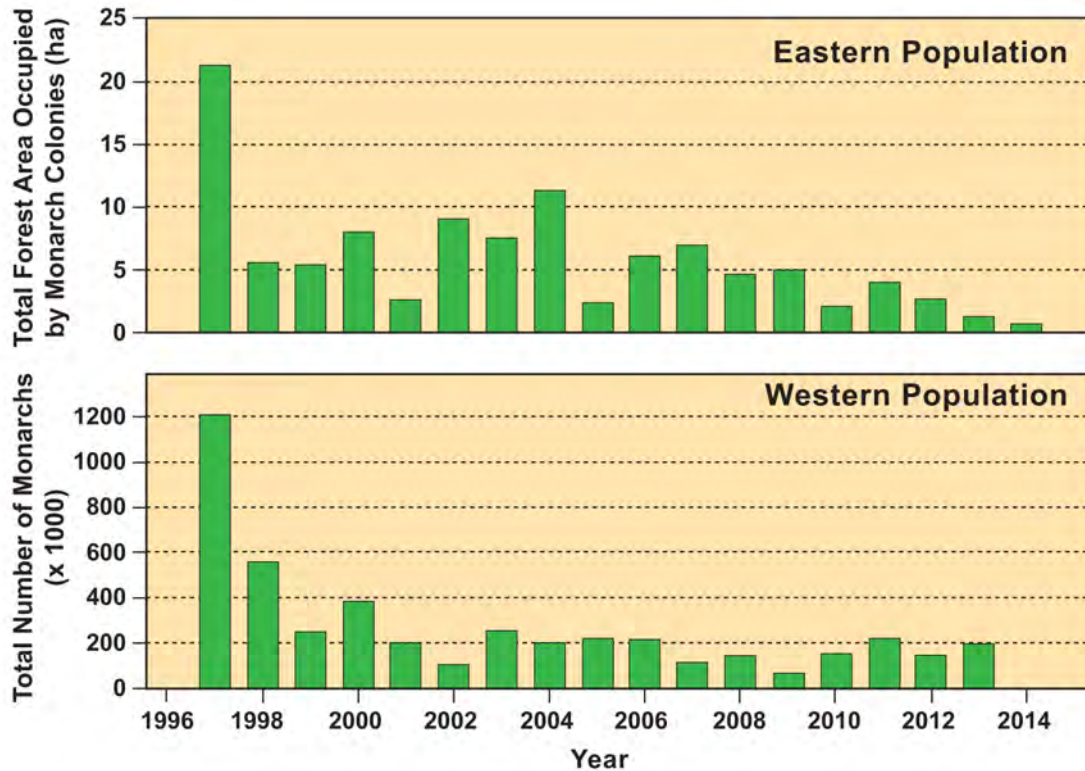


Fig. 1. Although monarchs were among the most common butterflies in the United States, overwintering numbers within the eastern (A) and western (B) populations have declined dramatically during the last two decades. (A) modified from Rendon-Salinas and Tavera-Alonso (2013), (B) modified from Jepsen et al. (2010).

PROPAGATING NATIVE MILKWEEDS

Milkweed can be propagated sexually (seeds) or asexually (root cuttings or rhizomes), although seedling production is much more common. Propagation protocols for 11 different milkweed species are provided in the Native Plant Network database (for example, Schultz et al., 2001; <<http://www.nativeplantnetwork.org>>).

Seed Source and Seed Production Areas

Monarch Watch recognizes 73 species of native milkweeds in the United States, but to date, monarchs are only known to use about 30 of these species as host plants. So, the first step is to determine which of these milkweed host species occur in your area. Helpful state-by-state maps are available on the PLANTS database (<<http://plants.usda.gov>>); clicking on the state will take you to the county level. A helpful table with all the milkweed species and the states in which they occur is also provided in Appendix 1 of “Milkweeds: A Conservation Practitioner’s Guide,” that can also be accessed on-line (Borders and Lee-Mäder, 2014).

Forest, conservation, and native-plant nurseries are well acquainted with the concept and importance of seed zones; locally-adapted plants usually perform best. Finding source-identified, locally-adapted milkweed seeds has, however, been a serious obstacle in the past, but efforts are underway to improve this situation. One objective of the Xerces Society’s Project Milkweed is to develop local milkweed seed sources (Xerces Society, 2013), and they offer a Milkweed Seed Finder feature on their website: <<http://www.xerces.org/milkweed-seed-finder/>>. Monarch Watch also has a Milkweed Market that sells seed packets and nursery plants of several species of milkweed (Monarch Watch, 2014). They have developed a milkweed seed zone map for the continental United States (Fig. 2) that is based upon ecoregions (Bailey, 1994). In this map, mountainous areas

rubber ball; gently shaking the bag dislodges the pappi and allows the cleaned seeds to fall to the bottom where they can be harvested by clipping the corner off the bag. A range of seed cleaning techniques and equipment for processing small to large collections can be found in Borders and Lee-Mäder (2014).

Many sources of milkweed seeds require stratification (cold, moist treatment) before sowing. In a review of stratification requirements for common milkweed, recommendations varied from as short as 7 days to as long as 11 months at 5°C (41°F) (Luna and Dumroese, 2013). Butterfly milkweed (*A. tuberosa*) germination increased from 29 to 48 to 62% as stratification duration increased from 0 to 30 to 60 days, respectively (Bir, 1986). Our informal natural stratification trial with showy (milkweed) and narrow leaf milkweed (*A. fascicularis*) in southern Oregon revealed that seeds began to germinate after 15 weeks in stratification (Fig. 3A).

Any of the standard seed propagation methods (Landis et al., 1999) are effective with milkweed. Direct sowing of non-stratified seeds during the fall followed by exposure to ambient winter conditions can be effective, but the seeds must be mulched and protected. Cover sown seeds with a thin mulch; research has found that common milkweed seeds germinated better when planted 1 to 2 cm (0.4 to 0.8 in.) deep than when at the soil surface (Jeffery and Robison, 1971). Others have had success sowing seeds without stratification. In early spring, non-stratified showy milkweed seeds that were direct-sown into Ray Leach Cone-tainer Super cells (164 ml [10 in³]; Stuewe & Sons, Tangent, Oregon) filled with Sunshine #1 mix showed 85% germination within 2 weeks under typical greenhouse culture. After 5 months, plants were averaging 13 cm (5 in.) tall (Bartow, 2006). Sowing germinants directly out of stratification has the highest seed efficiency because only live seeds are sown into containers. Growing milkweed in shallow germination trays and then transplanting (“pricking out”) the emergents to larger containers is also effective. Fill trays with a well-drained growing medium, press the milkweed seeds gently into the substrate and cover with a very thin layer of peat moss or perlite. The trays should remain “moist, but not wet” by misting as needed, and temperatures should be maintained between 18 and 24°C (65 to 75°F). Transplant young seedlings into larger containers when they have at least one set of true leaves (Kirk and Belt, 2011).

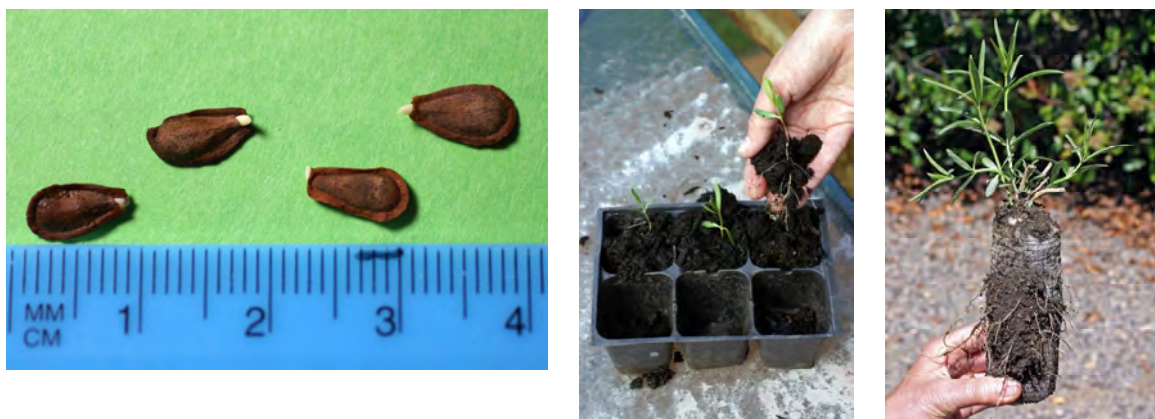


Fig. 3. Propagating milkweeds from seeds is most common, but can have its challenges. Milkweed seed germination can be extremely variable; these showy milkweed seeds germinate after a 15-week stratification treatment (left). Due to their rhizomatous nature, milkweeds do not develop many fibrous roots and their root plugs often fall apart during transplanting (center). Therefore, Jiffy[®] pellets (right) or containers with other types of stabilized growing media are recommended. Photos by T.D. Landis.

Vegetative Propagation

A couple types of vegetative propagation can be used with native milkweeds (Fig. 4). Most milkweed species can be propagated from root cuttings, but the process is much more productive for rhizomatous species, such as common and showy milkweed (Luna and Dumroese, 2013). The best time to collect rhizomes is during the late fall to early spring when the buds are dormant and the rhizomes contain high levels of stored energy. You can locate milkweed plants during the winter by looking for the dried flowering stalks. Rhizomes can be stored by trimming off dead shoots and replanting them outdoors in raised beds or in a large container filled with a well-drained growing medium. Sprouts will form once the weather warms. We have had success propagating from rhizomes during the growing season as long as frequent irrigation is possible (Landis, 2014). Even rhizome sections as short as 5 cm (2 in.) contain buds and can be used as propagules (Easyliving Wildflowers, 2014). When cultured properly, plants propagated from large rhizomes will flower and produce seeds the first year.

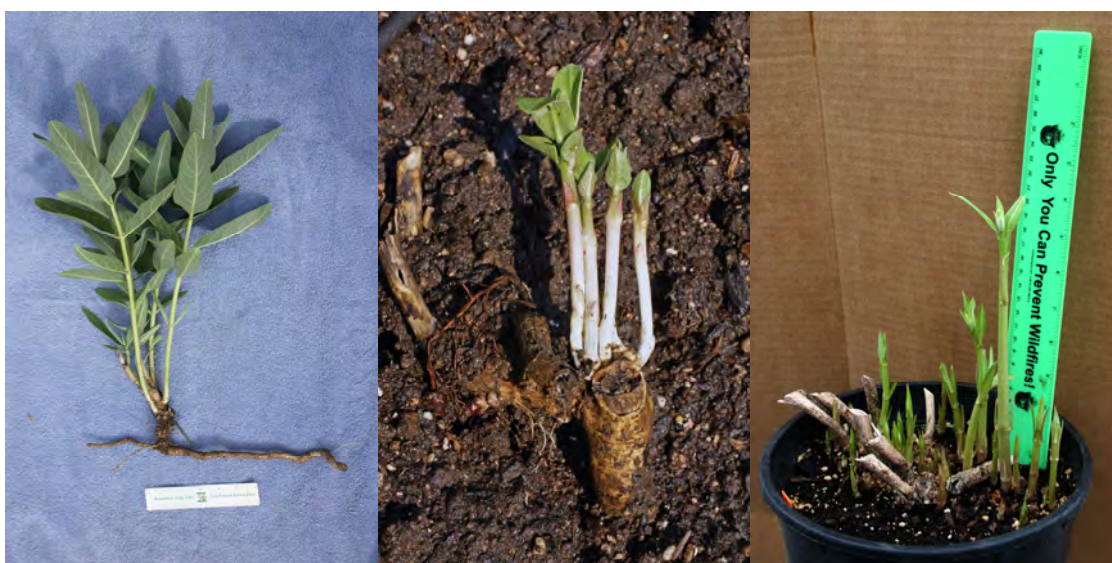


Fig. 4. Several species of native milkweeds can be propagated from rhizomes, such as showy milkweed (left). Rhizomes contain dormant buds that develop into shoots under moist and warm conditions (center), and rhizome sections can be used as propagules (right). Photos (left) and (center) by Thomas D. Landis, photo (right) by R. Kasten Dumroese.

Propagation Challenges of Different Milkweeds

Three species of milkweeds are found in southwestern Oregon (Borders, 2012). The seed and vegetative propagation methods discussed in the previous sections have worked well for narrowleaf and showy milkweeds, but heartleaf milkweed (*A. cordifolia*) has been more challenging (Table 1). Heartleaf milkweed is much less common than the others and in southern Oregon is restricted to rocky soils in the foothills and mountains. Seed germination of this species has been very low, less than 5% in our experience. This may be a function of poor seed quality caused by self-incompatibility of isolated clones, so we will be planting heartleaf milkweed from different local clones together in a seed production area to foster cross-pollination to, hopefully, improve seed quality.

Table 1. Propagation success for milkweed species of southern Oregon.

Common name	Scientific name	Seed propagation	Vegetative propagation
Narrowleaf milkweed	<i>Asclepias fascicularis</i>	Yes	Yes
Showy milkweed	<i>Asclepias speciosa</i>	Yes	Yes
Heartleaf milkweed	<i>Asclepias cordifolia</i>	A few	No

Our first-year trials with heartleaf milkweed found that this species grows poorly in standard peat-based growing media. Soon after germination, most seedlings succumbed to root rot and the same root disease problems occurred when rhizomes were planted in peat-based growing media. Based on a recommendation from a local grower, we transplanted young heartleaf milkweed plants into a commercial growing media composed of bark, perlite, and sand, which is pH adjusted with dolomitic limestone. Subsequent growth was much improved and one plant even bloomed.

Asclepias species grow in a wide range of environmental conditions with one species (*A. perennis*) growing in wetlands and another species (*A. solanoana*) restricted to serpentine soils (USDA NRCS, 2014). Therefore, growers should take local environmental conditions into consideration when deciding how to propagate specific milkweeds.

MANAGING MILKWEEDS IN YOUR GARDEN

Once established, milkweeds can spread aggressively if you do not manage them. Some things that have worked for us:

Grow in Raised Beds

Milkweeds spread rapidly by means of rhizomes so planting them in confined spaces, such as raised beds, is recommended. By the second year after establishment, the narrowleaf milkweeds in our raised beds had completely dominated the space and formed a thick canopy.

Prune to Extend Flowering Period

Like many ornamental plants, pruning flowers soon after they have withered will result in new flower buds. Because milkweed is such a good nectar plant, clipping old flowers will prolong the availability of nectar for monarchs and other pollinators. Narrowleaf milkweeds in a local park that had been mowed several times flowered well into September, more than 6 weeks longer than non-mowed plants.

Control Unwanted Seed Dispersal

Milkweeds produce seeds at a prolific rate and the fluffy seeds quickly blow all over, which can be a nuisance in a flower garden. Clipping off immature follicles will prevent seed formation and allow growers to better manage their pollinator gardens. If, however, you plan to save seeds from your plants, collect them early or apply a rubberband around the ripening follicles to prevent seed dispersal until harvest (Borders and Lee-Mäder, 2014).

Milkweed and nectar plants are the food elements of monarch waystations, which are specialized pollinator gardens that provide critical habitat for monarchs and other pollinators. Please see Landis (2014) and Landis et al. (2014) for more details on creating a monarch waystation.

CONCLUSION

Depending on the species, milkweeds can be readily grown from seeds or cuttings. Care should be taken to obtain source-identified, locally-adapted materials. Nurseries can provide a valuable public service by growing milkweed, establishing monarch waystations, and sharing new techniques and insights into propagation of more *Asclepias* species. The plight of monarch butterflies has been widely publicized and efforts to create monarch

habitat are very popular. Tom has been giving “milkweeds and monarchs” workshops in southern Oregon and the positive public response has been amazing. After a recent newspaper article that featured his monarch waystations, he received more than 150 requests for milkweed seeds. Milkweed gardens could also be used for seed production areas that would provide source-identified, locally adapted seeds for local communities. So, planting native milkweeds and creating monarch waystations is a “white hat” activity that can only reflect positively on your nursery and may create other marketing opportunities.

To those of us who care deeply about the environment, it is nice to have a project where we can truly make a difference. So many times, we end up thinking “but, what can one person do?” Growing milkweeds and establishing pollinator gardens is a simple, but effective way to do something positive for our world.

“I have to believe that we can have an impact if we get the gardeners in this country to help us out by planting milkweed and putting in native plants to stabilize native pollinator communities.” — Chip Taylor as quoted in Conniff (2013)

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QUESTIONS AND ANSWERS

Kerry Beane: You cautioned against the purchase of commercial seeds so where would you suggest we obtain high-quality milkweed seed?

Tom Landis: I suggest going to MonarchWatch.org. That website has a list of seed sources.

Douglas Justice: With those seed balls, are you using seed that have been stratified?

Tom Landis: We will make-up the seed balls this fall and put them in the ground and naturally stratify them.

Mike Evans: Could you comment on the four generations of butterflies one more time?

Tom Landis: The first generation comes off the western U.S. coast and flies into the California foothills. The second generation in May or June fly inland and north and that's when we begin to see them in Oregon. The third generation probably goes a little farther north and a little higher elevation, but we're not sure since the tagging research is still in progress. And, finally, the fourth generation shows up in the Rogue Valley at this time of year (October). This generation goes back to California, over-winters and then starts it up again the following year.

Mike Evans: A generation is about how long?

Tom Landis: The summer generations are about 6 weeks to 2 months while the winter generations are 6-7 months. They are the elite athletes of the Monarch world; they fly all that way, over-winter without eating and mate and start all over the following year.

Ray Maleike: Is there a list of other plants that the adults feed on besides milkweeds?

Tom Landis: Yes, there is and I can get that for you. Or, if you conduct a web search for “nectar plants” you’ll find long lists of plants. The butterfly bush is one of the best ones since it blooms for a long time and late into the year.