Mark Dimmit Desert Plant Conservatory Tour

Introduction and Welcome (at desert roses)

- The Mark Dimmitt Desert Plant Conservatory houses a variety of cacti kept in a controlled environment, and is dedicated to the renowned botanist, Mark Dimmitt.
    - This greenhouse is used for propagation of cacti for the USS Arizona Memorial located on the UA mall
    - As well as to help educate students about the care and maintenance of our cacti and succulents.
    - The greenhouse is currently home to over 100 unique species in 14 families, emphasizing some unusual botanical specimens that Mark Dimmitt personally values.
- Mark Dimmit biographic overview. What was his role in this conservatory? Why has it been named after him?
    - Had shown a love of plants since his adolescence, especially orchids. However, while studying zoology at UCLA, he discovered a mysterious plant hidden away in a university greenhouse that piqued his curiosity, an Adenium.
    - Nearly all Adenium flowers are pink, but due to Dimmitt's unwavering commitment, a red one emerged following three generations of crossings of the deepest pinks he could find. Years later he eventually bred the first red hybrid Adenium, which he named Crimson Star.
    - Crimson Star became incredibly popular once it reached Asia. Available in countless nurseries, thousands of Dimmitt's hybrids were available for sale.
    - Dimmit's personal greenhouse boasts more than 10,000 plants, and it takes him about five to six hours every day to water. Adeniums aside, he's created more than 200 colorful cacti hybrids with names like Apricot Glow (there is one found in our greenhouse)
    - Many of the plants in the collection have been donated by Mark himself and show his personal love of peculiar plant specimens.
        - ***Euphorbia abdelkuri***
        - ***Adenium arabicum* 'Hansoti Dwarf'**
        - ***Tillandsia usneoides***
        - ***Tillandsia ionantha***:
- Brief mention of species in this greenhouse contributed by Mark himself (Desert roses highlight, and transition to Tillandsia species highlight) (Highlight other contributions outside of adenium/tillandsia as you move throughout the tour)

Sources:

The Mark Dimmitt Desert Plant Conservatory | University of Arizona Campus Arboretum

Meet the obsessive botanist who became king of rare specimens | Arizona | The Guardian

Ice breakers and foundational knowledge:

Quick break up, allow everyone to do a brief loop, don't use qr codes, just observe.

Very weird looking plants right? Can anyone say why that might be (*adaptations)?* Can anyone describe or give an example of an adaptation? Many factors make life in arid climates challenging for plants, can anyone name some environmental characteristics to which a desert plant may need to adapt? (*Light intensity, predation, xeric environment*). Disperse and look for adaptations and regroup for discussion.

Break into groups assign different plants for each group to find, identify adaptations (don't use qr codes for this exercise, its meant to get everyone thinking, try to observe and guess!), what characteristics does each grouping of plants share? What characteristics are unique to each of them? What do you think these adaptations are for in an arid climate?

- ***Group 1:*** *Agave applanata 'Cream Spike', Agave montana, Agave parryi, Agave univittata 'Quadricolor'*
  - *Spined leaf apexs (predation adaptations)*
- ***Group 2:*** *Crassula ovata, Euphorbia lactea 'cristata', Echeveria agavoides*
  - *Color change (light intensity adaptation)*
- ***Group 3:*** *Curio rowleyanus, Fenestraria rhopalophylla (Most challenging)*
  - *Epidermal window & rotund leaves (light intensity, reduced leaf surface are to prevent water-loss)*
- ***Group 4:*** *Kalanchoe behariensis, Crassula Congesta*
  - *Trichomes on foliage (moisture retention, may also be for light intensity)*
- ***Group 5:*** *Mammillaria glassii & Mammillaria plumosa*
  - *Covered in thick spine coverage or fur to help reflect the sun and protect from over-exposure*

Examples of adaptations

- Light Intensity:
  - Trichomes/apex wool and spines reduce light exposure through partial shading and reflection of light, also break up drying winds across the leaf surface.
  - Carotenoids: some succulents can naturally adopt a reddish coloration on their leaves, often at the margin/tips, when exposed to full sun or extreme heat. The plant is responding to intense light/heat by producing a red pigment (carotenoids) to protect itself from sunburn.
- Drought, Extreme Temperatures:
  - Smaller leaves have reduced surface area; thus they don't become as heat stressed as a larger leaf.

    - Some desert plants are drought-deciduous, only producing leaves during the rainy season, and shedding them during drought to reduce water loss.
    - Shallow and widespread root systems allow desert plants to absorb as much rainfall as possible in a short duration.
- water-loss:
    - small and thick succulent leaves: reduced surface area decreases moisture loss
    - waxy cuticles keep plants cooler while reducing evaporative loss
    - fewer and smaller stomata, also deep placement in tissues (stomatal crypts) reduce moisture loss from drying winds
    - CAM respiration reduces evaporative loss, keeps stomatal pores closed during the day
- Predation:
    - investment in building tissues is metabolically expensive, in extreme environments plants need a strategic advantage (toxicity, spines) to protect against predation. (Examples: *Opuntia microdasys for spines, Euphorbias for toxicity*)
    - Spines are modified leaf structures for protection, and in turn, cacti evolved to have photosynthetic stems/trunks/pads

Sources:

Plant Adaptations - Teachers (U.S. National Park Service) (nps.gov)

Yecora Region (desertmuseum.org)

Our Plants - Life Science Student Association (uaplantscienceclub.com)

Mammillaria Information - Learn About Growing Mammillaria Cactus Plants (gardeningknowhow.com)

Mammillaria plumosa (llifle.com)

Ethnobotanical uses of plants in the collection

Emphasis on grouped ethnobotanical histories (Euphorbiaceae, Adeniums)

Ethnobotanical uses: The first thought that comes to mind is always about the medicinal uses of plants, usually followed by whether they are edible (and tasty of course). However, the ethnobotanical value of plants extends far beyond this, they are sensory as well, being beloved for their beauty, carefully chosen for being repellent of pests or attractive to pollinators, spiritual/religious/symbolism (Christmas trees/poinsettias for holidays, bamboo for Goodluck, *Haworthiopsis coarctata*), weapons/poison (Adeniums and Euphorbias), landscape design (sensory gardens, shade in hot urban climates, themed gardens). Ethnobotanical use is not restricted to how they can be physically used only, but also how they make us feel.

Activity: What are some plants you can think of that have an ethnobotanical use? Do you have any that are significant for you personally? Break away into pairs and try to find at least one plant with a unique and interesting ethnobotanical purpose (use qr codes), reconvene and discuss.

Examples to Highlight

- *Apocynaceae*:
    - *Adenium Swazicum*: Toxic sap is produced from the trunk and has been used by African tribes to poison arrow heads, kill parasites, and treat heart failure or skin disease when diluted. This milky sap is characteristic of all Adeniums, other species such as *Adenium obesum* and *Adenium arabicum* have been used for similar purposes.
    - Highlight of *Adenium* 'Hansoti dwarf' (Mark Dimmitt accession, very rare piece in the collection)
    - Adeniums prove great as ornamentals and are prized for their gorgeous flowers, and unique caudex, and twisting bonsai-like growing habit
- *Euphorbiaceae*
    - *Euphorbia grandicornis* (cow's horn succulent): possesses diterpenoids with anticancer and cytotoxic abilities.

    - *Euphorbia flanagani* (Medusa's head succulent): commonly used as a purgative in traditional African medicine, often prescribed to pregnant women. Many species in the Euphorbia genus have been used as purgatives.
- *Asophodelaceae*
    - *Hawothiopsis coarctata* (spiritual significance) In the past, this species was used as an intelezi plant to ward off evil spirits and confer bravery to soldiers in battle. It has also been used in mathithibala (love-binding spells), to develop mutual love in treated individuals.
    - Aloes (medicinal uses for burns, toothaches, and hemorrhoids)
- *Bromeliaceae*
    - *Tillandsia usneoides*: excellent bio-indicator of air quality, used in the detection of metal pollutants. Since they receive all their nutrition from the air, the concentration of pollutants observed in its tissues correlates to the concentrations found in the atmosphere they inhabit.

Sources:

Our Plants - Life Science Student Association (uaplantscienceclub.com)

Euphorbia Plants are not Cacti - So What are They? - A Natural Curiosity

Taxonomy and identification

Move to *Tillandsia* species

- Ice breakers, ask crowd about their knowledge of "air plants", the *Tillandsia* genus, and give facts on these species
- Story of Dr. Tillands (genera namesake for them): The genus name for these plants was a playful nod to the Swedish botanist Dr. Elias Tillands, who was said to be extremely afraid of water. Plants of the genus Tillandsia are all epiphytic, residing high in the trees, seemingly avoiding water. (Overarching message: to explain how often times a species' genus/specific epithet conveys different meanings as well as relations. This will be useful for exploratory exercise.)
- Family names group different genera of plants that are closely related, genera group species that are very closely related, and an individual & distinct species is designated by the genus name followed by a specific epithet. The specific epithet can pay homage to the individual who discovered the plant, *Curio rowelyanus* (Specific Epithet named for British botanist, Dr. Gordon Douglas Rowley), give information about its origin, *Euphorbia abdelkuri* (origin: endemic to Abd al Kuri Island, Yemen) or say something about a characteristic it possesses, *Mammillaria plumosa* (bird's feathers/plumage).

Taxonomy exploratory exercise

- Example of *Curio rowelyanus, Curio repens*, and *Sedum morganianum*. Using their common names, query about what these plants have in common morphologically, and ask which two of the three the group think are more closely related? People will most likely pair *Curio rowelyanus* and *Sedum morganianum* together due to their pendulous growth habit, however they are not closely related! Not only do they belong to different genera, but they also don't even belong to the same botanical family! Explain how morphological similarities are often a tool for identifying related species but can be misleading.
    - *Fouquieriacea* vs. *Dideriaceae*
        - *Fouquieria splendens* vs. *Alluaudia procera*: Ocotillo vs Madagascar ocotillo, extremely similar in morphology and growth habit but no relation. Example of convergent evolution.
        - Convergent evolution: species independently evolve similar morphology in response to similar selection pressures and environmental conditions, despite very distant relation. (*Euphorbiaceae* vs *Cactaceae*)

Activity: Free exercise to explore the 14 different plant families (use qr codes), and observe the similarities that group them, take note of the Latin names! Look for root-words and see if you can discover why it may have gotten its name.

Sources:

Fouquieriaceae (ocotillo family) (desertmuseum.org)

Convergent Evolution - an overview | ScienceDirect Topics

Our Plants - Life Science Student Association (uaplantscienceclub.com)

Remainder of the time: free exploration, use the QR codes! Say goodbye, thank everyone, ask for feedback (provide index cards)