Letter from the Desk of David Challinor
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The study of various plants is becoming a more and more important part of biology and some plants are being used for new and unusual purposes. This letter is about a particularly widespread and valuable plant which has had many uses while at the same time has spread out of control in some places. To use plants and yet to control their spread is a balancing act that is not always easy or successful.

The Cactaceae (cactus family) evolved in our hemisphere as a large, fascinating and economically important family of plants. Cacti are well-adapted to arid, desert-like conditions where their dry, waxy stems protect the plant from water loss and their spines prevent large herbivores from eating them. Nonetheless, since ancient times, some species have provided an emergency source of water for travelers able to penetrate the outer coat of a barrel cactus and thus squeeze water from the wet pulp inside. A particularly widespread and valuable cactus of the genus Opuntia, better known as prickly pear, encompasses about 180 species. It was initially perceived by European explorers as a valuable economic plant, and in the XVII and XVIII centuries it was rapidly introduced throughout the dry temperate regions of the Old World.

Prickly pear is easily recognized by its flattened circular stems, thorns and pear-shaped fruit whose color ranges from yellow to orange to dark red. Opuntia is exceptional among the Cactaceae in that it is endemic to virtually all of our 50 states except Vermont, New Hampshire, Maine, Alaska and Hawaii, although it has been introduced and will readily grow in the latter state. The northern limit of its range is Canada's Peace River Valley (Lat.56 degrees N, or about that of Ketchikan, Alaska), where it is small and inconspicuous, but near the equator in the Galapagos it develops a cylindrical trunk 6 to 10 feet tall crowned with the familiar pad-like stems of the procumbent (trailing on the ground) forms. Its southern range stretches to Tierra del Fuego.

With a distribution covering almost the entire western hemisphere, it is not surprising that opuntia was so readily adaptable to many places in South Africa, India and Australia/New Zealand. From the late XVI century onward, European colonists introduced opuntia as a crop plant to the Old World for its edible fruit, or as drought-resistant forage for livestock, for some species of prickly pear have needles that either could be readily burned off or were small enough not to deter a hungry goat or cow. Another early incentive to spur its introduction to the eastern hemisphere was as a source of red dye. Some species of opuntia are the host for a large mealybug (Dactylopius coccus) which, when crushed, exude a bright red fluid. Before the development of synthetic dyes, this exudate was used to color the robes of Aztec emperors and later was the source of the British Army's "Red Coats."

In 1781 Captain Arthur Phillips took mealybug-infested cactus pads on his voyage from Rio de Janeiro to Australia. Although the cactus pads survived the trip, the mealybugs did not and had to be reintroduced years later when the plants were well established in New South Wales. Further introductions to Australia after 1839, especially that of the common Opuntia stricta in 1860, soon triggered major problems. By 1870 the introduced cactus had spread out of control and needed to be curbed, but with no agreement on how to do so. When chopped or even crushed, small particles left in contact with the soil merely developed roots and sprouted. It was similar to the tale of the "Sorcerer's Apprentice." Plants were burned and 3,000 tons of arsenic peroxide were spread on the invading plants, all to no avail. By 1925 about 100,000 sq. miles were covered by prickly pear and thus were useless for pasture. The government posted a reward of $20,000 in 1907 for anyone who could come up with an effective control measure. More than 600 proposals were submitted, but none were deemed successful. When opuntia was spreading in Australia at its most rapid rate, it was estimated to be gaining 100 ha/hour (250 ac)! At one point the farmers and ranchers were so desperate that they killed some 335,000 birds, mostly emus, in the mistaken belief that they spread this plant from the seed which passed through their gut after eating the fruit.

All these measures failed, so Australian scientists in the early 1920's looked for natural predators of opuntia. They tested about 150 insect species known to feed on prickly pear and the most promising was the larvae of the South American moth (Cactoblastis cactorum), whose name literally translated means "cactus shriveler." This moth lays its eggs in a chain-like sequence on opuntia pads, thereby allowing for their easy collection for artificial propagation. When the larvae emerge they chew their way into the pad, exposing the moist internal tissue to invasion by bacteria and fungi, which soon kill the plant. Within a scant 5 or 6 years from the introduction of this moth to Australia in 1925, the spread of opuntia was sufficiently curbed so that it was no longer a serious problem. This moth, however, was not effective in curbing the spread of opuntia in South Africa, where it was also a serious invader. Instead, a species of mealybug imported from South America was eventually able to control the plant there.

The controlled release of specific insect predators on a prolific invading plant has seldom had a more successful outcome than was achieved in the two countries above. It is worth noting that prickly pear has not disappeared from the landscape; if it had the predator would also be gone. It was the balance between the two that was sought and successfully achieved.

Prickly pear is still cultivated in plantations for the production of red dye, which is used in preparing stained tissue samples for microscope slides and for coloring certain specialty textiles. Only the female insect produces the exudate from which the dye is made. She is relatively large (1-2 mm in diameter) and moves very little, making her easy to harvest. The male is small -- merely half her size, bright red, short-lived, and only ½ % of the population. The Spanish learned the source of the dye from the local Indians and soon established plantations of opuntia, which they tried to keep secret from their European commercial competitors. However, when the Dutch instrument maker and scientist Leeuweenhoek developed his microscope, he studied the dye material closely and concluded that it must have come from a cochineal insect. It did not take

long for the secret source to be discovered, and soon opuntia plantations were established around the Mediterranean and on the Canary Islands to supply the strong demand in Europe and the Near East for the red dye.

For a relatively brief period the spines of opuntia were also an unusual and valuable byproduct. They were a crucial component in the recording industry. Those of my vintage will remember the wind-up gramophone, whose steel needle at the end of the arm converted into sound (music) the bumps in the grooves of the record. Actually, a steel needle was too hard for the record substrate; when a record was played too often its grooves became so worn that it caused an audible hissing that interfered with the clarity of the music coming from the speaker. Various substitutes were tried to replace steel needles, including bamboo slivers. The most successful substitute, however, turned out to be prickly pear spines which were shaped and chemically hardened. The discoverer of this substitute was a South African who formed the BCN Gramophone Needle Co. in the 1920's. The spines had just the right degree of hardness to pick up the sound clearly, yet were not so hard as to distort the bumps in the record grooves. Indeed, after a few playings, a cactus needle would actually mold itself to the record's groove, thereby producing a hissless reception and minimum wear on the record. What had seemed to have been an inexhaustible needle source in South Africa came to an abrupt end when the government, following the experience of Australia, also imported a predatory insect from Argentina, which in a short time controlled the 750,000 ha (just less than 3,000 sq. mi.) overcome with prickly pear. Although the ranchers and farmers of the Cape region were delighted with the results of the government's efforts, the BNC company had to find a new supply and turned to Arthur Hill, the Director of Kew Gardens in London, for advice. He told them that the nearest uncontaminated opuntia was growing on St. Helena Island, where it had also been introduced. This island, best known for Napoleon's exile there, was the principal source of quality gramophone needles until they became obsolete. "Sic transit gloria cacti!"

Opuntia still furnishes many byproducts to humans, particularly in Latin America, where its fruit is collected and often made into jams and jellies. In addition to being cultivated for its fruit, its flat stems have long been fed to livestock. In America and Europe, cacti in general are popular house plants because of their colorful and disproportionately large blossoms, as well as their generally low maintenance. A small cactus has sat on the shelf over our kitchen sink for more than a decade. It has not blossomed for years, but it seems to thrive despite hardly ever being watered. Such characteristics make small cacti suitable gifts, especially to those without green thumbs. The recipient should be cautioned not to get "hooked" on this family of plants, for I am sure the reader, like me, has friends who have been so taken with this plant that they have potted cacti in almost every available window sill. Those who have been to southern Arizona in the early spring when the cacti are in blossom never forget the impressive floral display. Sadly, the uncontrollable, illegal collecting of rare cacti is expanding, thereby depriving us all of some spectacular flowering plants. Stick with the small common ones for your own collections for they too can give great pleasure.

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