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The Fertilization of Opuntia

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carbonic anhydride gas, causes unequal growth along their mutual limits and their outlines become broken and assume irregular shapes; segments growing faster than others produce the diversified serrations, elongations, partings and fimbriations which characterize the leaves of different plants, all this however taking place in subordination to the ancestral peculiarities of the plant by which a general ground form or architectural type is preserved. Looking at the leaves of *R. toxicodendron*, we find them arranged in pedunculated, terminal sets of three, one distal and two lateral leaflets. The distal or central leaflet normally, and putting aside the divergent shapes found in this plant, is rhombic-ovate, equilateral, and symmetrically toothed on each side, the two side and proximal leaflets are subrhombic-ovate, inequilateral, and toothed conspicuously on only one side of the free margin. In other words, along the edges of the two lateral leaves where they come in conflict, especially with the edges of the terminal leaf, a restriction of growth takes place, and the usual lobation seen in the end leaf, and which may be considered typical, is suppressed, and on the margin, which is relieved from any competition, this lobation appears. Does not this contradict Mr. Allen's assumption? That there is a struggle for nourishment and that the terminal leaf, in the direct line of the sap's flow, is favorably placed, is seen by the slight growth of the halves of the side-leaflets facing the former, and the natural character of the halves away from it. But the tendency is to obliterate serration at the parts mentioned, and might, we should suppose, under persistent repetition, form an entire edge. A very similar condition of things, with some interesting details, is seen in the leaf-clusters of *Negundo aceroides*.\* An interesting change of form in the leaves of the poison ivy takes place when they have been stung by a species of gall-insect (?) at the apex of a leaf. In the terminal leaf it produces an 'arrest of growth, a deep cleft, and lateral enlargement, which destroys the notched outline, enveloping the lobes in a rounded full blade.

Of course it is not difficult to explain the abortive character of the one side of the leaflets mentioned above. It is due to the predominant shade caused by the expanded sides of the terminal leaflet, which owes its vigour to its favorable position. The conditions presented here are apparently what Mr. Allen would wish, two neighboring leaves contending for the molecules of carbonic anhydride and evidently unequally matched, as appears from the result; but the result does not seem desirable for his theory, as the characteristic toothing is suppressed, not exaggerated in the weaker, and this notching, which he seems to regard as due to impeded growth, is best shown in the stronger competitor.

L. P. GRATACAP.

**The Fertilization of Opuntia.**—For the purpose of adding brilliancy of color to the window-garden in front of my house, I planted in two separate boxes a large number of plants of *Opuntia vulgaris*, which I obtained from near Hartsdale, Westchester County, N. Y.,

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\* Mr. A. Hollick gave me the name of this tree, which I had previously observed in connection with this subject.

on the 15th of June last. All the plants when taken up were well set with large flower-buds, which opened a week later and lasted until the middle of July. During that time I watched about one hundred and thirty flowers out of a total of two hundred and ten during their period of flowering, and noticed with much interest the great sensitiveness of the stamens, which are very numerous in this prickly-pear.

The window-boxes have an eastern exposure, and consequently the sun passes out of view about one o'clock in the afternoon. The flowers opened about seven in the morning and closed shortly after two, or about an hour after the sun passed away, although they would have remained open two hours longer under its direct influence. During sunshine each flower would open for two consecutive days, but in cloudy weather for only one day. On the first day of the opening of a flower the pointed stigmas were hardly separated sufficiently to admit of the passage of a small-sized straw. But on the following day, under the influence of the sun's rays, the stigmas expanded to their fullest capacity.

Less pollen was observable on the anthers during the first than on the second day of flowering. Or, in other words, the longer a flower remained open the greater the number of pollen grains that were discharged from the anthers. And yet fructification seems to have been effected in nearly every case in which a flower opened for either one, or two, days in succession. I now count about one hundred and ninety promising fruits.

The beautiful lemon-colored flowers of this *Opuntia* attracted many honey-bees, and their movements I carefully watched with a pocket-lens in hand on every fair or sunny day. A bee would alight on the mass of anthers, then push its forelegs down among the filaments, which were sufficiently compressed to admit of the body of the insect passing more readily down to the nectaries of the flower.

As soon as the filaments were released from the grasp of the insect, the stamens were suddenly thrown against the pistil, from which they slowly receded to their former position. I should judge that sometimes more than a dozen stamens were thus rudely seized by a honey-bee in its endeavor to reach the nectaries, the insect frequently making the circuit of the whole arrangement of stamens, and always coming up again to the surface of the anthers before taking a second plunge to the base of the corolla. Although the feet (legs) of the insect were covered with masses of pollen after visiting a flower, yet at no time do I remember seeing one crawl *over the stigmas*, whereby fertilization might have been insured. It seems to me that the pollen grains are thrown between the stigmas after the sudden movement of the stamens following the retreat of an insect.

I have also noticed flies of several species visit these flowers on a similar errand, this apparently being followed by the same movements of the filaments. On the 12th of July, I was collecting in Pelhamville, Westchester County, and there also observed a few late-flowering specimens of *Opuntia vulgaris*, on one of which I observed a large humble-bee going for his nectar; and how he did make the dust (pollen) fly!

From one of the joints of my plants there has exuded a straw-colored gum. The gum found on *Opuntia* is edible like that secreted by *Acacia vera* and *Prunus cerasus*.

New York, July 18th.

RICHARD E. KUNZÉ.

**Among the Palms and the Pines.**—On the 28th of May, 1883, my father, H. C. Orcutt, and myself left San Diego City, Cal., on what proved a short trip into Lower California.

The first day rewarded us with two beautiful *Abutilons* with orange-colored blossoms and velvety leaves (*A. Berlandieri*, Gray, var., and another) and a new species of *Cordylanthus* found at the head of Tia Juana Valley near the boundary.

A little beyond, among the hills, was *Lupinus gracilis* among the rocks in company with *Phacelia Parryi*, both struggling for existence in so "dry a year," while further along we found *Acanthomintha ilicifolia*, the beautiful *Chorizanthe procumbens*, *Breweria minima*, and others, thriving on the adobe hills (the whole surface of the latter cracked like the bottom of a dry mud-puddle), and, on similar ground, acres were covered with the red-flowered *Chorizanthe fimbriata*, forming a beautiful feature in the landscape as we entered Valle de los Palmas where we made our next camp among the mesquite, screw-bean and other trees—but no palms!

The next morning we proceeded through the valley till we noticed at our right, in a large cañon, two novel trees which proved to be palms, *Washingtonia filifera*, and on further exploration we found twenty still standing, but over fifty lying dead—cut down by the enterprising ex-governor that he might cover his house with their leaves!

Beneath the few remaining palms flowed a cool stream of water, enabling *Epipactis gigantea* and *Juncus xiphioides* to exist, while near by we found the last flower of *Lathyrus splendens*, *Lupinus albicaulis* as a small shrub, *Berhavia viscosa*, *Galium pubens*, Gray, and others. *Mentzelia micrantha*, Torr. & Gray, with *Physalis crassifolia* were growing on the side of the cañon, the *Mentzelia* covering my clothes with its very tenacious brittle leaves which it was impossible to wholly remove.

May 31st found us in the evening at rancho Guadalupe, 75 miles from San Diego by road, where we made our headquarters for a day, till our return. Here, in the evening, we found a new (?) *Phacelia* with white flowers and yellow centre which had strayed to the dry bed of the San Antonio Creek, where in the morning I also found an abundance of *Astragalus Sonora*, Gray, in fruit, and *Lupinus gracilis*.

Late in the morning of June 1st we left the camp and proceeded up the valley till we came to a cañon which led to Guadalupe Mountains, credited with an altitude of 4,000 feet. Here we found many interesting plants at different altitudes. Among them were *Trichostema Parishii*, Vasey, *Mimulus Palmeri* (?), *Helianthus gracilentus*, Gray, *Actinolepis Wallacei*, Gray, at a low altitude, *Calochortus Weedii*, *C. venustus* above it, and, higher still, *C. Palmeri*, an *Allium*, *Dendromecon rigidum*, and many species of *Gilia*, one (a new species) being particularly conspicuous for its delicate, variegated blossoms.