

How Cacti Got Their Spines

Story and photos by Peggy Rudberg



Opuntia phaeacantha (prickly pear) and *Cyllindropuntia imbricata* (tree cholla)

The mystery and wonder of how a simple dicot could transform itself through its own volition into a plant that not only survives but flourishes in blistering arid environments has inspired scientists to explore the lineage of the Cactaceae family. W. Hubert Earle, American horticulturalist and author of *Cacti of the Southwest*, is of the opinion that the Cactaceae family evolved from the Rosaceae family because both families have inferior ovaries and the flowers look similar. Lacking relevant fossil data for cacti, it is difficult to reconstruct its early evolutionary history. However, by analyzing genome sequences in saguaro and other extant cacti, geological and atmospheric events, and succulent plant lineages, some scientists have estimated cacti emerged 35 million years ago. But most of the major diversifications that make cacti unique happened rapidly and more recently, perhaps 10 to 5 million years ago.

In the late 1600s *Pereskia* was collected in the West Indies and called *kaktos*, the Greek word for a spiny plant. *Pereskia* has leaves and a non-succulent stem but it also has areoles, the source of spines and hairs and a distinguishing characteristic of cacti. When Linnaeus published *Systema Naturae* of binomial nomenclature in 1753 he included only *Cactus* as a genus. In 1789 a French botanist named Jessieu suggested grouping cacti and *Pereskia* into one family under the Latin name "Cactaceae." Today all cacti and *Pereskia* are genera in the Cactaceae family.

Perhaps spurred by expanding arid environments cacti stems evolved into water storage units and leaves became condensed lateral shoots, or spines, arising from areoles. Photosynthesis, usually



Ask a Master Gardener

Master Gardeners and interns will be at the Santa Fe Botanical Garden during four of the Garden's upcoming [Community Days](#), where New Mexico residents and students get in **free** with appropriate identification. Look for our volunteers between 11 a.m. and 2 p.m. on the following dates:

- Monday, June 20 ► [National Pollinator Week](#)
- Monday, July 4 ► Independence Day
- Saturday, Aug. 20 ► [World Honey Bee Day](#)
- Sunday, Sept. 18 ► [Museum Hill](#) Community Day

Note: These dates are subject to change. For current information, check out santafebotanicalgarden.org.

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Our Mission

Santa Fe Extension Master Gardeners is a nonprofit volunteer organization whose mission is to learn, teach and promote locally sustainable gardening through reliable, current research-based practices.

sfemg.org

SFEMG is one of more than a dozen county-based Master Gardener programs run under the auspices of New Mexico State University's College of Agricultural, Consumer and Environmental Sciences. aces.nmsu.edu

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A Message from SFEMG Board President Wendy Wilson

Spring's hope is eternal. A play on words, but, oh-so-true. Daffodils are pushing out of the cold soil, lilac buds are fattening up, plant orders have been placed and the smell of thawing earth all trigger hope of summer to come. I spent the first day of spring planting bare-root roses. It's hard to believe that in a few short weeks there will be fragrant, colorful flowers climbing up my garden fence.

The SFEMG Project EXPO was an amazing chance for Master Gardeners and interns to come together, chat and learn about our projects. Unsurprisingly, many of the workdays at the Audubon Center, El Zaguán, the Cornell Rose Garden and the Demo Gardens at the County Fairgrounds are almost fully staffed.

Working at these gardens gives our interns and members a chance to learn about the historic sites and the cultivation of the plants the leaders have selected for beauty, pollinator availability and their attractiveness as host plants for the larvae of many butterflies and moths. When you have larvae, you have birds. When you have nectar and pollen plants, you have hummingbirds, bees and other pollinating insects. As always, the public is welcome and encouraged to visit these lovely gardens to chat with our knowledgeable members, investigate the labeled plants and observe which plants thrive in Santa Fe County.

It won't be long now before area gardeners can visit with us in person at various sites where the public is encouraged to "Ask A Master Gardener." Look for our information table at the April 23 Community Garden Planning Day described on page 5. We love answering your gardening questions and, especially, meeting our neighbors. AAMG sites will be staffed Saturdays at the Railyard Farmers' Market starting on Memorial Day weekend, Tuesday afternoons at the Market Del Sur starting in early July, Saturday mornings at Reunity Farm Market through the summer, Friday afternoons at the Eldorado Farmers' Market, four Community Days at the Santa Fe Botanical Garden and at each SFEMG Let's Grow community event through the summer.

Pat Hollingsworth, our project coordinator, is finalizing the 2022 Let's Grow calendar. These activities are open to the public and provide learning experiences for both new and experienced gardeners. All Let's Grow classes will be posted to our website as soon as they are finalized.

Sadly, two of our master gardening friends, Bev Adkins and Charlie Hauber, passed away recently. We'll miss their gardening wisdom, joy, humor and good company. Our thoughts are with their families.

I wish you a joyous, busy, growing spring.

Wendy

performed by leaves, was taken over by stems. To reduce water loss cacti use a resource-poor photosynthesis method called crassulacean acid metabolism. The plant's stomata open at night to collect CO₂ and store it as malic acid. At daylight the cacti convert the acid back to CO₂ to be combined with water using light energy to create sugars needed for cellular activity. Some larger cacti have taproots but most cacti survive with extensive shallow lateral roots that quickly absorb any available water for storage into flexible sponge-like cells in the stem. Flutes and ribs in the waxy epidermis allow stems to expand and contract as needed. The spines protect cacti from predators while offering some shade and slowing down evaporation by limiting surrounding air flow. Some spines collect condensed nighttime moisture and funnel it to the plant.



Echinocereus triglochidiatus ('White Sands' claret cup) in front, *Opuntia basilaris* (beavertail prickly pear) at left

Cacti protect themselves from temperature extremes by shrinking their surface area and producing anthocyanin, a red to violet pigment which may act as a sunscreen to prevent chlorophyll damage. Thus the color change in times of stress.

Cactus flowers, their crowning achievement, are made up of undifferentiated tepals (combined petals and sepals), hundreds of stamens and a multi-lobed stigma. They bloom briefly and are mainly pollinated by solitary bees and hummingbirds. Prickly pear, especially *Opuntia phaeacantha* and *Opuntia polyacantha*, and tree cholla, *Cylindropuntia imbricata*, are two of the most common cacti in our area with yellowish and magenta flowers respectively. For red flowers we have multiple species of *Echinocereus*, such as claret cup hedgehogs.

Master Gardeners maintain a public demonstration cactus garden located at the Santa Fe County Fairgrounds on Rodeo Road. To see cacti in full bloom is to understand how we become cactophiles. Bloom times depend on sunlight and temperature, and the changing climate has advanced the life cycle of many plants, with earlier flowering. Look for them soon.

References:

[Handbook of Texas, Cacti](#)

[New World Encyclopedia, Cactus](#)

[Botanical Art of the Sonoran Desert Past & Present](#)

[Plant of the Week: Cactus Evolution, University of Arkansas Division of Agriculture](#)



Let's Grow is a free public education series for home gardeners and the garden-curious who want to learn about soil, compost, native plants, creating habitat for pollinators and more! Join us on the following dates, ask questions and maybe even get your hands dirty! Look for more Let's Grow sessions on our website (sfemg.org) and in future issues of the SFEMG Newsletter.

Clinic: How to Correctly Prune Roses

Instruction: 9-9:30 a.m. / Practice: 9:30 a.m.-noon Saturday, April 9
Harvey Cornell Rose Park, 1315 Galisteo Parkway

Bring hand-held pruners, gloves and drinking water. Wear long-sleeved clothing. Hats and sunscreen recommended. No registration required.

Community Garden Planning Day

1-4 p.m. Saturday, April 23
Santa Fe County Fairgrounds, 3229 Rodeo Road

Volunteers representing various [SFEMG projects](#) will staff information tables at the Santa Fe County Extension Office. You can pose questions to Master Gardeners and learn more about the Santa Fe Native Plant Project, the Seed Library and the SFEMG's new Yard Habitat Certification Pilot Program. It's a great time to check out the SFEMG's on-site cactus, herb and veggie demonstration gardens as well as the compost demonstration area. No registration required. *All SFEMG project leaders are invited to participate. Master Gardeners and interns are encouraged to check out SignUpGenius for opportunities to act as greeters and site information guides.*

Analyzing Your Soil and How to Improve It (limited to 10 participants)

10 a.m.-noon Saturday, April 30
Randall Davey Audubon Center & Sanctuary, 1800 Upper Canyon Road

Learn how to improve the soil in your yard! Master Gardener Sandy Powell will discuss how to easily analyze your soil with simple household items. You will get a feel for identifying the structure and texture of the soil you find in various locations in your yard without spending a penny. Sandy also will offer guidance on how, where, when and why you should send soil samples to be tested for chemical and biological data. Handouts provided. Contact Colleen Madrid at cmadrid74@gmail.com to register.

ONLINE PLANT SALE

Get ready to shop! The SFEMG's 2022 online plant sale — the organization's primary fundraiser — gets underway later this month. Gardeners wanting to imagine what to grow this season will have a chance to preview offerings before the sale goes live. A list including the botanical and common names of the plants to be sold will be posted on the [SFEMG website](#) the first week of April.

In addition, you can learn more about these plants by joining us from 1-4 p.m. on Saturday, April 23, for a free Community Garden Planning Day at the Santa Fe County Fairgrounds. Master Gardeners and interns will be on hand to answer questions about plants that are best suited to New Mexico's challenging conditions and to help you plan your own successful garden.

Native plants will dominate the sale inventory, which also will include perennials, annuals, vegetables, herbs, cacti, shrubs, trees, vines and grasses sold in 2-inch and gallon pots. The plants are being provided by Santa Ana Native Plant and Tree Nursery and Reunity Resources.

The sale goes live at 6 p.m. Saturday, April 23, and ends at 5 p.m. Wednesday, May 11. Scheduled curbside pickup will take place Saturday, May 14, at the Fairgrounds.

Proceeds from this sale support more than a dozen [SFEMG community-based gardening projects](#) throughout Santa Fe County, including four demonstration gardens at the County Extension Office.

The organizers of this year's sale are Pat Oliver-Wright, Sandy Lemke, Holly Henry, Bonnie Martin, Wendy Wilson, Pam Wolfe and honorary Master Gardener Russ Funk, who created the online sales platform initially put into service in 2021.





Fameflower (*Phemeranthus calycinus*, synonym *Talinum calycinum*) By Amy Eads with photos by Pam Wolfe

The origin of the plant is the central southern United States (Illinois to Nebraska, Colorado, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, Texas and Arkansas). The name comes from the Greek *ephemeros*, living for one day, and *anthos*, flower. The fameflowers are a group of approximately 25 plants of the purslane family (16 in North America) that grow in dry, rocky regions. For most of the past two centuries, the fameflowers of North America have been assigned to the Old World genus *Talinum*, first used by Frederick Pursh in his 1814 book *The Plants of North America*. That same year, C.S. Rafinesque, an eccentric polymath who studied botany, biology, linguistics, anthropology and other fields, proposed the genus *Phemeranthus*, from the Greek *ephemeros*, ephemeral, transient, and *anthos*, flower, to describe the New World fameflowers. In the 1990s, careful analytical examination of morphological traits and DNA analysis convinced modern botanists that Rafinesque was correct and transferred all New World species to the genus *Phemeranthus*. The plant can be found in nurseries under the older name (synonym) or the more recent name.



Landscape use: A tough native perennial that grows well in rock gardens and containers. It prefers full sun and dry conditions. It is a favorite flower of bees and butterflies.

Planting and care: Fameflowers are easy to grow in a sunny, well drained and dry sandy soil. Their foliage is diminutive in size. Space plants 8-12 inches apart and avoid overfeeding and overwatering.

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Propagation: Easily propagated by seeds or cuttings. Cuttings can be taken from woody stems after leaves and tops removed. Seedlings appear after about one week and should be transplanted within five weeks. It self-seeds freely once established but rarely becomes a problem because it is small and seemingly fragile.

Plant type: hardy to semi-hardy perennial succulent

Bloom time: Early summer through fall the flowers open around noon and last until midafternoon. Each slender stem bears a cup-shaped, wine or magenta-colored 5-petaled flower approximately 1 inch in diameter. The center of each flower is congested with a cluster of as many as 25 yellow stamens.

Size: 10-12 inches tall x 6-12 inches wide but varies depending on conditions

Sun: full sun

Soil: average well-drained soil, but also poor quality sandy and rocky soils

Water: prefers dry conditions and has low water requirements

USDA zones: 5-9

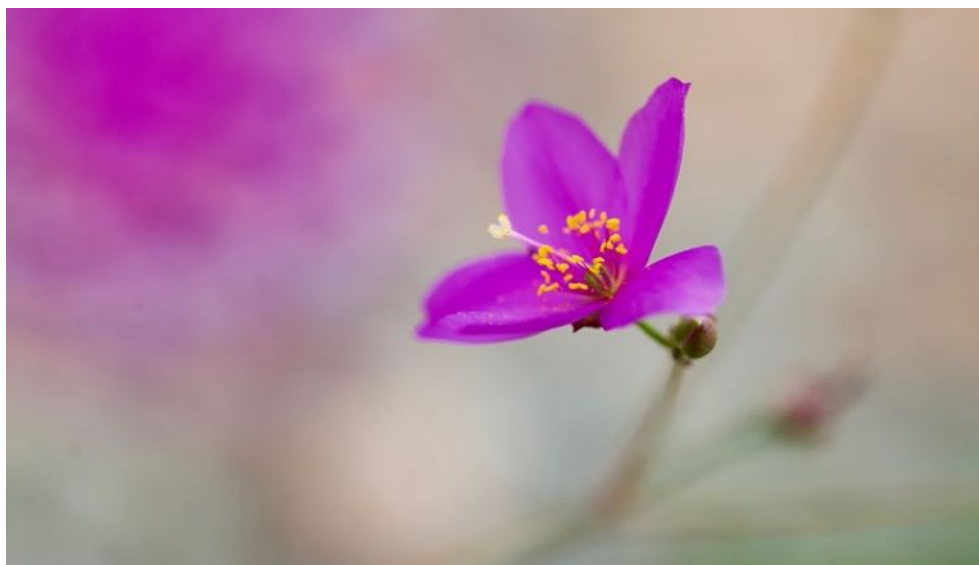
References:

Robert H. Mohlenbrock *Flowering Plants: Pokeweeds, Four-o'clocks, Carpetweeds, Cacti, Purslanes, Goosefoots, Pigweeds, and Pinks* SIU Press, 18 July 2001.

Robert W. Kiger in *Flora of North America* (vol. 4).

[Embassy Landscaping Group](#)

University of Arkansas System Division of Agriculture, Cooperative Extension Service



Calendar

Note: Santa Fe Community College requires proof of vaccination for all in-person classes. For more information visit <https://sfcc.edu/covid>. For a list of current SFCC noncredit Continuing Education "Home and Garden" courses, see pages 12-13 in the spring schedule. \$ means there is a fee. The acronym "phc" means Master Gardeners can earn 1 credit hour of Continuing Education for each hour attended.

Mondays April 4-11

[Introduction to Bulbs](#) (New York Botanical Garden)

1 CE phc / \$

April 13

[Caring for your forest lands to reduce fire risk and increase water yield](#)

(New Mexico Acequia Association)

1 CE phc

April 13

[Café Botanique: The Rainbow Below - The Art and Sciences of Soil](#) (Denver Botanic Gardens)

1 CE phc / \$

Thursdays April 14 through May 5

[Container Gardening](#) (New York Botanical Garden)

1 CE phc / \$

April 7

[Climate Change and Biodiversity: A Critical Nexus for Conservation](#) (Xerces Society)

1 CE

April 21

[Wildflower Identification](#) (Santa Fe Community College)

2 CE / \$

April 23

[Greenhouse Design and Operation](#) (Santa Fe Community College)

3 CE / \$

April 27

[Shane Smith on ruthless gardening and growing in a challenging climate](#)

American Horticultural Society's Conversations with Great American Gardeners

1.5 CE / \$

"I sincerely believe that for the child, and for the parent seeking to guide him, it is not half so important to know as to feel. If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil."

— American marine biologist, author and conservationist Rachel Carson (1907-1964) from her 1965 book, *The Sense of Wonder*

New & Noteworthy

Have you recently read a gardening-related article or book, visited a horticultural website or blog, listened to a podcast, or seen a nature show or documentary you think other gardeners would enjoy or find useful? Send a link to the newsletter (news.sfemg@gmail.com) and we'll try to include the information in the next issue. **Note that some of these sources may have paywalls.**

[“Spring inside, with microgreens”](#) by Laurie McGrath, shared with permission of *HOME/Santa Fe New Mexican* (March 2022)

[“Save the Forests — Especially the Five Biggest Ones”](#) by John W. Reid and Thomas E. Lovejoy, *The Atlantic* (March 22, 2022)

[“‘Crime against nature’: the rise and fall of the world’s most notorious succulent thief”](#) by Lois Beckett, *The Guardian* (March 20, 2022)

[“Bark beetle infestations could cause huge piñon die-off”](#) by Scott Wyland, *Santa Fe New Mexican* (March 19, 2022)

[“Purslane Plant Care”](#) by Daniel Thompson, *Hunker* (March 19, 2022)

[“Survey: People Turned to Gardening for Stress Relief, Food Access During Pandemic”](#) by Emily C. Dooley, University of California, Davis press release (March 17, 2022)

[“It Turns Out the World’s Largest Potato Is Actually a Gourd, Guinness World Records Says”](#) by Jennifer Calfas, *The Wall Street Journal* (March 16, 2022)

[“Why Gardening Offers a ‘Psychological Lifeline’ in Times of Crisis”](#) by Margaret Roach, *The New York Times* (March 16, 2022)

[“How I learned to love weeds — and why you should, too”](#) by Alys Fowler, *The Guardian* (March 16, 2022)

[“Killing cockroaches with pesticides is only making the species stronger”](#) by Troy Farah, *National Geographic* (March 16, 2022)

[“Tree Planting Is Booming. Here’s How That Could Help, or Harm, the Planet.”](#) by Catrin Einhorn, *The New York Times* (March 14, 2022)

[“Ancient prairies, home to endangered bees and rare plants, may soon be razed by airport”](#) by Susan Cosier, *National Geographic* (March 14, 2022)

[“ Amazon Rain Forest Nears Dangerous ‘Tipping Point’ ”](#) by Chelsea Harvey, E&E News, *Scientific American* (March 8, 2022)

[“Start small: why growing from seeds is the best way to garden”](#) by Allan Jenkins, *The Guardian* (March 5, 2022)

The Garden Journal Radio Show



Every Saturday
10 to 10:30 a.m. on KSFR 101.1 FM

April 2: Slow Food Santa Fe Edition

Hosts Lissa Johnson and Nina Rosenberg talk with with Denisa Livingston (Diné), community health advocate and food and health justice organizer.

April 9: SFEMG Edition

Co-hosts Christine Salem and Santa Fe County Extension Agent Tom Dominguez explore more gardening topics with NMSU Extension experts.

April 16: Soil Stories Edition

Host Carrie Core presents Ancestral Lands Acoma Program Manager Aaron Lowden, a traditional farmer, land-based skills instructor, seed caretaker and restorer of the community's traditional food systems.

April 23: SFEMG Edition

Co-hosts Christine Salem and Alexa Bradford chat with Reunity Resources Program Director Juliana Ciano.

April 30: Home Grown New Mexico Edition

Jannine Cabossel, "The Tomato Lady," shares tips and techniques for backyard vegetable gardening. See more at [Giant Veggie Gardener](#).



We are here to help!

If you have a gardening question, Santa Fe Extension Master Gardeners are available to help.

Just go to sfemg.org and pose your question. We'll do some research and get back to you.