The beach strawberry, an important natural resource

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A narrow strip of the western coastline has furnished California with a rare, unique source of wild plant germplasm that has helped the strawberry industry to flourish.

Ironically, the agricultural wealth this beach strawberry species has helped to generate is contemporaneous with forces driving the plant itself toward extinction in many areas. Subdivisions, commercial development, and people have intruded into the niche the berry had carved for its balanced existence beside the salty Pacific Ocean.

The beach strawberry of California (*Fragaria chiloensis* [L.] Duch.) may very well be the most useful of all the remaining (octoploid) strawberry germplasm in the world. The species ranges northward intermittently as far as the Oregon border, from Oso Flaco Lake near Santa Maria in Santa Barbara County. In the fragile, very vulnerable "oasis-like" environment at its southerly limit, it is surrounded by shifting sand dunes, and a few scattered colonies only tenuously survive. Fortunately, at its northern boundaries the plant is much more abundant. Overall, the narrow coastal corridor occupied by the species extends inland only a few miles at most, being confined to the heavier fog belt.

Much of the area once occupied by *F. chiloensis* has been built over or converted to uses incompatible with the survival of the *Fragaria* species. Recently, for example, in the expansion of the city of Pacifica, most of the important colonies we have studied there for many years were destroyed completely. Our modest collection at Davis of some of the most valuable stock is all that remains.

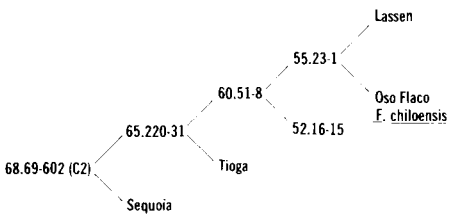
Other colonies we have studied at various coastal locations for many years include those of particular clones which we can readily identify at Point St. George, Bodega Bay, Point Reyes, Pigeon Point, Point Sur, and Oso Flaco Lake. They survive very well at a given site if the natural habitat is not completely destroyed or paved over as is the case too frequently. Photographs taken at 10 year intervals of the very eroded Point St. George colony site show that although erosion has progressed, clones of particular interest still thrive.

Desirable traits

Among the many desirable traits of great commercial value to be found in selected California beach strawberries are: tolerance to drought; high tolerance to salinity; low requirement for fertilizer; low chilling requirement; and resistance to the two most important root diseases of strawberries, Red Stele (Phytophthora root rot) and Verticillium wilt. In a recent screening of 59 representative clones of California *F. chiloensis* for Verticillium wilt resistance, most proved highly resistant, about 16 percent were partially resistant,and only 15 percent were highly susceptible.

Where the clones come from makes a great deal of difference for most traits. Some plants grow in pure beach sand within a few feet of the sea but seedlings germinate and normally develop what closely resembles a tap system, with one to several roots penetrating relatively deeply. These plants have thick, leathery leaves with a glossy, heavily cutinized surface, typical of certain moisture-conserving species. They are very prostrate and normally few other species compete with them.

At the opposite extreme, some of the beach strawberries grow some distance from the sea among the grasses, herbs, and chaparral in heavier soil containing considerably more organic matter and surface litter. Their roots are numerous, fibrous, and relatively shallow; frequently their leaves are thinner and less glossy and the plants are more erect.



Pedigree chart of a potential cultivar derived from *Fragaria chiloensis* by backcrossing.

Development of cultivars

F. chiloensis is fully compatible with cultivated strawberries; both are octoploid with eight times the minimum functional number in the genus (2 n = 8 × 7 = 56 chromosomes); consequently the hybrids are fully fertile. In breeding, the large fruit size and other commercially important characters of cultivated strawberries are easily recovered, along with the new traits provided by the wild strawberry, after as few as three generations of backcrossing to appropriate cultivars.

Undesirable linkages have been few and heritabilities for Verticillium wilt resistance and even the most complex traits, including yield, have been relatively high with *F. chiloensis.*

All the existing California strawberry cultivars have California *Fragaria chiloensis* ancestory and this has contributed much to the high adaptation of these varieties that has resulted in the highest strawberry yields in the world; a state average of about 20 tons per acre. As breeding efforts focus more finely on specific traits, the species will be used even more extensively. For example, it should be possible to breed varieties with extremely high tolerance to salinity, a very serious problem in drought-stricken California right now.

Unfortunately, the California *F. chiloensis* with the greatest breeding potentiality are those colonies native to the most vulnerable southern habitats, and appropriate steps should be taken to preserve them.

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