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The Symposium on The Phylogenetics of the Bromeliaceae - A Brief Report

by Herb Plever

On July 12th I attended the Symposium on the "Phylogenetics of the Bromeliaceae" that was part of the 5th International Conference on Monocotyledons, co-sponsored by the New York Botanical Gardens and Fordham University.

[Phylogenetics is the study of evolutionary relationships among species populations that is discovered through analysis of DNA molecular sequencing data acquired in biological laboratories, PLUS morphological (physical/structural) data. The goal of the research is to improve the taxonomy of the different bromeliad groups and to gain insight into their evolutionary history. This important work has already resulted in revision of the bromeliad sub-families from three to eight, as reported in the May issue of BROMELIANA].

The Symposium was organized by Jason Grant of the University of Neuchatel in Switzerland. It was attended by 23 scientists, 3 from the U.S., 9 from Brazil, 6 from Germany, 3 from Austria, 1 from Australia and 1from Switzerland. Eight papers were presented: "Adaptive Radiation, Historical Biogeography, Correlated and Contingent Evaluation, and Net Rates of Diversification of the ***Bromeliaceae***" by Thomas Givnish; "Systematics, Evolution and Biogeography of ***Bromeliaceae***" by Georg Ziska; "New Generic Circumscription and Phylogeny of the ***Cryptanthoid Complex*** Based on Neglected Morphological Traits" by Elton Leme; "Systematics and Biogeography of the ***Ronnbergia Clade***, a Case of Diversification Interconnecting Three Neotropical Biodiversity Hotspots" by Julio Aguirre-Santoro; "Systematics and Evolution of ***Tillandsioideae***" by Michael Barfuss; "Phylogentics and Evolution of ***Tillandsia Subgenus Tillandsia***" by Juan Pinzón (publ. in March-June 2013 BSI Journal); "Phylogentics of the ***Tillandsia fasciculata Complex***" by Brian Sidoti; "Biodiversity and Molecular Phylogeny of Genus ***Werauhia***" by Jason Grant.

Most of this material is highly technical and is more appropriate for publication in the Journal of Botany or the BSI Journal than our newsletter. I will, however, try to summarize in plain language a few issues raised by the talks which I believe will be of interest to our readers.

In one part of his talk, Tom Givnish, a leading researcher from the University of Wisconsin, presented a molecular tree that was focused on the two pathways for photosynthesis that have evolved in bromeliads - CAM and C3 are two different ways plants fix and infuse CO_2 into the leaf cells. [The combined radiant energy from the sun (absorbed by the green chlorophyl pigment of the leaves), carbon, oxygen and hydrogen from the infused CO_2 and H_2O absorbed moisture plus enzymes, are processed to produce acids that breakdown into food sugars. In CAM, leaf pores are

NEXT MEETING - Tuesday, September 3rd , 2013 promptly at 7:00 P.M. at the Ripley-Grier Studios 520 8th Ave. (between 36th & 37th St) Room 16M

HOW ARE THE PLANTS AND TISSUE CULTURES YOU ORDERED GROWING? Please bring in one or two plants - especially a tissue culture if you ordered one this year or last - whether they are growing well or poorly, to promote a productive cultural discussion. Bring in plants for sale and for Show and Tell. We'll give out free pups: 2 ***Ae.*** 'Mirlo', 3 ***Cr.*** 'Strawberries Flambe', 2 ***Nid. innocentii v. lineatum,*** 6 ***Neo.*** 'Rafa', 3 clumps ***T.*** argentina.

closed during the day and open at night to reduce water loss by transpiration. In C3s the leaf pores are open during the day and are closed at night because their habitats are water sufficient and humid so water loss is not a major problem.]

I was surprised to learn that among the 9 genera of sub-family ***Tillandsioideae*** only 60% of ***Tillandsia*** species and only 3% of ***Vriesea*** species use CAM metabolism. The rest of the tillandsioids use the C3 pathway for photosynthesis. The CAM tillandsias are all "atmospheric" species whose leaves do not hold water; their habitats are more open, higher altitude cloud forests with dryer, cooler, water insufficient conditions. They all evolved via natural selection to epithytism with fairly full trichome leaf coverings that enabled them to adapt to those more adverse conditions when the land was pushed up to create the montane Andes about 3 million years ago.

The other 40% of the tillandsia species use the C3 pathway for photosynthesis, despite the fact that many do have leaves with trichomes. They all come from water sufficient habitats at lower altitudes, and if they are tank types or rosettes that can collect and hold water, they use the C3 pathway. The 3% CAM vrieseas are all tillandsia-like such as ***Vriesea espinosae.*** It should be noted that a relatively small number of species has been studied in the current research. The addition of many more species is needed to give the data even greater reliability.

Rokautzkyia habitat photo by E. Leme

In subsequent correspondence with Givnish on a related issue, he pointed out that while water collection on tank and rosette type tillandsias was probably responsible for their using the C3 pathway, but it doesn't at all work to explain why almost all of water-collecting species of subfamily ***Bromelioideae*** use CAM photosynthesis. (This includes all 35 genera such as ***Aechmea, Billbergia*** etc.) Researchers hypothesize that CAM occurs in many species because their absorptive trichomes are wet much of the time, preventing CO_2 from diffusing into the leaf tissue. However, CAM photosynthesis, often allows what is called an "idling" phase, which efficiently recycles respiratory CO_2 within the leaf.

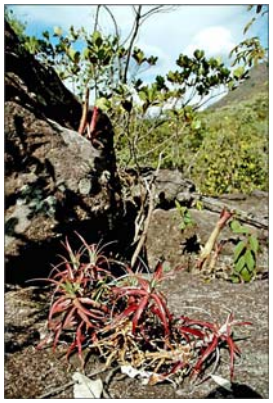
Tom commented that no one is sure the CAM idling hypothesis is true, but he says it's the best explanation that he and his co-authors have heard; that it is an article of faith among many bromeliad physiologists that extreme atmospheric types can't function under constantly very high humidity. He remarked that it is surprising, after all these decades, that the exact daily and seasonal timing of CO_2 uptake – especially in relation to relative humidity – of bromeliads is still not known.

Inferences for Indoor Growers -

1. Even if they are soaked, the soft-leaved broms such as ***Tillandsia cyanea*** and other rosettte or tank types won't grow well indoors if mounted epiphytically. (The photo on page 4 of a clump of cyaneas growing well, epiphytically, at the NY Botanical Gardens is no doubt due to their being hosed down once or twice a day.)
2. We should not soak mounted CAM tillandsias at night when their leaf pores are open, because the soaking would flatten the trichomes over the pores and would prevent the diffusion of CO_2 into the leaf tissue that is needed for sugar manufacture.
3. We can and should experiment more to grow tillandsias in pots with a medium that can stay damp but drains very well. I know of one tillandsia nursery that grows beautiful tillandsias that way.

In his symposium paper on what he calls the ***Cryptanthoid Complex,*** the noted taxonomist Elton Leme of Brazil demonstrated his findings of significant dif-

Cryptanthus low altitude terrestrial habitat - Leme



Hoplocryptanthus rocky. habitat ph Leme

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Orthophytum habitat ph E. Leme

Orthocryptanthus habitat photo by E. Leme

ferences between groups of plants that fall within the currently accepted genera of ***Cryptanthus, Lapanthus*** and ***Orthophytum.*** The species in this "Complex" have in common: that they are all endemic to Brazil in overlapping geographical ranges, growing terrestrially or in rock crevices and that their leaves cannot hold water.

The research of Leme and his associates with these groups primarily deals with the morphology (physical characters) of their flower parts. His microphotos show the differences in the sizes, shapes and apices of their stamens, stigma, pollen and fruits. I believe that there is ongoing work on biodiversity and molecular studies to confirm these findings.

Lapanthus habitat - rocky, open, high altitude. Photo E. Leme

On the basis of that research, Leme proposes a revision of the ***Cryptanthus, Lapanthus*** and ***Orthophytum*** genera as follows:. Genus ***Cryptanthus*** would comprise 3 subgenera:

1. Subgenus.***Cryptanthus***-type plant ***Cr. bromeliodes.*** Low altitude, terrestrial or rupicolous, shady, andromonoeicious (some flowers with male and female organs and some with only male organs), odorless, white petals 4-8 times longer than wide, basally connate (connected), stamens equal.
2. Restored subgenus ***Hoplocryptanthus*** (per Mez's classification)with the type plant ***Cr. glaziovii***. Median to high altitude, hermaphrodite (male and female organs on each flower), fragrant, white petals only about 2-3 times longer than wide and basally connate, stamens equal.
3. New subgenus, ***Rokautskyia*** (no type species has been named)**.** Median to high altitude, hermaphrodite, strongly fragrant, white petals 3 times longer than wide and basally connate, stamens equal.
4. New Genus ***Orthocryptanthus*** (no type species named yet.) High altitude in open sun, hermaphrodite, strongly fragrant, lilac-rose petals about 2-3 times longer than wide and free (not connected), stamens distinctly unequal.
5. ***Laptanthus*** - at this time with only two species: ***L. duartii*** and ***L. itambenis.*** High altitude, hermaphrodite, odorless, white, orange or yellow petals about 2-3 times longer than wide and free, stamens equal.
6. ***Orthophytum*** - Low to high altitude, hermaphrodite, odorless, white or green petals about 3-7 times longer than wide and free, stamens subequal to unequal.

(Many of these attractive plants are new to us. It is to be hoped that one fine day some of them will become available to us from mail order bromeliad nurseries.)

Another additional, important and constructive accomplishment of this symposium is that it resulted in a meeting afterward at which the participants formed a permanent organization, and they initiated plans for the construction of a website to facilitate the exchange of data among and between scientists around the world. They also initiated plans for a conference to take place near Rio de Janeiro next year. ❑

Hoplophytum species (unnamed) ph by Elton Leme

Hoplophytum species (unnamed) ph by Elton Leme

2 ***Rokautzkyia*** species (unnamed) ph by E. Leme

Orthocrypthanthus (unnamed spec. ph E. Leme

Guzmania 'Denise' albomarginated form

Tillandsia cyanea mounted at the NY Botanical Gardens

Tillandsia 'Sandy' & ***Vriesea*** 'Davine' tissue cult.

Spring/Summer Growth

by Herb Plever

Many of my broms have bloomed during the spring and summer: ***Billbergia decora*** (on my terrace), many tillandsias, eight guzmanias, a ***Vriesea*** 'Stoplight' and ***Aechmea farinosa***. I bought the albo-marginated ***Guzmania*** 'Denise' shown above as a pup from Grant Groves at the end of September, 2010. It bloomed in May and is still in full color. The margination is very stable - equal white margins on every leaf; it pups withe same margins. This is a beautiful cultivar that should be registered by Grant.

For the second time the ***mini Guz.*** 'Lydia' that I purchased as a tissue culture a number of years ago has bloomed. As I commented the first time, this plant is small but not really mini.

Two years ago we acquired a number of pieces of tissue cultured ***Vriesea delicatula***. They had inadvertently missed our usual May shipment, so as a favor they were grown on during the summer before they were delivered in September. The plants were more robust than the usual scrawny 6 week old tissue cultures. I bought three of them to test the cultural advice from a knowledgeable European grower that ***V. delicatula*** preferred the medium to be kept on the dry side, but with water in its leaf axils.

I potted them all in a well draining mix of chunky peat moss, coconut husk fiber and perlite. The plants are growing side by side in an unobstructed, east-south-east window which gets 3-4 hours of sun from the late spring to early fall and about 1½ hours of sun in the winter. On the 8th floor that window also gets continuous horizon light. The plants are in a fibre glass window sill tray that has a 1½ inch trough that fills with water when the plants are watered through. One plant is growing wick-watered in a container, one has a wick that is placed in the trough(that gets dry fairly quickly) and one plant is growing without a wick and has gotten watered every 7 to 10 days or when I remember to get around to it.

At this time there is no significant difference in their growth. They all have now more than tripled their original size; they have tight conformations, are 9" high, 10" in diameter and have about 20 crisp, ½" wide leaves! It will be a show when they all bloom.

I bought many tissue cultures in our spring order. They came in fairly strong and to save space I potted two plants in each 4" pot of my mix. As you can see from the above photo of one of those pots, they are growing very well; I'll have to separate them into different pots as soon as I get around to it.

The above photo of ***Tillandsia cyanea*** by Pres. Mimi Gussow is from the June trip to the N.Y. Botanical Gardens.

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