Far North Coast Bromeliad Study Group N.S.W.

Study Group meets the third Thursday of each month

Next meeting 20th December, 2012 at 11 a.m.

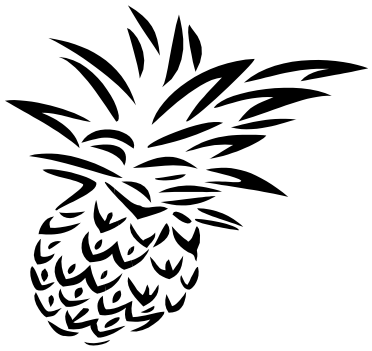
Venue: PineGrove Bromeliad Nursery
114 Pine Street Wardell 2477
Phone (02) 6683 4188

Discussion: November 2012

General show & tell

Vr. 'Highway Beauty' *et al*

Editorial Team:
Don Beard
Ross Little & Helen Clewett
pinegrovebromeliads@bigpond.com



Meeting 18th October 2012

Ross opened the meeting at 11:00am. All members and visitors were made welcome. A total of 31 members were present, with apologies received for nine members. Included in the visitors was Warren Hulbert of Newcastle on his annual pilgrimage to PineGrove. As previously, Warren will demonstrate for the group some of his excellent floral arrangements.

General Business

Ross announced the very sad news that Harry Luther had passed away. Harry was a botanist, and recognized internationally as an expert in bromeliads. This is a massive loss to all those associated with bromeliads. Harry finished his brilliant career at the Singapore Botanical gardens. This group would like to offer its condolences and sympathy to Harry's family and close friends (see article p.15).

On a happier note, Derek Butcher (Uncle Derek) was awarded the 2012 BSI Wally Berg Award. Congratulations Derek, a nice reward for your extensive contributions to this discipline (see FNCBSG NSW Newsletter Oct. 2012 p. 5), and to your support team, Margaret (Auntie Margaret).

Given the growth in membership of the FNCBSG NSW in the past four years, it is apparent that it is time to become a little organized, but not suffocatingly so. Such organization to be aimed at giving help and support to those members who are carrying the heaviest burdens. A preliminary time-table was distributed to give some direction regarding tasks during meeting day. Improvements to this time-table will be incorporated as they arise. Remember, it is a guide which we should try to accomplish. For the time being Kay will handle the library, Marie the sale of pots, fertilizer etc., Trish the members' sale plants, whilst Helen will look after the PineGrove sales.
The library books have been made more accessible, having been placed on a stand. Please abide by the proper procedure when borrowing these books.

'Away' member Joy Clarke from Sydney has again donated a box of bromeliads for the raffle. This she has done for three months in a row. Thanks Joy. While we are thanking people, thank you to Shane for his contribution toward the newsletter costs, and to Coral and Gary for their donation of plates for the Christmas party.

Final decisions were made regarding the Christmas party and the form of members gifts for this year. The party will be held on the 20th December meeting and this year approximately six quality bromeliads will be purchased from PineGrove by the group with the lucky winners of these plants to be drawn from a hat (like a door prize). Of course, those members wishing to bring a plant as a gift to add to the draw or to gift swap with others can certainly do so.

The October raffle contributed $133 to the bank account whose balance stood at $709.65 prior to the meeting. Thank you to all concerned.

Before the competition announcements were made, Kay and Ross made a plea for more people to get involved in the competitions, after all it was the members who sort to add a Novice section to the competition. From all the grunts and general noises of approval, it would appear that the competition tables for next month will be groaning under the weight of potted broms.

Members' Show and Tell

Dawn brought in a pup from a brom she was given from a Brisbane Bromeliad show. It was a *Nidularium rutilans* cultivar known as *Nid.* 'Leprosa'. This plant had previously gone under the name *Nid. regelioides* 'Spotty' but then became *Nid. rutilans* 'Spotty', the spotty being a nursery name. Her next two plants turned out both to be *Aechmea organensis*. The smaller of the two being previously called *Ae. gracilis.* (article p.14)

Work continues on Marie's ? *Quesnelia edmundoi* var. *rubrobracteata* (see FNCBSG NSW Newsletter Oct. 2012 p.16). Thus far no success.

In the FNCBSG NSW Newsletter Sept. 2012 p.16, Shane's *Neo*. "Dr. Lecter" did not bear the tag of unregistered (editor's error). In spelling 'Lecter' as he did, Shane has pointed out the possible spelling error in the original naming of *Neo*. 'Hannibal Lector' (editor's underlining). Apparently the question may be asked of Chester Skotak as to whether or not the original spelling needs to be changed.

Ross mentioned the x *Biltanthus* article on p.6 of the October newsletter, which was following up on the article on p.5 of the September newsletter. This is good updating information which may be published in the next BSI journal.

Laurie displayed a *Vriesea* which he bought from PineGrove in July 2010. The multi-branched inflorescence can be red and orange or orange and yellow. Marie believed it to be *Vr*. 'Tiffany' which in all probability it is. (photo p.8)

Ross next referred to some past discussions involving *Vriesea* 'Highway Beauty' and *Vriesea* 'RoRo'. A third plant *Vriesea* 'Slow Lane' (unregistered) was introduced by Meg more than a year ago, as having been sold on e-bay. The plant was reported to be a very slow grower. However it was believed to be *Vr.* 'Highway Beauty', and therefore no need for the name 'Slow Lane'.

Recently the name *Vr*. 'Slow Lane' an albo-marginated plant (still unregistered) was reintroduced on Planet Bromeliad by Jacob Koning of Port Macquarie. Jacob believes it is a distinct plant with floral differences between it and both *Vr.* 'Highway Beauty' and *Vr.* 'RoRo'. Jack has been asked to explain and show the differences, because if he is correct the plant needs to be registered.

For the record again, *Vr*. 'Highway Beauty' is albo-marginated (*Vr. platynema* x *Vr. saundersii*), *Vr*. 'Highway' is the plain green version of 'Highway Beauty', *Vr.* 'RoRo' is the variegated version (*Vr. saundersii* x *Vr. platynema'*) and *Vr*. 'Shiraz' is also plain green and never throws variegated pups. Now what has to be sorted out is *Vr.* 'Slow Lane' and *Vr.* 'Laser' (also unreg.). The latter has reportedly skinny white lines on each leaf, yet consistent appearance of this feature appears lacking, and so the plant is probably 'RoRo'.

Dawn showed an *Aechmea fasciata* showing typical wrinkling which may indicate the presence of double chromosomes. These plants generally are spineless and produce at a faster rate, and have a larger flower head. Double chromosomes are produced when colchicine (very toxic) is introduced during cell division. The majority of seed die, but those that survive have double chromosomes. Because of the wrinkling these plants tend to quill readily, so they need plenty of room, more moisture and foliar feeding. This is fairly typical of the recent *Ae. fasciata*, not so for the older plants. Ross related the story where a very badly quilled *Neoregelia* was put aside after watering and feeding, and then produced three good pups. These pups turned out to be *Neo*. 'Lilac Prince' (yet to be registered). So don't throw away your quilled plants, you never know your luck.

Laurie moved to Ballina some 17 years ago. He had brought with him several Alcantareas. Currently some of his *Alc. extensa* are flowering. He stuffs hanks of *Till. usneoides* into the tank and it hangs off the inflorescence as it grows.

Ross displayed a quaint little *Aechmea carvalhoi* which is an endemic to Brazil, it was discovered by the botanist André Maurício Vieira de Carvalho in a rainforest area of Bahia State in 1989. It prefers a humid environment with plenty of light.

Dr André Maurício Vieira de Carvalho (1951 - 2002), curator of the Herbarium of the Centro de Pesquisas do Cacau (CEPEC) in Ilhéus, Bahia, Brazil.
He died in his sleep of tuberculosis on 16 November, 2002. He was buried the same day in Pontal, Ilhéus, where he was born on 5 October, 1951.
André was one of the most productive plant collectors ever in Bahia, with over 7,200 numbers, mostly collected in Bahia.
His legacy is the CEPEC hebarium, the largest in north eastern Brazil and one of the best curated herbaria in the country.
In his honour, the CEPEC herbarium has been renamed the Herbário André Maurício de Carvalho.
Ref: http://homepage3.nifty.com/~ttera/collection/Aechmea_carvalhoi.htm
http://mailman.nhm.ku.edu/pipermail/taxacom/2002-December/042151.html
Eltom M C Leme - JBS Vol.39, 1989, Pereira & Leme 1989
Reprinted in part from the Hunter District Bromeliad Society inc. December 2011.

For those who didn't know him from previous visits, Warren was introduced by Ross. Prior to his demonstration, Warren passed around photographs of some of his displays at various shows around the country. What a remarkable collection of displays. This year Warren was invited to the Royal Easter Show, where he received a 'Highly Commended' Certificate for his work. Congratulations to Warren. Warren first spoke about what was needed by way of implements and materials, and for his demonstration Warren's floral art included one traditional piece and one piece as a modern arrangement (see photo p.8). No matter how many times we watched Warren work as well as receiving his 'how to' instructions, most would find it difficult if not impossible to replicate his work. Many thanks to Warren for so generously donating his time and effort, and of course for the beautiful and remarkable results he achieved.

Aechmea organensis by Derek Butcher, Nov 2005.

This is a very popular species from the subgenus *Ortgiesia* and comes in many sizes. Ever since Peter Franklin and I presented a paper at the Perth Conference in 1997 we have dithered about whether some may need cultivar names. Even at that time we had the Queensland form and NSW form which could only be identified when flowering side by side. The Queensland form having a more reddish tinge to the ovary. We already had the form that got named as *Aechmea* 'Derek's Organensis Ha Ha' which stemmed from Grace Goode in 1989 and has already been written about. See http://fcbs.org – Uncle Derek says. Interestingly, current photos from Brazil suggest that this may well be within the species description of *Ae. organensis*.

We had Harry Luther point out that the plant we were growing as *Ae. gracilis* was really a small form of *Ae. organensis* (see 'Bromeliaceae '#3. 1999). The true *Ae. gracilis* is not in Australia because nobody has imported it yet. It was in limited supply at Tropiflora and is apparently self sterile because I have been unable to acquire seed! What has happened to the name tag on the many plants that are around? I'll bet they still say *Ae. gracilis* because *Ae. organensis* 'Small form' takes too long to write.

Recently the name *Aechmea* 'Coral Beauty' has been coined by Olive Trevor and had been happily growing as a medium sized *Aechmea organensis* for the past 10 years. Peter Franklin has it under PAF1739.

We should now bite the bullet and call the small form 'Graceful' which is a minimal change from '*gracilis*'.

ALL of these are linked under the species name *A. organensis* because as far as we can gather they are not hybrids – per se – but forms of a very variable species.

This is not just an Australian problem because we know the wrongly identified *Aechmea gracilis* plants were at least sold by Pineapple Place in Florida and these should be corrected to 'Graceful'.

For additional information / article on FCBS in:
"Uncle Derek Says"
Aechmea gracilis

Photosynthesis 3 by Don Beard

This is the final talk in a series of three on photosynthesis. An alternative title may well have been " Photosynthesis for Bromeliad Gardeners". Previous articles can be seen in FNCBSG(NSW) Newsletters Apr. 2012,pp 6-7; July 2012, pp10-14. In this article the CAM photosynthetic pathway and CAM plants are discussed. CAM is an acronym for Crassulacean Acid Metabolism, meaning the type of acid metabolism found in the Crassulaceae, a family of succulent plants. It was developed as an adaptation to arid conditions. Briefly the CAM pathway involves the plant shutting stomata during the day to reduce water loss, opening them at night to collect CO_2, and storing the CO_2 as the 4C molecule malic acid. Then the next day with the stomata shut, CO_2 is reproduced and used for photosynthesis. The malic acid gives the leaf of the CAM plant a bitter/acid taste during the night which disappears during the day.
The term CAM is generally attributed to Thomas and Ransom in 1940, but 2000 years ago the romans noticed the distinctive acid taste that CAM leaves have at night. However it wasn't until the early 1930's that the process was suspected, and then verified during the 1940's. The process was almost completely understood by1980. Examples of CAM plants include bromeliads, orchids, cacti and Jade plants. Most are epiphytes or succulents.

Mechanism

CAM probably developed as a two part (day/night) 24 hour cycle as an adaptation to increased water efficiency. At night during lower temperatures the stomata open and atmospheric CO_2 enters and is fixed in the spongy mesophyll cells by an enzyme reaction (PEPC) forming HCO_3. Malate is produced which synthesises malic acid to be stored in the cell's vacuole over-night (remember it is dark and no photosynthesis can occur without sunlight).

Night $CO_2 \rightarrow HCO_3$ (with PEPC) $\rightarrow$ Malate $\rightarrow$ Malic acid (in vacuole)

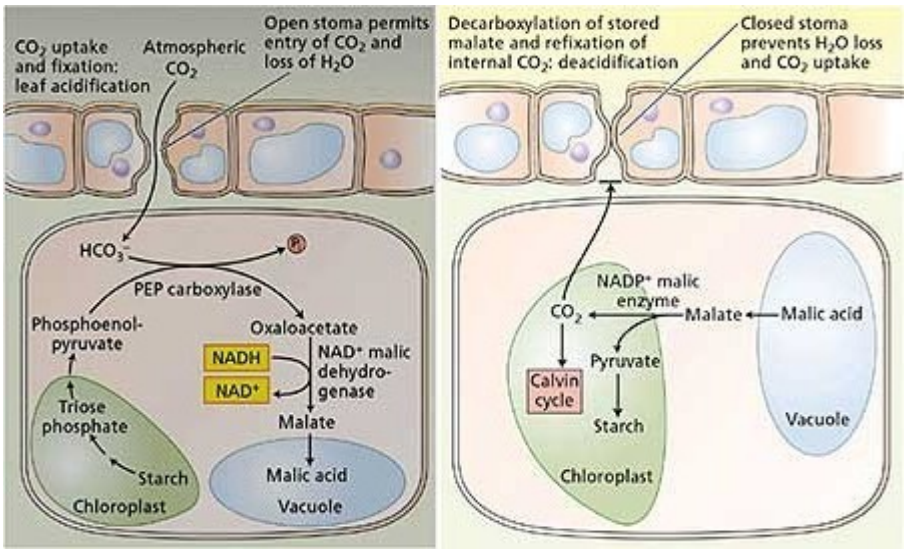
At dawn the stomata close, the malic acid moves from the vacuoles, is converted to malate and decarboxylated in the chloroplasts into CO_2 and PEP. The CO_2 concentrates around the enzyme RuBisCo and photosynthesis via the Calvin cycle results.

Day Malic acid $\rightarrow$ Malate decarboxylated $\rightarrow$ PEP + CO_2 (for Calvin cycle)

In the late afternoon the stomata open and this day/night cycle repeats.

The water efficiency of this process is demonstrated by the fact that C3 plants lose 97% of their water by transpiration whereas CAM plants loose little to none. All this is achieved by just shutting the stomata during the day.

Night **Day**



CAM Types

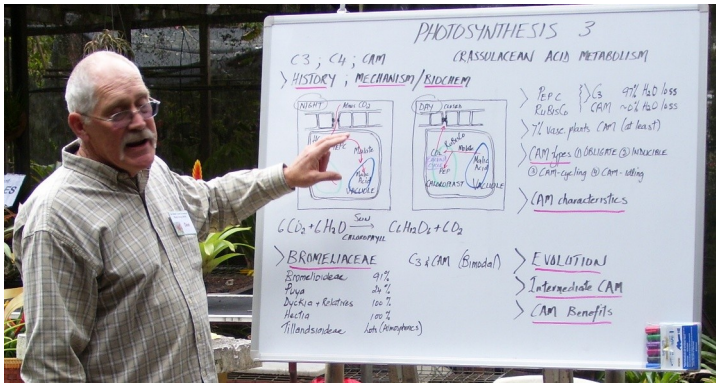
Obligate (Constitutive). Night uptake of CO_2 occurs at all times i.e. only the CAM photosynthetic pathway is used by the plant.
Inducible (Facultative). These plants only use CAM when stressed, and can switch from C3/C4 to CAM, depending on the environment.
CAM Cycling. With these plants the stomata don't open at night. The plants have to recycle the CO_2 produced by respiration. These are usually well watered plants that keep their stomata open during the day. Benefits of this type of CAM are not at all obvious. This may be a precursor to CAM Idling.
CAM Idling. This photosynthetic pathway is used by plants which are often drought stressed. With these plants, the stomata are closed both day and night. Here as with CAM Cycling there is night time assimilation of respiratory CO_2. The benefit here is that metabolism continues during severe drought. These plants usually have a rapid response to rain showers.

Plants using the last three CAM types are usually found in areas where water shortage alternates with water excess. Epiphytes and lithophytes also use these pathways. Often the benefit of continued metabolism (survival) is at the expense of quantum yield (growth).
Plants which can switch photosynthetic pathways between CAM and C3 depend on environmental factors for the switch e.g. plants under water stress will switch to CAM as will plants under saline stress. Plants which are dry then exposed to moisture switch to C3. Note some C4 plants can switch to CAM (no bromeliads use the C4 pathway). Some plants express CAM in their stems and branches. With CAM photorespiration is limited, transpiration is limited and so water efficiency is at least five times greater than for C3 and C4 plants.

Canistrum triangulare - Marie Essery
1st Open and Judges Choice

Aechmea luddemanniana
1st Novice - Kay Daniels

Vriesea 'Tiffany'



Don Beard presenting Photosynthesis 3, CAM.

Floral Art by Warren Hulbert

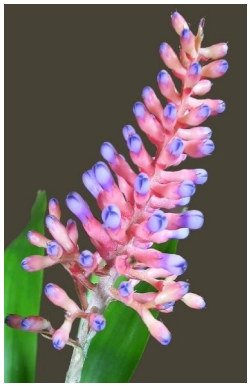
Nid. 'Leprosa' note spotting on bracts

Vr. 'Slow Lane' (unreg.) JK

Vr. 'Highway Beauty'

Ae. organensis

PAF 1739



Ae. 'Coral Beauty'

Ae. 'Graceful'

Aechmea carvalhoi

Ae. fasciata showing some wrinkling

Photo's supplied by: Ross Little, Jacob Koning, Ian Hook and Derek Butcher.

CAM Plants and Their Characteristics

* Of the vascular plant species, some 7% or 15,000-20,000 species, 300 genera, and 40 families are CAM plants (this is considered an under-estimate). As stated previously the majority of CAM plants are either epiphytes or succulents, although just about every other growing environment is represented. Most are angiosperms (flowering plants), and CAM species are five times more numerous than C4 species.
  There are a number of factors which influence the degree of CAM photosynthetic pathway, and these include salinity; pollutants, these decrease the nocturnal CO_2 uptake; nutrient availability; increased CO_2, which increases the malate; the light level; oxygen; air vapour pressure; temperature; water stress, which influences the enzyme type and volume; nitrogen etc.

* CAM plants often show xerophytic characters which include; thickened and reduced leaves, which have a low surface to volume ratio; thickened cuticles; sunken stomata; trichomes; and many CAM plants shed their leaves in the dry season.

* Because of the controlled use of CO_2 and water, the photosynthetic process is protected from CO_2 and water stresses; few other plants can survive such extended neglect….my kind of plant. The following characteristics belong to all CAM plants:

* CAM plants can separate the photosynthetic light and dark processes.

* Large vacuoles; reduced intercellular air-space; increased cell size.

* Because the CAM primary driver is the frugal use of water, CAM plants have meagre photosynthetic rates, and hence suffer a yield (growth) penalty. CAM plants need more energy to fix CO_2 than C3 or C4 plants. C4 plants have the highest growth rate of all land plants, whereas CAM plants are amongst the slowest growing on earth. C3 plants grow predominantly at night, but CAM plants maximum growth rate is in the middle of the day.

* Net CO_2 exchange is inhibited by surface wetting. This is a clue on when <u>not</u> to water your CAM broms, since exchange occurs at night.

* The more the stress the higher the usage of CO_2 recycling, so that the photosynthetic process is little affected by drought.

* CAM plants fix CO_2 15% more efficiently than C3 plants, but 10% less efficiently than C4 plants.

* The CAM pathway involves a temporal concentration of CO_2 around the RubisCo enzyme, whereas the C4 pathway involves a spacial concentration of CO_2 about RuBisCo.

Bromeliaceae

Bromeloideae	91%
Puya	24%
Dyckia and relatives	100%
Hectia	100%
Tillandsioideae	28%
nearly all the atmospherics	

69% of the Bromeliaceae are CAM plants or CAM-C3 (meaning depending on the conditions can convert to either). Obviously then, 31% are C3 plants. There are no C4 plants in this family. The table highlights which broms are CAM within the family. There may well be some alterations/additions to this list as time passes, however because of the fairly clear determination process of whether a plant is C3 or CAM, they are unlikely to be numerous.

Note that the Orchidaceae has more CAM species than any other plant family. As a generalization, those bromeliads which are atmospheric Tillandsias, or tank bromeliads with trichomes and stiff leaves are CAM plants. C3 plants have softer leaves and live in shaded and less stressful habitats. However there are many exceptions and the photosynthetic pathway is difficult to identify with morphology alone. The experts have done it by identifying the prevalent enzyme (major carboxylating agent) in the brom. RuBisCo for C3 broms and PEP for CAM broms.

CAM is a means for successful colonization of different habitats, particularly the stressful habitats such as arid, sandy, salty, rocky, and high and low light, together with the habitats of epiphytes and lithophytes. It is probable that CAM is more of a survival mechanism than a biomass increaser. CAM is enhanced by drought.
A couple of interesting points regarding CAM broms, are that water on the leaves appears to prevent the uptake of CO_2 because the trichomes become bloated and flattened and block the stomata. Also the leaves contain a pigment called zeaxanthin that prevents photo-damage (sunburn) to the photosynthesis apparatus.

Evolution

CAM has evolved convergently many times i.e. the same biological trait is the end result in different or unrelated lineages. In the Bromeliaceae it has evolved at least four times in response to climatic and geologic changes since the late Tertiary (2.5 million years).

Within the subfamily Tillandsioideae C3 is plesiomorphic (ancestral) and CAM has developed later in most extreme epiphytes. In the subfamily Bromelioideae CAM predates epiphytism with subsequent radiation into less xeric habitats and with reversion to C3 in some taxa. Thus we have gained and lost CAM in evolutionary history. The evolutionary trend, terrestrial to epiphytic is closely linked to the elaboration of absorptive epidermal trichomes that are characteristic of the family. CAM broms come in all shapes and sizes, i.e. they are extremely diversified, from soil rooted terrestrials to rosulate tank broms which impound both water and nutrients, to rootless extreme epiphytes which are independent of the substrate.

To sort out a more precise evolution of CAM within the Bromeliaceae one needs a robust phylogeny (evolution) for the family based on molecular (genetic) and morphological characteristics, something which needs more work and is unavailable at present. Consequently many taxonomic relationships remain controversial. Since it is not possible to assign precise chronology to the family's history it is equally impossible to construct the history for CAM in the Bromeliaceae. However one thing is clear, and that is CAM is a 'Key Innovation' associated with the success of broms and their adaptive radiation into more xeric (arid) habitats.

The Bromeliaceae are relatively young but almost completely absent from the fossil record. There is a single report of a *Tillandsia* type pollen from the upper Eocene (approx. 35 m.y.). Because this is a fairly dubious piece of evidence, scientists have reverted to other means to establish a beginning and develop a history for the Bromeliaceae. Because of the neotropical distribution of broms the conclusion is drawn that the beginning must have come some time after the western Gondwana break-up, and with the separation of South America and Africa sufficient to prevent biological exchange (approx. 85m.y.). There are plant fossils in other families related to the Bromeliaceae (Order Poales), perhaps also the Bromeliaceae emerged at this time in the early Tertiary (65 m.y.). All this is inconclusive and no date of origin or family history for the Bromeliaceae has as yet been established. Thus far it is all surmise.
However some help is gained by the mainly Andean distribution of *Puya* and the abundance of Tillandsioideae in northern Peru, Equador and Colombia suggesting diversification and radiation into new habitats formed during the Andean mountain building episodes from the Miocene to the Pliocene (23-2.5 m.y.). Certainly the declining concentration of CO_2 in the Tertiary would have favoured the emergence of the CAM pathway in broms, as it did for the C4 pathway.

It is appropriate at this stage to mention the remarkable epiphyte *Guzmania monostachia*. Appropriate because the plant may have evolutionary implications, and remarkable because it has an intermediate photosynthetic pathway between C3 and CAM Idling. There are other species of other genera which may possess this trait but as yet they are undocumented. *Guz. monostachia* when well watered is a C3 plant and when confronted with drought conditions reverts to the CAM Idling pathway. Suffice it to say there are functional differences along the length of its leaves and resultant divisions of labour which aid this process. CAM Idling is induced by drought stress very quickly (after seven days verses 150 days for an *Aechmea* species) and since this extremely efficient pathway is seen as a survival mechanism, we have one special plant.

CAM Benefits

* The shutting of the stomata during the day leads to greater water efficiency. This is particularly useful for seasonal and intermittent water supply.

* The CAM pathway keeps the metabolism going in stressful conditions. This is a survival mechanism rather than a biomass or growth producer.

* The pathway provides maximum CO_2 uptake, minimum photorespiration, and minimum transpiration.

* There appear to be four CAM clades (a single ancestor and all its descendants), in the Bromeliaceae which all have greater species richness and diversity than the C3 clades.

* CAM plants are very tough and can survive extreme conditions leading to successful colonization of different habitats. They are very competitive and cling to keeping the metabolic processes alive.

* CAM is the first case of a physiological attribute being a 'Key Innovation' in plants.i.e. evolution of the CAM photosynthetic pathway and the ensuing colonization of arid and other extreme environments, has promoted taxonomic diversification in the Bromeliaceae.

References: In an attempt to explain the CAM photosynthetic pathway in mostly layman's terms (some technical terms are unavoidable), the article comprises information from the following scientific articles and internet pages. Just reinventing the wheel.

Black C. C. and Osmond C.B. 2003. *Crassulacean acid metabolism photosynthesis: 'working the night shift'.* Photosynthesis Research 76: 329–341.

Borland A.M. et al 2011. *The photosynthetic plasticity of crassulacean acid metabolism: an evolutionary innovation for sustainable productivity in a changing world.* New Phytologist 191: 619–633.

Crayn D.M. et al 2004. *Multiple origins of crassulacean acid metabolism and the epiphytic habit in the Neotropical family Bromeliaceae.* PNAS .101 No.10: 3703–3708.

Cushman J.C. and Borland A.M. 2002. *Induction of Crassulacean acid metabolism by water limitation.* Plant, Cell and Environment 25, 295–310.

Freschi L. et al 2010. *Specific leaf areas of the tank bromeliad Guzmania monostachia perform distinct functions in response to water shortage.* Journal of Plant Physiology 167: 526–533.

Haslam R. et al 2003. *Physiological responses of the CAM epiphyte Tillandsia usneoides L. (Bromeliaceae) to variations in light and water supply.* J. Plant Physiol. 160: 627–634.

Martin C.E. 1994. *Physiological Ecology of the Bromeliaceae.* Botanical Review, Vol. 60, No.1: 82

Nelson E.A.and Sage R. F. 2008. *Functional constraints of CAM leaf anatomy: tight cell packing is associated with increased CAM function across a gradient of CAM expression.* Journal of Experimental Botany, Vol. 59, No. 7: 1841–1850.

Nobel P.S. 1991. *Achievable productivities of certain CAM plants: basis for high values compared with C3 and C4 plants.* New Phytol. 119: 183-205.

Pierce S. et al 2002. *The role of CAM in high rainfall cloud forests: an in situ comparison of photo synthetic pathways in Bromeliaceae.* Plant, Cell and Environment 25, 1181–1189.

Quezada I. M and Gianoli E. 2011. *Crassulacean acid metabolism photosynthesis in Bromeliaceae: an evolutionary key innovation.* Biological Journal of the Linnean Society, 104: 480 – 486.

http://www.ag.unr.edu/cam/education.aspx
http://en.wikipedia.org/wiki/Crassulacean_acid_metabolism
http://plantsinaction.science.uq.edu.au/edition1/?q=content/2-1-6-crassulacean-acid-metabolism-cam
http://www.marietta.edu/~biol/biomes/photosynthesis.htm
http://wc.pima.edu/~bfiero/tucsonecology/plants/plants_photosynthesis.htm

WHY BROMELIAD ?

Lyman B. Smith BSI Journal 1951 V1(2)

Obviously "Bromeliad" is simply a shortening of the scientific name "Bromeliaceae" to indicate any member of the Pineapple family. We might call them all pineapples since they are members of that family, and not bother to find a new term. However, it would cause confusion to associate such diverse forms as the giant *Puya* and the Spanish moss under a name for which we have already a sharp and narrow concept. As the Bromeliaceae were unknown before the discovery of America, we did not have any such ancient general term for the family as there was in the case of grasses, sedges, lilies or orchids, and one had to be manufactured.

It is not possible to say now who first coined the word "Bromeliad" but it was probably some fairly recent botanist or horticulturist who was tired of having to use the phrase "species of Bromeliaceae" after the cumbrous and stately fashion of the old school. French and German botanists of the nineteenth century regularly used such single words for members of one family, had a standard way of making them, and seemed to find nothing undignified in the process.

The second step in tracing our genealogy is to find the origin of "Bromeliaceae" and this is very clear. With few exceptions the scientific name of a plant family is derived by combining the name of one of its genera with the ending "aceae." Thus in 1805 the French botanist, Jaume Saint-Hilaire, defined the Bromeliaceae and formed the family name from the genus *Bromelia*.

Our next step takes us back to Linnaeus the father of systematic botany for he it was who established the genus *Bromelia* in 1754 according to the rules we now follow in making scientific names. The name was taken from the family name of Loofa Bromelius, a Swedish botanist. Since Linnaeus also was Swedish, we might at first suppose that he had named the genus for a friend, but Bromelius died before Linnaeus was born.

Actually it was Plumier, the early French explorer of the West Indies, who first had the idea of renaming for Mr. Bromelius the genus that previously had gone by the Indian name of Karatas, and Linnaeus so credited it. Plumier was on familiar terms with the genus *Bromelia* in the West Indies. Bromelius, on the other hand, was famous mainly for the fine Flora that he wrote for his home town of Goetheborg and it is by no means certain that he ever laid eyes on a single plant of the great group that was to bear his name.

Associate Curator, Div. Phanerogams, Smithsonian Institution.

A few years ago, in a conversation with Dr. Lyman B. Smith, the matter of a common or nick-name for bromeliad came up. It was his feeling that we should agree, if possible, on the use of *one* common name. After considering them all he thought that if the word bromeliad was to have a more simple form it should be "bromel." As the family was named for Bromelius, so the word bromel seemed the most apropos as the abbreviated form. *M.B.F*

A Tribute to Harry Luther (1952 – 2012)

Born and raised in St Petersburg, Florida, USA, Harry was Director of the Mulford B. Foster Bromeliad Identification Center at Marie Selby Botanical Gardens in Sarasota, Florida, as well as curator of living collections. Throughout his career there, he had identified and named more than 180 species of bromeliads and was responsible for managing the growth and propagation of the enormous diversity of species at Selby Gardens.

His involvement extended across the world through his participation in many global Bromeliad Societies such as the Brazilian Bromeliad Society, Japanese Bromeliad Society, Sarasota Bromeliad Society and the Florida Council of Bromeliad Species. With over 200 published articles in hobbyist and scientific journals to his name, he was also recognised as a major contributor to many books and as a scientific and editorial advisor to several journals such as the Journal of the Bromeliad Society International and The Cryptanthus Society Journal. In 2009, he co-authored “Native Bromeliads of Florida”.

Harry's pre-eminence in the world of bromeliads, however, unfairly obscures the fact that he was truly an all-round plants man with a wide and deep knowledge of the Plant Kingdom. In 2010, he joined Gardens by the Bay in Singapore, bringing with him more than 30 years of experience in the field of botany and horticulture. As a member of the Gardens’ senior staff, he was responsible for directing the horticultural research and providing curatorial inputs and guidance for the Gardens’ anchor plant collections.

Harry played a crucial role in building up the Gardens’ collection of bromeliads and epiphytic plant materials, as well as coordinating their preparation for incorporation in landscape displays. The bromeliad-dominated vertical gardens cladding the 18 Supertrees, as well as the green wall planting cloaking the mountain in the Cloud Forest, are living legacies of his contributions, at a larger than life scale befitting his immense involvement in the Gardens.

Regrettably his short time at Gardens by the Bay did not allow fulfilment of his dream of seeing more epiphytes naturalistically mounted on trees throughout the Gardens. However his enthusiasm has inspired the colleagues he has sadly left behind to work at achieving his goal.

Harry passed away on 17 October 2012. He will be fondly remembered as a quiet, unassuming man with fatherly patience to coach his younger colleagues or the public who were keen to learn. Other endearing traits included his dry sense of humour, love of cats, and playing the role of a thoroughly convincing Santa Claus at a staff Christmas party.

"Harry Luther was one of those individuals you meet in life who you grow to know, like, respect and care for. He becomes intrinsically woven into your fabric of life, and when he leaves, your fabric is rent. You become that bit less. And that was Harry."

Dr Kiat W Tan CEO, Gardens by the Bay

Novice Popular Vote

1st	Kay Daniels	*Aechmea lueddemanniana*
2nd	----------	

Open Popular Vote

1st	Marie Essery	*Canistrum triangulare*
2nd	Laurie Mountford	*Vriesea ospinae var. gruberi*
3rd	----------	

Judge's Choice

1st	Marie Essery	*Canistrum triangulare*

Comments from the growers:

Marie's *Canistrum triangulare* with lovely leaf stack was bought from PineGrove as an unpotted pup some 12 months ago. It grows under 70% beige shade cloth and is fed with slow release fertilizer. This was a very nicely grown plant showing good conformation.
Laurie's *Vr. ospinae* var. *gruberi* is one of a batch of four, one of which Laurie has shown successfully at the Woodburn Orchid Show. This plant grows under 70% shade cloth where it is watered regularly. Another nice plant by Laurie.
Kay's *Ae. lueddemanniana* grows in her shade house under 70% mesh. She acquired it from Trish about a year ago, since being in Kays care this plant has matured into a fine specimen worthy of being presented on any show table.