Clone Preservation Project Update - Dec 2009

I would like to devote the update this month to a brief review of some aspects of plant taxonomy because I will need to devote more time to discussing the taxonomy of bromeliads in the wild rather than cultivars in cultivation in some upcoming updates. These discussions will be much easier to understand with some background information. I also want to explicitly lay out my approach to taxonomy. In general terms, I base my taxonomic decisions on evolutionary theory. I attempt to guess the evolutionary history of a group of plants based on available data, and then attempt to construct a taxonomy that provides a consistent model of the postulated evolutionary history.

This review is based on the basic concept of the **species**. I will only be dealing with species-level and subspecies-level problems in the near future.

First, it must be admitted that a taxonomic concept as important as '**species**' is to a certain extent arbitrary. Many attempts have been made to precisely define **species**, but none have proven adequate to deal with all the forms of 'species-level' taxa found in nature. Still, the concept is strongly rooted in observation of our natural surroundings. If you carefully study the plants in southern Florida (and learn to account for variations in appearance caused by differences in light exposure, differences in water supply and differences in nutrient supply), you will find they separate out into easily distinguishable groups (with a few exceptions). If you move to northern Florida, you will find many plants that look different from anything in southern Florida, but you will find many other plants that look the same (i.e. they fall within the expected range of variation). As you keep moving further north, you will find fewer plants that look like those in southern Florida. But, what you don't find are cases where plants from southern Florida seem to be gradually changing shape as you move north, until they become something that looks completely different (there are exceptions, but this statement is generally true). The plants that look like those from southern Florida continue to look like plants from southern Florida until they disappear completely. The plants that replace them look completely different. It is this consistency and lack of intergradation that lead us to consider **species** as occupying a special place in the natural world. For the purposes of plant taxonomy, I consider the **species** as a group of plants (more properly a group of populations of plants) that share an evolutionary history distinct from all other groups.

If all groups of plants behaved in this manner there would be no controversy surrounding the **species** concept, but there are always exceptions. Hybridization can occur between plants belonging to different species in natural habitats. Usually this is

rare, and the hybrids are easily recognized, but, in some cases, hybridization between two **species** is extensive and produces 'hybrid swarms'. If you have the case where hybridization occurs not only between the two **species**, but between the **species** and the hybrids in the swarm ('introgressive hybridization'), you will be able to pick a series of plants within the swarm that bridge any differences in appearance between the two original **species**. In other words, there is no way to tell the two **species** apart from within such a swarm.

We have a perfect example of introgressive hybridization between bromeliads in southern Florida. *Tillandsia balbisiana* and *Tillandsia fasciculata* form hybrid swarms in several localities. In most areas where these two **species** grow in Florida, they do not form hybrids, so they are easy to distinguish from one another. In areas where the hybrid swarms form (typically stands dominated by small cypress trees), it is no longer possible to find any characters that separate the two **species**. You can find examples that look exactly like either **species** (as defined by the way they look in locations where no hybrids are formed), but you can also find plants intermediate to any degree in any character that separates them.

Another problem arises in plant groups where chromosomes are not passed to successive generations in a consistent manner. This can lead to groups of populations that differ from each other by the slightest amount although the extremes may be very distinct. I am not aware of any cases where this has been found in bromeliads, although the complex of plants surrounding *Tillandsia fasciculata* certainly seem to present many variations that could arise from this source. Perhaps someone more familiar with this group could provide a review, and let us know what the current thinking is on the observed variations.

A final problem is found where you do have plants that change in appearance gradually over an extended range (these are called **clines**). Plants at the opposite ends of the range may be very different in appearance, but there is no obvious line of demarcation where you can say plants on one side of the line differ from plants on the other side. These **clines** are usually found in species growing over a wide natural range although they can also occur over a range of 10s of miles. One of the basic assumptions in my taxonomic approach is to interpret these **clines** as nascent speciation events. In theory, if the populations at the extreme ends of the **cline** (remember, these populations already look different) lose connection with the plants in the middle of the **cline**, they will drift off on their own separate evolutionary path, becoming separate **species**.

Some adherents of the cladistic approach to taxonomy have argued that the lack of a

single logically consistent definition of **species** means the whole concept should be abandoned. (In fairness, I must point out that cladistics attempts to explain the evolution of groups throughout time, not just at a single point in time, and the problem of defining **species** becomes much more complex when we consider the changes a **species** may undergo through time.) Unfortunately, the basis of cladistic methodology, the 'taxonomically significant character' (technically called a **synapomorphy**) is no easier to define and no less arbitrary than the '**species**'.

As mentioned above, a **species** can be thought of as group of populations that share an evolutionary history distinct from all other groups. The distinct evolutionary history implies a different appearance from all other groups (although the differences may involve inconspicuous, even obscure, characters). One of the characteristics we expect to find within a species is the ability of individuals to interbreed. This means we cannot have different forms of the same species growing within sight of each other unless special conditions are met. In rare cases, a character such as flower color may be controlled by 1 or 2 genes. Under these conditions, you may get a mixed population of plants, all belonging to the same species, with some plants having one flower color an other having a different color. More commonly, you may find differences in appearance that are correlated with environmental factors.

When we have a **cline**, and believe the **cline** represents a species on the verge of separating into 2 (or more) species, we record this through the use of **subspecies** and/or **variety** names. Historically, the category **subspecies** has been used predominantly by taxonomists working with animals and the category **variety** has been used predominantly by taxonomists working with plants, but both have essentially the same meaning: a geographically based, recognizable difference between populations within a species. By this definition, we cannot have 2 **subspecies** (or **varieties**) coexisting in the same locality at the same time.

If you are confident that you have a detailed enough knowledge of the evolutionary history of a group, you may use (in descending order) **subspecies**, **variety** and, even, **subvariety** to describe varying degrees of evolutionary separation. In the bromeliad universe, where it is still often difficult to determine **species** status, it is hard to see any need for this degree of precision.

One further category, **form**, appears in the taxonomic literature. By definition, this category represents evolutionary variations within a species that imply less divergence than seen in a **variety** (or **subvariety**). In contrast to the definition, however, the category is currently used to denote a recognizable variation within a **species** that is not thought to have any evolutionary significance. Accordingly, any arbitrary

characteristic that can be used to distinguish between plants is assumed to be sufficient to define a **form**. A common example among the bromeliads would be the use of **form** to distinguish variegated plants found in the wild.

This ends the review. In future updates, my discussion of current bromeliad taxonomy (at the species and subspecific levels) will follow the guidelines given above.