Tomatoes That Occasionally Outbreed

Some Implications About Evolution, Adaptation and Selection
by Alan Mushroom Kapuler PhD
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As gardeners who save some of the seeds that they use for planting, one becomes accustomed to having their tomato seeds breed true. What you grew and then saved gives the same kind of plants and fruits in the following years.

This was certainly true for us during the first several decades that we grew more than a hundred tomato cultivars. They all bred true, mostly heirlooms but some F1's as well. Rarely did the F1 hybrids show segregation of traits that one would expect from a biparental cross. After all, the tomatoes we grow have been selected to inbreed. The stigma (female) is below the stamens (male) and as the pollen is maturing the stigma is growing through and beyond the ring of pollen and pollination takes place. Pollinators like honeybees and bumblebees don't get to the stigmas until pollination has taken place. Thus, although tomato plants make fruits that usually contain seeds, the seeds arise from self fertilization. They are not crosses in an ecological sense. So they are non-adaptive. They are evolutionarly sterile.

We usually don't look at genetics of backyard garden food plants in terms of adaptation. The crosses needed to further the process of better vigor in response to environmental changes, the production of more and better fruits and resistance to fungi like the ones that cause late blight do not take place.

So since we began saving tomato seeds in the mid 1970's we only found cultivars in which the parents and children were the same.

Then in the early 2000's Kusra Kapuler and I crossed the Grape Tress Tomato (*Solanum lycopersicum*) with several wild species from the Andes of Peru, South America. One of these was *Solanum habrochaites v. glabratum*. This cross gave rise to large tresses, like the flowing of flowers or hair, which had more than a hundred flowers on a flowering spike (inflorescence). We call these large clusters of flowers coming as a branch from the main stem **hypertresses**. Sometimes the tomato plant itself is a **centiflor**, for 100 or more

flowers on a tress. Subsequently we have seen photos of centiflors with hundreds of flowers on an infloresence. Although we were surprised and delighted with this new development of centiflors with red and yellow colored fruits, it was several years later that Dylana Kapuler began to see hypertresses in cultivars such as Palestinian heirloom, Peacevine Cherry and Sungold.

Thus it turns out that centiflors are occasional outbreeders. The stigmas are exerted and hence accessible to pollinators that carry pollen from one flower to another. So outbreeding tomatoes can exchange pollen with other tomatoes in the garden. If hypertress centiflor tomatoes planted with other tomatoes cross and pass on their hypertress trait this gives gardeners and seed savers the opportunity to develop new lines that are locally eco-adapted without having to hand pollinate. The new genetic mixes have both hypertresses and novel recombinants encouraging environmental adaptation.

If one has both centiflors and currant tomatoes (*Solanum pimpinellifolium*) in the garden flowering at the same time as favorite cultivars, there will be crosses between these different categories of tomatoes. By saving the seeds of these potential mixes for several years, one will encourage the development of hypertresses, late blight resistance from currant tomatoes and fruit size and flavor from long time favorites.

Most heirloom tomatoes are late blight sensitive.

By setting up the garden with a mix of centiflors, currant tomatoes and established favorites we can allow the rejuvination of the tomato plant as a widely adapted grex ie mixtures of crosses of crosses of crosses. See Mushroomsblog article called **Diploids, Hybrids, Landraces and Grexes**.

It has only recently dawned on us, after 40 years of growing and seeding tomatoes that what was is a wild characteristic of native species has been eliminated in our present routinely grown tomato cultivars. They are inbreeders, not outbreeders. We have been propagating ecological sterility. We have been propagating cultivars that are non-adaptive.

The centiflors reopen the tomato genome pool adapting them to a wider diversity of ecologies and the changes in environmental conditions. More tomatoes for more climates. More tomatoes with enhanced free pre-protein amino acids. Tomatoes that help us sleep better ie ones with higher amount of gamma-amino butyric acid.

Tomatoes that help us think faster. Tomatoes that make more energy for our brains (high in glutamine for example).

This helps usher in a new era of public domain tomato breeding using conventional Mendelian whole organism breeding techniques.

This is a frontier for plant breeding by backyard gardeners. By using organic cultivation conditions we enhance both the public domain (new cultivars) and improve the gardening environment (no poisons in the plants, fruits, soil, water and air.