Botanical Colonialism

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When the lotuses and clovers first colonize a "sterilized" area, they are often huge (this *A. brachycarpus* is well over a foot across). In the second generation, after they have seeded, they germinate nearby in large numbers, but are much smaller, at most four inches across with a half-dozen flowers or so (inset). I speculate that the seed of pioneer plants have thinner coats with which to establish many scions to control the spot. Once established, the strategy becomes to hold the spot; so the same hormonal signals that make them smaller (Ludlow 2008) also have them produce seeds with a thicker coats that render them capable of extended dormancy.

As these clovers colonize the property, they then appear to differentiate. Three of the four photos are notch leaf clover *(T. bifidum)*. The funny thing is that the two that appear to be the most similar are actually different species! The first (1) is at least four times the size of the other two notch leaf clovers here (2 & 4) and is by far the most common. Each subsequent variant has since bred true. It subsequently differentiated or the property was simultaneously colonized by three varieties. The oddball is (3), *T. microdon*.

1

Trifolium bifidum

3

Trifolium microdon

4

5

Clovers (3 & 5) are variants of *T. microdon.* To the casual observer, in may ways (3) resembles the notch leaf variant (4) more than either resemble their respectively more common varieties (1 & 5). Meanwhile, the latter two share several attributes not shared with the smaller flavors of each. So, why does the taxonomy work this way? The traditional distinguishing features are the attributes of the flowers, whether or not there is hair, etc. Interestingly, they are unlikely to be hybrids because apparently clovers do not interbreed. In fact, they are more exclusive of other varieties within their species than without! Still, it would seem that there might either be blocks of genes or conditional branches in the gene algorithm that interact with environmental factors.

Clover (1) is the usual erect form of pinpoint clover *(T. gracilentum).* It entered in 2003 and later appeared as a variegated and prostrate flavor (2) that breeds true and shows a similar albeit slower dispersion pattern to (1). A later entrant (2006) at first I thought was tree clover *(T. ciliolatum)* (3) with monotone lanceolate leaves that later became more elliptical. So, was that *T. ciliolatum* or *T. obtusiflora*? Well, it's not at all glandular, nor was it clear if the calyx was fused or not. Two years later we had a variegated flavor (4) with that was *clearly T. ciliolatum* with wider variegated leaves that, true to its name of "tree clover," is prostrate!

I have also seen clovers that were erect when they first came in, then to breed decumbent to prostrate varieties that were not so strongly variegated. Then they went erect in grasses, which then produced offspring that grew erect in the open (upper right). I'm wondering if that propensity is epigenetic. I say this because I have had the rare opportunity to witness colonization behavior in several species in completely different plant families behaving according to the same principles.

Spanish lotus *(Acmispon americanus* – go figure… I'm starting to hate taxonomists) does the same thing. But is this simply a phenotypical adaptation? From what I have seen, I believe this to be a heritable adaptation, or epigenetic behavior.

This is the same area as the prior photo when colonized by grasses. This Lotus purshianus, grew flat on the ground in the open.
Yet I have seen it too grow erect beyond the edges of grasslands.
I saw that picture this year, but I didn't take it. Sometimes… (grumble grumble…). Next year.

It is hard to be certain, but it is my guess that clovers suppress germination among each other from year to year due to residual chemistry left in the soil, thus possibly allowing other species in the cohort to express themselves in turn (which would explain a lot). I have seen patterns of germination that almost looked like a photographic negative from the prior year, both in instances of disturbance (because I had killed a patch with a burn pile) and without. Unfortunately, planning to document that photographically is very difficult because it is unusual to have two good successive years for clover germination. Maybe some day. At least now I know what to look for.

Another aspect of colonization behavior is whether these returning plants find the specific bacterial strains they require for successful nodulation. I was skeptical about what I had been told, “the bugs are there,” despite their hosts being displaced by exotics over a hundred years. So with these newly returning alleles, I had to take a look. The results were a mixed bag for that hypothesis. The lupines did fine as did all of our small Lotus species, all of which I had long suspected had survived in our seed bank. The exotic *Trifolium hirtum* I introduced without inoculum did not nodulate, yet the exotic *T. dubium* nodulated quite well. I suspect the reason is that the latter was here as a weed when the land was grazed and the local *Rhizobium trifolii* adapted to it by genetic transformation, either in the animal rumen or as a result of trampling mud. Still, the nodules were white, indicating a lack of leghemoglobin and therefore no nitrogen. Where *T. dubium* still germinates is among the poorest soils on the property; i.e., no molybdenum.

Table of Content

Each line in the TOC is a link that opens the corresponding chapter in a new file.

Next