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While walking between campus and home each day, I pass along a natural grassland next to an iron smelter. Two of the most unlikely "sister" species occur in this grassland: *Cannonus erectus* and *Cannonus platyphylla*. Both species have very attractive flowers, but neither species ever seems to attract any attention by pollinators (typical for the genus), and so I am guessing that each is self compatible. Once a month I spend a day in this grassland measuring a number of key plant features: leaf water potential (units are MPa), leaf angle (units are degrees above the horizontal), and maximum leaf width (units are mm). All of the values within a column are statistically different from each other if the differ by more than 0.15 units.

	C. erectus Water potential (MPa)	C. platyphylla Water potential (MPa)	C. erectus Leaf angle (degrees)	C. platyphylla Leaf angle (degrees)	C. erectus Leaf width (mm)	C. platyphylla Leaf width (mm)
Feb 1	-1	-1.2	5	5	16	32
Apr 1	-1.5	-2.1	30	6	18	21
Jun 1	-2.5	-3.3	55	6	15	15
Aug 1	-3	-3.7	70	5	16	12
Sep 1	-3.5	-4.2	84	10	15	11

After collecting the data this past summer, I realized that there were indeed some very interesting patterns in the data. Oh my gosh, I hope that I can remember to get these data published as soon as possible, because one of these sister species may have real horticultural significance for gardens in drier parts of the Midwestern US. However, tonight Winthrop is coming to town, and you know how it is - when the "W&W" Weatherly boys get together; we have a wild and wicked time whooping it up in our search for wyverns and phlogopites.

Some of the most unusual growth responses I have observed recently are the comparative growth responses of *Helioattractus vulgaris* and *Nocturnus platyphylla*, two herbaceous species common to the understory riparian tree communities in our nearby mountains. Both species have an opposite leaf arrangement. *Helioattractus vulgaris* is a competitive species, often overtopping and shading its neighbors. *Nocturnus platyphylla* is a long-lived herbaceous species (>10 years) that grows well in the understory of many forest canopies. Below are the growth observations I made for plants growing at different locations.

Height of uppermost leaves (cm)	Midday light level (% of sunlight at the top of the tree canopy)	Ratio of red to far red light at this height in the canopy	Average internodal distance of uppermost 3 leaves of *Helioattractus vulgaris* (cm)	Average internodal distance of uppermost 3 leaves of *Nocturnus platyphylla* (cm)
22	4	0.7	10	3
142	24	1.9	4	4
78	16	1.0	8	4
250	44	3.2	2	3
187	30	2.3	4	4

I then measured the nitrogen content of the uppermost leaves of *Helioattractus vulgaris* and *Nocturnus platyphylla* leaves.

Height of uppermost leaves (cm)	Percent leaf nitrogen content to uppermost 3 leaves of *Helioattractus vulgaris*	Percent leaf nitrogen content of uppermost 3 leaves of *Nocturnus platyphylla*
22	1.0	1.2
142	2.5	1.2
78	1.5	1.1
250	3.1	1.0
187	2.7	1.1

In southern Utah, I looked at the hemi-parasitic mistletoe (*Phoradendon juniperinum*) growing on juniper trees. These are interesting hemi-parasites with roots that tap their host's xylem but not their host's phloem. These mistletoes photosynthesize and are characterized by a transpiration rate that is 3-5 times higher than that of their hosts.

Here you see quite a few mistletoes parasitizing the stems of the Utah juniper. These mistletoes can live from 2-20 years.

Here is a close up of *Phoradendron juniperinum*. The mistletoes branch once a year, allowing you to reliably age a mistletoe by counting the number of branching points.

Here you see the fruit of the mistletoe *Phoradendron juniperinum*. A single seed occupies most of the volume of each fruit.

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In southern Utah, I looked at the hemi-parasitic mistletoe (*Phoradendon juniperinum*) growing on juniper trees. I noticed that mistletoe ages were not normally distributed when the abundances of these parasites were counted on these juniper trees. Mistletoe mortality is known to be associated with extreme climate events, such as the 2-4 year long drought such as we are experiencing now in Utah. On the other hand, success in mistletoe establishment is thought to be associated with spring-time soil moisture conditions.

Age category of mistletoes on the host tree	Number of mistletoes on tree #1	Number of mistletoes on tree #2	Number of mistletoes on tree #3	Number of mistletoes on tree #4
1 year old	15	14	7	19
2 year old tree	27	33	23	23
3 year old tree	33	39	29	33
4 year old tree	20	30	32	28
5 year old tree	32	27	33	31
6 year old tree	29	32	28	28
7 year old tree	26	30	26	29
8 year old tree	1	2	1	0
9 year old tree	1	0	0	1
10 year old tree	1	0	1	0

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At the same time, I evaluted seed production in these same mistletoes (page 426).

In their reproductive cycles

- Mistletoes flower in the spring
- Seed development takes place in the summer
- Seeds are dispersed in the fall

One unusual phenomenon I observed was that the average seed biomass of mistletoe seeds was not constant across different aged mistletoes.

After measuring seed mass, I brought these seeds into the laboratory and

- Measured the chemical composition on a subset of the seeds
- Conducted germination studies on another random subset of the seeds. Germination was not delayed in this species and seeds germinated within 4 days or did not germinate at all.

All of those data are summarized below.

Age of mistletoe	Mistletoe seed mass (mg)	Germination rate (%)	Seed lipid content (%)	Seed starch content (%)
1 year old	12	20	7	37
2 years old	17	42	8	44
3 years old	20	54	7	52
4 years old	22	82	7	71
5 years old	23	87	8	80
6 years old	26	92	6	82
7 years old	26	89	7	81
8 years old	28	96	8	84
9 years old	31	98	6	82
10 years old	33	98	7	83

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Last week I got into a terrible argument with a colleague about what metabolic and biochemical components of photosynthesis are sensitive to temperature.

My colleague stated that if you exposed a sun-lit leaf from a plant grown at 25°C to high leaf temperatures (say 48°C) for a brief period of time (say 5 to 10 minutes) and then returned the leaf temperature to 25°C that the rate of photosynthesis measured at 25°C would decline relative to a control (a plant that had been exposed only to 25°C). On that we both agreed.

Where we differed was on the mechanistic basis for the decline in photosynthetic rate following exposure to high temperature.

He argued that the decline in photosynthesis was caused by the temperature sensitivity of photosystem I reactions.

I argued that the decline in photosynthesis following leaf exposure to the high temperature was caused by the temperature sensitivity of photosystem II reactions.

Then, another colleague came by and made the claim that the decline in photosynthesis following leaf exposure to high temperature was caused by the temperature sensitivity of the Hill reaction.

Now I am confused as to who is right.