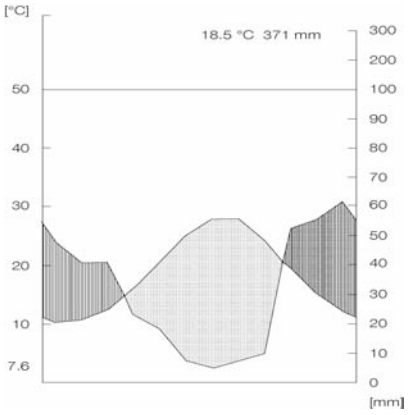
Oh that darn brother of mine! Sometimes William is absolutely useless. There he has gone off and done it again - traveling around and never getting his notes completely together. I swear his memory is failing him. What can I possibly do to clear up this mess he has created? Below and on pages 246 and 247 I have copied some of his field notes and some of the climate diagram data from places he has visited.

The details of these locations are somewhat unclear, but I know that he was doing a lot of traveling last summer, visiting relatives across North America and Europe. Eventually I will find the time to sort out this mess. Below are some of the notes from William's diary.

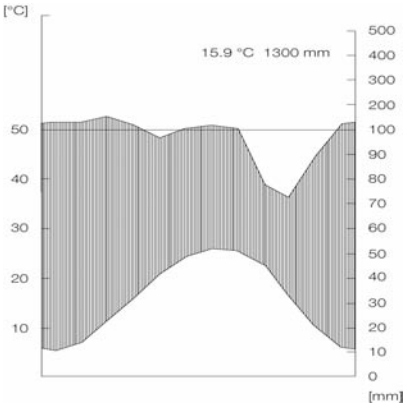
Field location	Vegetation information	Tidbits
A	Since the end of the last glacial, the dominant life forms here have been deciduous trees. Ocassionally, we do see grasslands in the region although the locals call them prairies.	They say that Gertrude Stein spent time here writing.
B	The dominant vegetation is clearly temperate deciduous forest. An interesting invasive vine is showing signs of covering many trees.	Surprisingly, Athens is not that far away
C	The dominant vegetation is clearly temperate deciduous forest, which is not at all what I expected given the name of this city.	Here folks think athletics dominates too much.
D	Since the end of the last glacial, the dominant life forms here have been deciduous trees. Ocassionally, we do see grasslands in the region although the locals call them prairies.	The cities of Palestine and Lebanon are not too far away
E	The vegetation here is dominated by shrubs and small trees.	Napoleon was exiled here, but he escaped.
F	The vegetation here is dominated by shrubs and small trees.	Veni, vidi, vici.
G	The vegetation here is dominated by shrubs and small trees.	Here folks think athletics dominates too much.

page 244 page 246

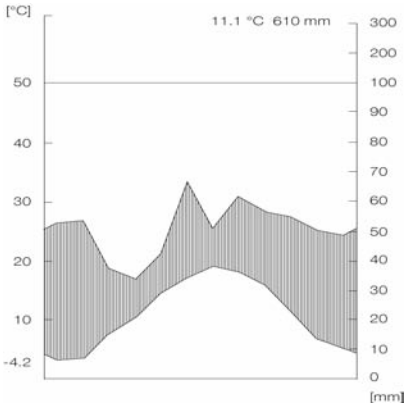
Athens A



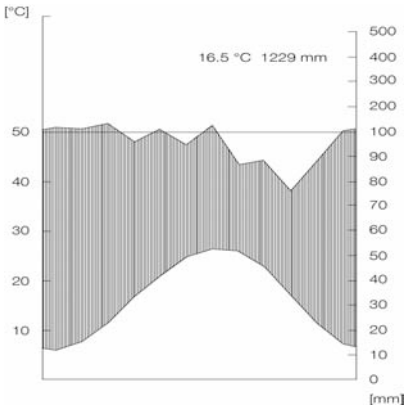
Rome A



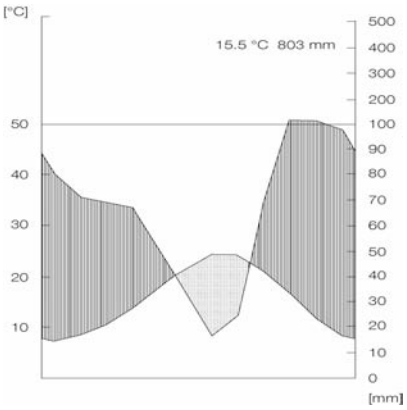
Paris A



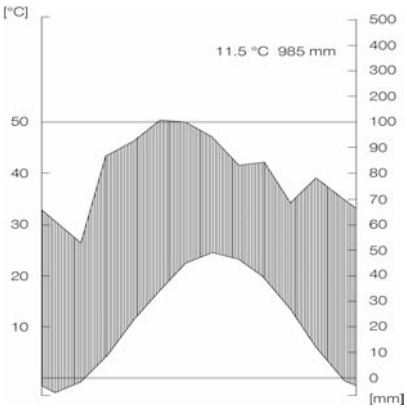
Athens B



Rome B



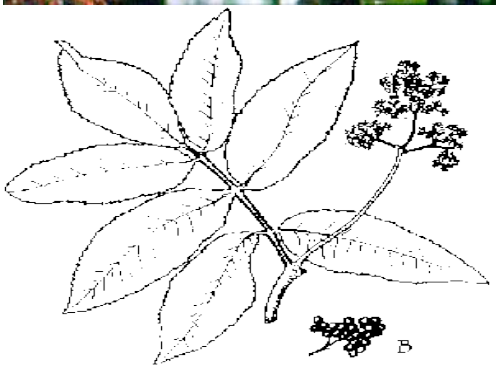
Paris B



page 245 page 247

247

Now is the time of year to go pick elderberries (*Sambucus*) up in the nearby canyons. The fruits are ripe in mide-September and are a blue to waxy light blue color. Pick, wash, and freeze the elderberries for making pies later. Here is a recipe:



Recipe for a 9-inch double crust pie

4 cups elderberries
1 cup white sugar
3 tablespoons cornstarch
1 tablespoon lemon juice

Directions

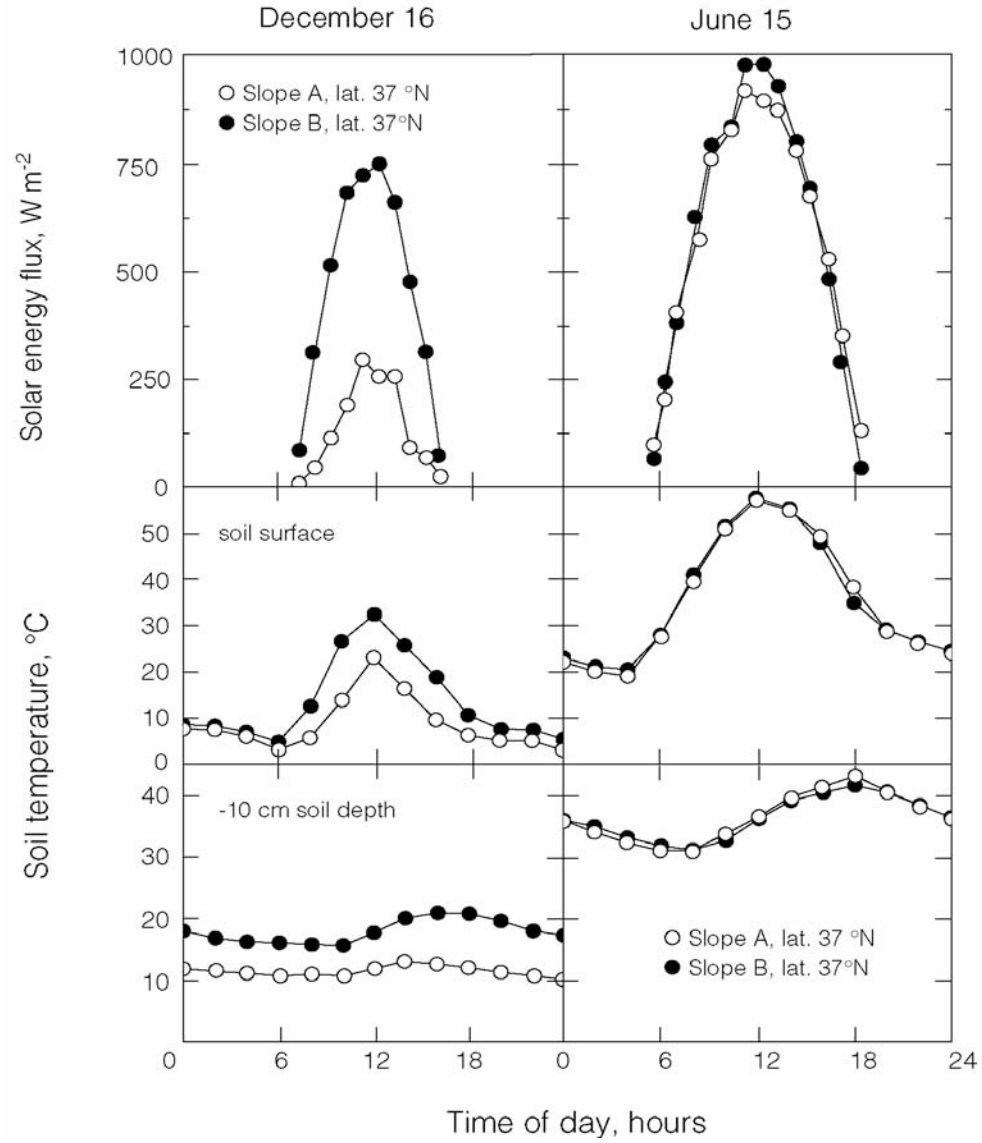
1) Preheat oven to 375 degrees F (190 degrees C).
2) Mix cornstarch in a little bit of water and add to berries and sugar.
3) Cook, stirring constantly until desired thickness. Add more cornstarch if not thick enough. Add lemon juice.
4) Pour into bottom crust. Dot with butter. Put on top crust or make a lattice.
5) Bake at 375 degrees F (190 degrees C) until browned and berries are bubbling through holes in the crust.

Note: It is a good idea to put a pan or foil under the pie as it bakes since it might bubble over.

page 246 page 248

Last year I revisited to one of my favorite field sites in the Anza Borrego Desert. I placed two sets of sensor packages out in the field on December 16 (during winter break) and again on June 16 (after classes were over). With these sensor packages, I measured solar energy on two different slopes at this site (top plates on right), soil temperatures at the very surface of the soil (middle plates on the right), and soil temperature at 10 cm depth in the soil (bottom plate on right).

Wow!!! I think that these data fit the temporal and spatial patterns described by Jim Ehleringer in class. Yet I am confused about several things that I will need to clarify before I go back to Death Valley again. I know the sensors were working, so there is no question about the quality of the data on these 2 clear days.



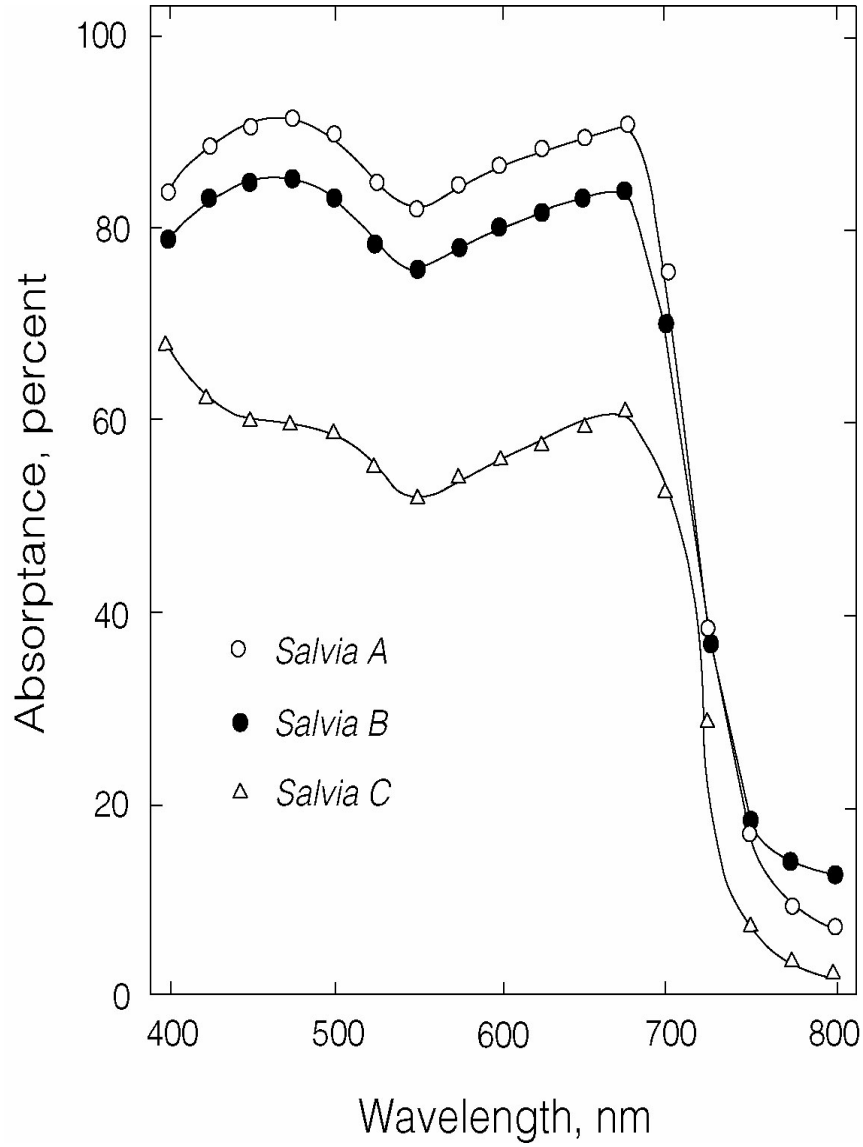
page 247 page 249

249

Salvia is an interesting genus of plants common to many of the arid and semi-arid regions of the world. In California, I found 3 species occupying different regions of the coastal chaparral vegetation. The leaf spectral characteristics were quite interesting and I have placed some of the SEM images I collected on the page 250 of my notebook.

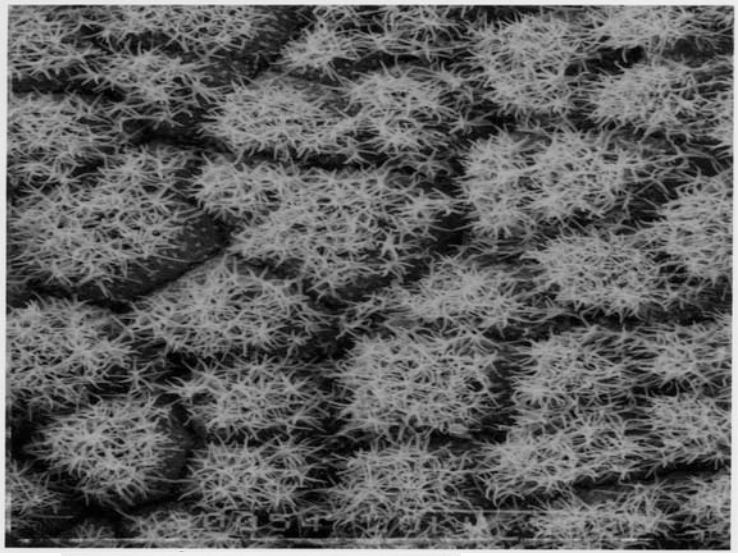
What confuses me still though is what biochemical and structural characteristics account for the dramatic reductions in leaf absorptance. I will have to look into this further. Now *reflecting* on this further, I cannot recall just how much transmittance plays into a reduction in absorptance.

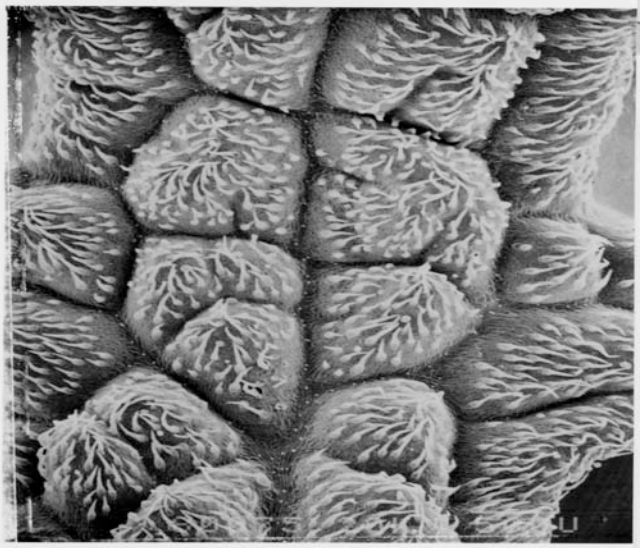
In any event, it is wonderful to see that the citizens of southern California oftens plant these 3 species in their front yards as part of a xeriscaping plan.



page 248 page 250

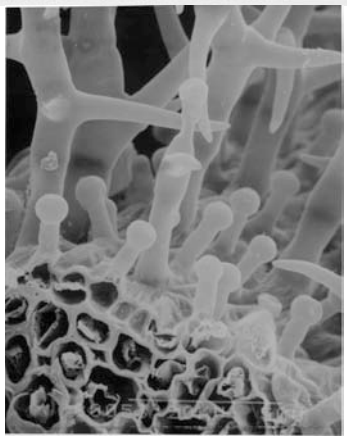
Leaf surface scanning electron microscope (SEM) pictures of the surfaces from different *Salvia* species from southern California. 250





The glandular hairs (distally globular) are the storage locations for the aromatic compounds that characterize different *Salvia* species and make them so useful as a culinary spice.

The globular hairs serve a different function from that of the dead, air-filled linear hair cells that also occupy the leaf surface.



page 249 page 251

251

One of my favorite activities is to hike through the Wasatch Front in the Fall as the aspen turn colors. Having just received an altimeter for my birthday, I decided to take it along on my hike last Friday. I was especially happy because the Runnin' Utes had just beat Air Force in football. It was a beautiful day for a hike: sunny, warm, and low humidity!

Well to my surprise while hiking up Millcreek Canyon, I noticed that the coniferous trees along this elevation gradient showed very distinctive elevational trends. I had noticed these trends before on earlier hikes in Big Cottonwood Canyon and had even made a few notes earlier in my notebook. What strruck me as unusual was that at about 7,000 feet elevation (about 2,100 m), I came across three firs on the same hillside: *Abies concolor* (white fir), *Abies lasiocarpa* (subalpine fir), and *Pseudotsuga menzieseii* (Douglas Fir). It seemed unusal for these three fir tress to have distributions that overlapped, but nevertheless this is what I observed.

Well, being curious I pulled out my portable water potential measuring device and measured the midday water potentials. I also had my portable photosynthesis measuring equipment with me and so I measured the photosynthetic rates (as CO_2 uptake rates) on sun and shade needles on each of these three species. I then measured the dark respiration rates (as CO_2 loss rates) on these same needles.

I came back early the next morning before sunrise and then measured the pre-dawn water potentials of these plants. All of those data are presented on page 252 of my notebook.

I expected that there should be some clear relationships between these physiological parameters. The data fit my expectations.

The observed relationship between water potential and fir species at this particular non-streamside, hill slope site also fit my expectations.

Next time I am up here, I will have to measure these same physiological parameters on the trees occurring on the other slope since it faces the opposite direction.

page 250 page 252

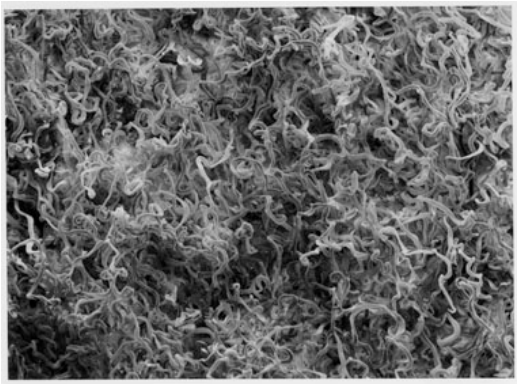
	Douglas fir	Subalpine fir	White fir
Midday water potential of stems (MPa)	-2.7	-3.3	-2.0
Predawn water potential of stems (MPa)	-1.5	-2.0	-1.0
Photosynthesis rate of sun needles in full sun light levels (μmol CO_2 m^{-2} s^{-1})	8.5	4.5	11.0
Respiration rate of sun needles in the dark (μmol CO_2 m^{-2} s^{-1})	-1.1	-0.6	-1.5
Photosynthesis rate of shade needles in half-full sun light levels (μmol CO_2 m^{-2} s^{-1})	3.0	3.0	3.0
Respiration rate of shade needles in the dark (μmol CO_2 m^{-2} s^{-1})	-0.4	-0.4	-0.3

page 251  page 253

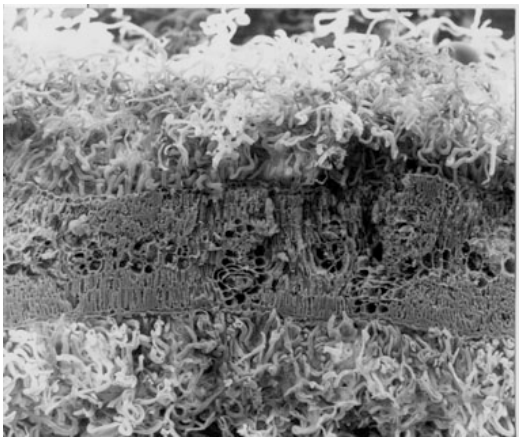
Whenever I go to Death Valley in California, I am always amazed to see *Encelia farinosa*, the drought deciduous shrub whose leaves have these fantastic reflective hairs. I have collected some leaves and brought them back for scanning electron microscope analyses. Pictures A and B below are cross-section and top views of a white, pubescent leaf collected in summer. In winter, *Encelia* can produce leaves with few hairs as shown in Picture C.

When I visited Death Valley one winter I found a mutant *Encelia farinosa*, whose leaves reained green all of the time. I looked further at the leaves under the microscope and saw the basis of this mutation. The surface hair cells of the mutant were unable to elongate and so remained as short, stubby structures as shown in Picture D.

A



B

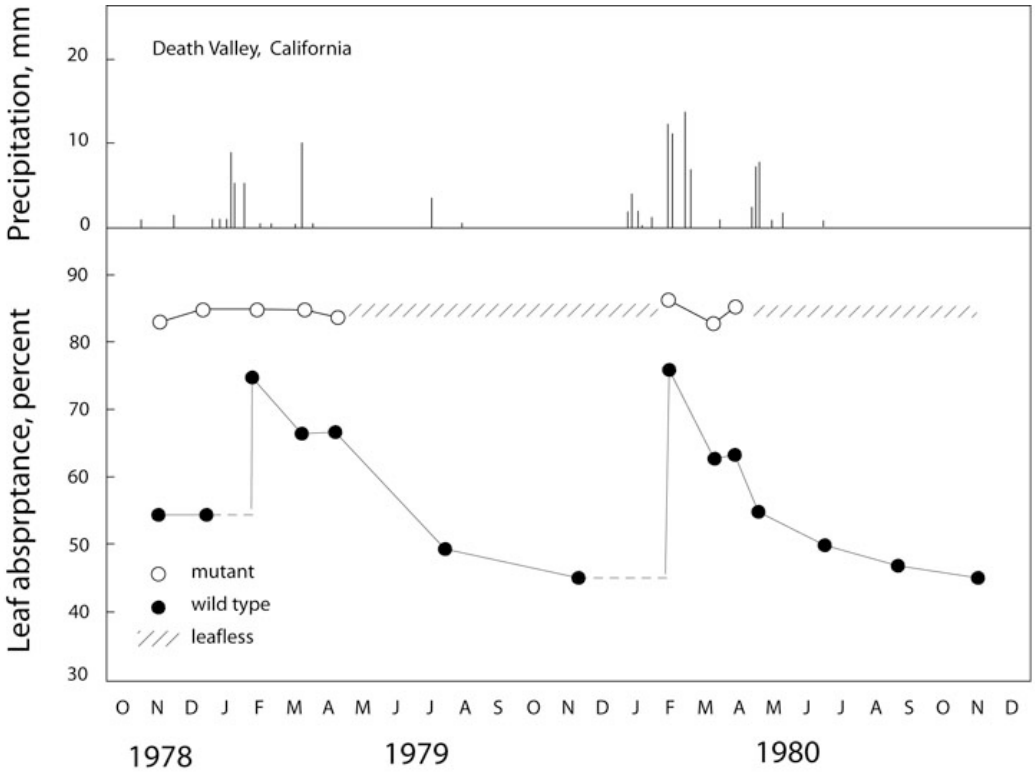


C

D

page 252 page 254

Being quite excited by the microscope observations, I then measured the 400-700 nm leaf absorptances of both the mutant and wild type *Encelia farinosa* leaves over the course of the year. This meant that I was on the road a lot, but the drive along Interste 15 was very enjoyable. The absorptance data are presented below along with two additional observations. First, I note when it rained and how much it rained at this site. Second, I noted whether or not the plants were in leaf or without leaves (drought deciduous). Interestingly, the wild type plants were able to remain in leaf essentially all year long, whereas the mutant plant had leaves for only present for 3-5 months of the year.



The seasonal courses of leaf absorptance in wild type and mutant (without hairs) Encelia farinosa, a common shrub in the deserts of southwestern North America. Note that while the wild type plants retain their leaves throughout the year, the mutant plant abscises its green leaves shortly after the rains cease.

page 253 page 255