



Pitahaya Diseases

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California has a Huge Advantage!

In Pitahaya Production

- Our dry climate allows us to grow this fruit without fungicides (at least until something new comes along)
- The tropical countries have to use fungicides on Pitahaya, much like avocado production in tropical countries

Diseases – *Cause for Concern?*

- There is always a cause for concern because everything can become diseased.
- While certain Pitahaya varieties are grown for the quality of their fruit, they will also select for diseases as more acreage is grown.
- We have not experienced Pitahaya cultivation in California during wet winters.

Diseases in California

- Generally, with our dry climate, the diseases are few, however:
- Plants can be damaged by intense light, and this damaged tissue may be susceptible to stem rot caused by a bacterium
- Plants can be damaged by too much water, making them susceptible to root rot caused by several fungi



Cactus Virus X on Pithaya



Image: from Deborah Matthews

Disease Caused by Bacteria

- Soft rots of the stem and blades are caused by *Xanthomonas campestris* and *Erwinia carotovora*
- *Several countries report these as Enterobacteria cloacae (2009). Are they the same??*
- Calcium deficiency in Mexican plantings has been shown to make this problem worse



Soft Rots

- Soft stem rot caused by *Erwinia caratovora* in Taiwan matches a stem rot found in Calif.
- Infection starts from injured areas (sunburn, other diseases spots caused by anthracnose)
- Control includes pruning out dying stems and spraying with copper sulfate —Whitewashing before onset of the problem



Diseases Caused by Fungi

- Dothiorella (*Botryosphaeria*) ★
- Anthracnose (*Colletotrichum*) ★
- *Bipolaris*
- *Fusarium* ??
- *Alternaria*
- *Phytophthora* ??

Botryosphaeria

Brown Stem Spot Disease

- *Botryosphaeria dothidea*
- First reported in Mexico in 2003, Isolated in Ventura County.
- The *Fusicoccum/Dothiorella* stage was isolated in pure culture, re-inoculated and the exact same symptoms were produced.
- Small chlorotic specks which enlarge up to 5 cm in diameter



Botryosphaeria

- Picture is from Thailand



Botryosphaeria Disease Management

- Prune off dead limbs and dispose away from the plantings. Maintain a thick layer of mulch to hasten decomposition of fungi on the ground. Use good sanitation and optimal cultural practices to minimize disease.
- When weather changes from cool to warm, appropriately modify the irrigation program, and pay special attention to irrigation needs during periods of hot weather.



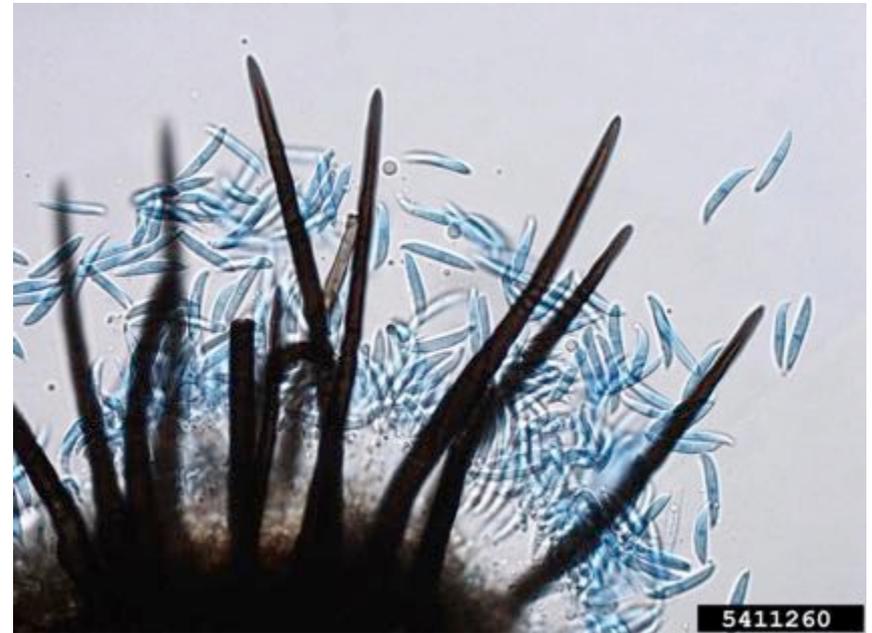
Anthracnose

- *Colletotrichum gloeosporioides*
- Reported in S. Florida in 2007
- Reddish brown lesions with conspicuous chlorotic haloes developed concentrically on the edges of vine ribs.
- Lesion centers became white and coalesced to rot much of the vine column, and in severe cases, only the vascular column in the vine center was not diseased*
- From Palmateer, Ploetz, van Santen and Correll 2007



Management of Anthracnose

- Remove diseased cladodes
- Clean clippers with 10% bleach or use a torch
- If high rainfall and misty wet conditions, apply copper hydroxide prior to wet conditions. Copper will reduce new infections, but will not “cure” an existing infection.





Bipolaris Fruit Rot



- This rot begins as small tan, circular lesions on the fruit surface and as the disease progresses the lesions enlarge and turn black.
- Usually a black felt-like growth of the fungus can be observed on the lesions. Under ideal conditions (warm and humid), the fruit develops large areas of soft rot.



Bipolaris fruit rot

- The lesions are caused by a fungus, *Bipolaris cactivora*. This species causes stem and fruit rot of cacti (including pitahaya) in California, Florida, Europe and Japan.
- Former name was *Helminthosporium*



Bipolaris fruit rot

- The disease is most severe on mature and ripe fruit. While young stems are susceptible to *B. cactivora*, mature stems are relatively resistant to infection.
- *Bipolaris* rot on ornamental cactus is most severe between 75-91 F.
- In general, diseases caused by *Bipolaris* are favored by humid conditions.
- Inoculum sources include diseased plants in the field and crop residue. Conidia are most often spread by wind, irrigation and rain.

Bipolaris fruit rot

- “The high incidence of fruit rot affecting commercial operations in Miami-Dade County over the past 2 years requires an effective disease management strategy.”
 - T. L. B. Tarnowski, A. J. Palmateer, and J. H. Crane, University of Florida, Tropical Research and Education Center, Homestead 33031-3314

Management of Bipolaris fruit rot

- Currently there are no fungicides labeled for use on Pitahaya in California or Florida.
- Cultural management includes limiting canopy wetness by irrigating in the morning so plant surfaces can dry quickly throughout the day.
- Maintain a weed free planting and remove and discard diseased plants (i.e. stems, fruits, and flowers) promptly when symptoms occur.
- *(From the Sarasota Fruit and Nut Society)*



Diseases of the main stem

- The central cylinder of Pitahaya feeds the entire plant.
- If the xylem of the main stem is compromised the entire plant will lose production.
- Often the outer part of the cladophyll can rot away and the main cylinder of conductive tissue will support the vine.
- While Root rot and collar rot are reported they are not well understood in California
- Likely there are *Phytophthora* or *Pythium* collar rots of Pitahaya that need to be studied.

Pitahaya plant from the field (July, 2013)



Outer stem cut away



Infection in the xylem and phloem



Fusarium conidia in pure culture

(isolated from this same plant)



Which *Fusarium*?

- *Fusarium* sp. been isolated for several years by other plant pathologists
- Dr. Akif Eskalen is the first to identify to species by analyzing DNA
- The verdict?

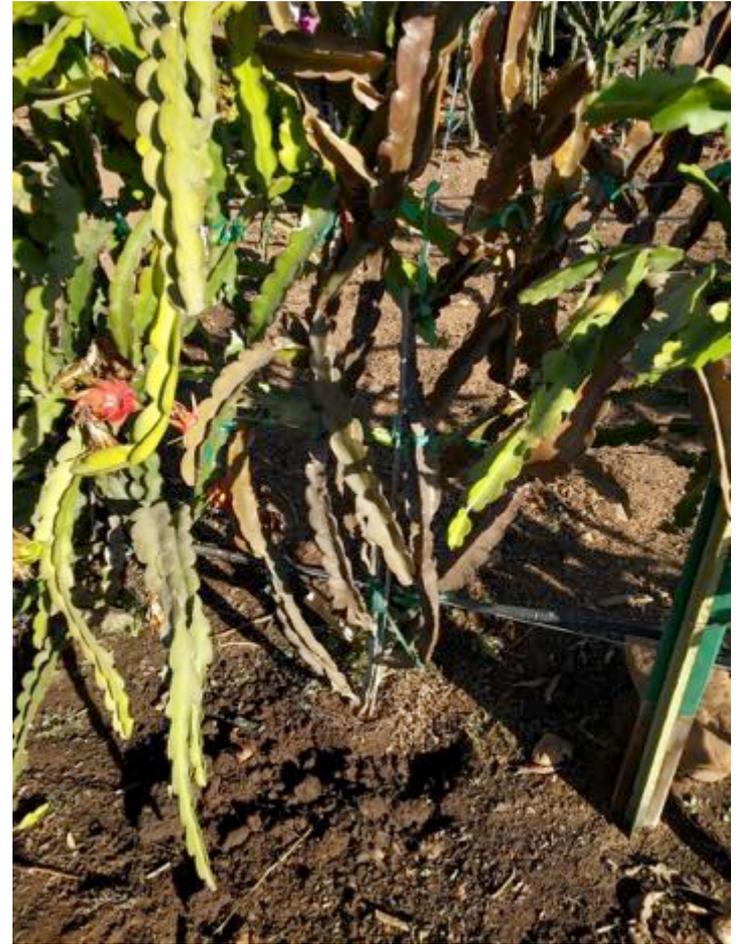
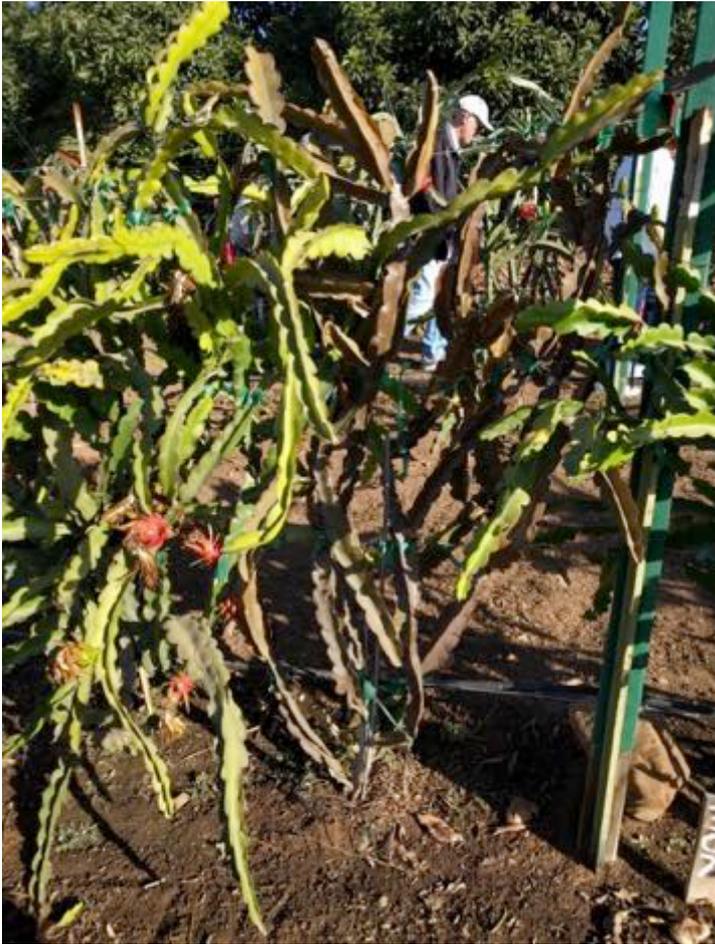


Phytophthora, Pythium??

- Root rot is certainly known but the etiology is uncertain
- When root rot is present plants:
 - Have poor tolerance to drought
 - Sunburn more readily
 - Stop growing
 - Fruit are smaller
 - Susceptible to other diseases
- Poor root development may mimic root rot disease

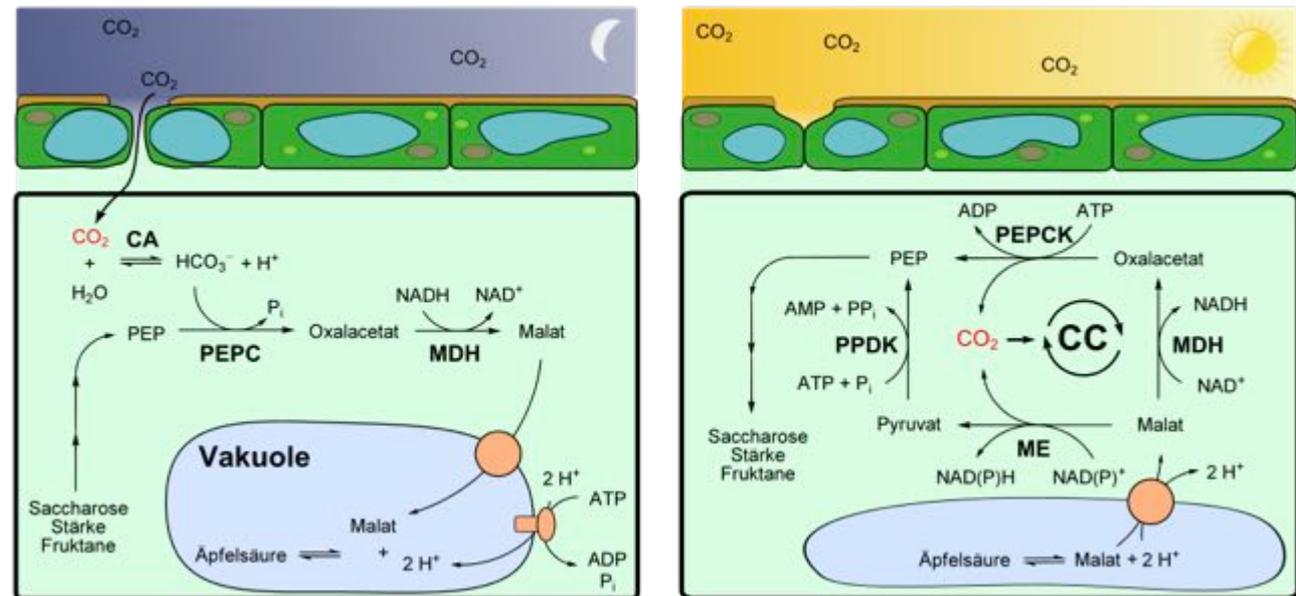


From Today



- Crassulacean Acid Metabolism
- Stomata closed in the day
- Therefore if in full sun and drought stressed or root rotted they will sunburn.

CAM Plants

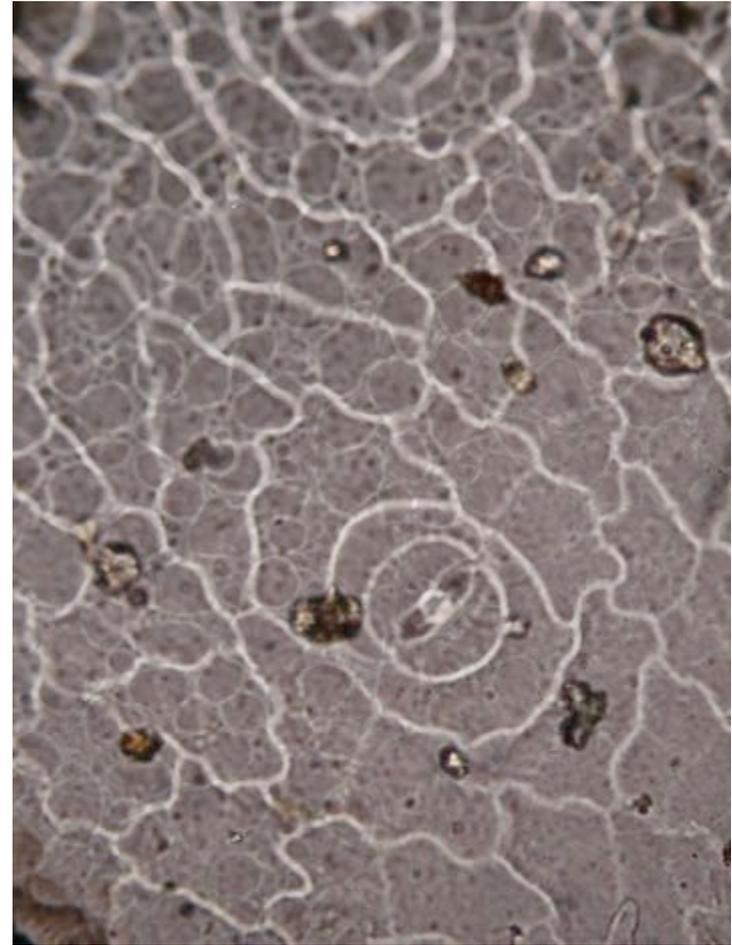
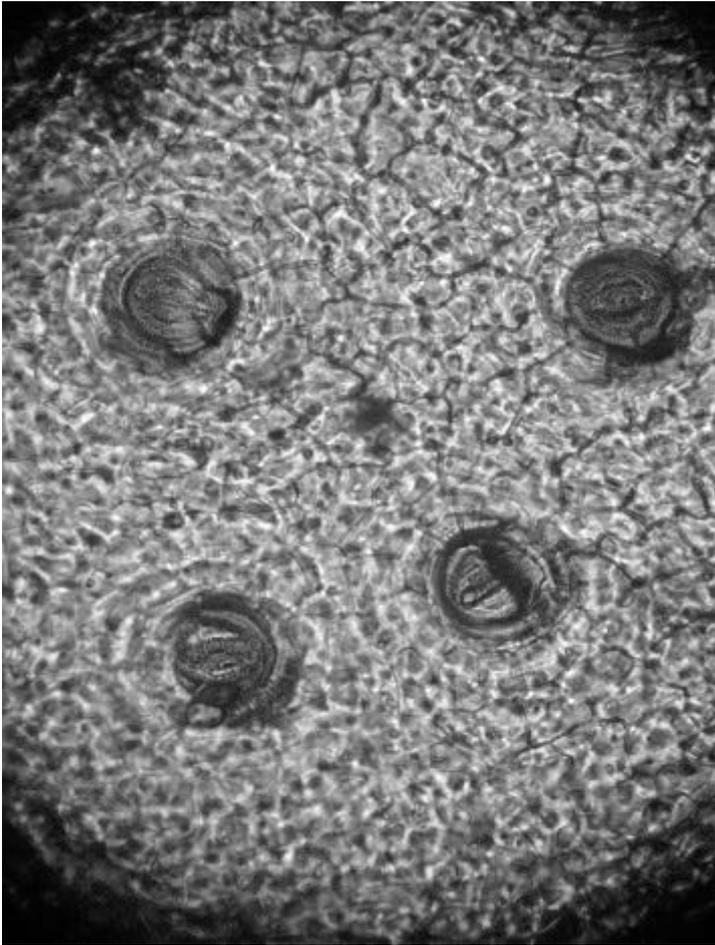


Sunburn

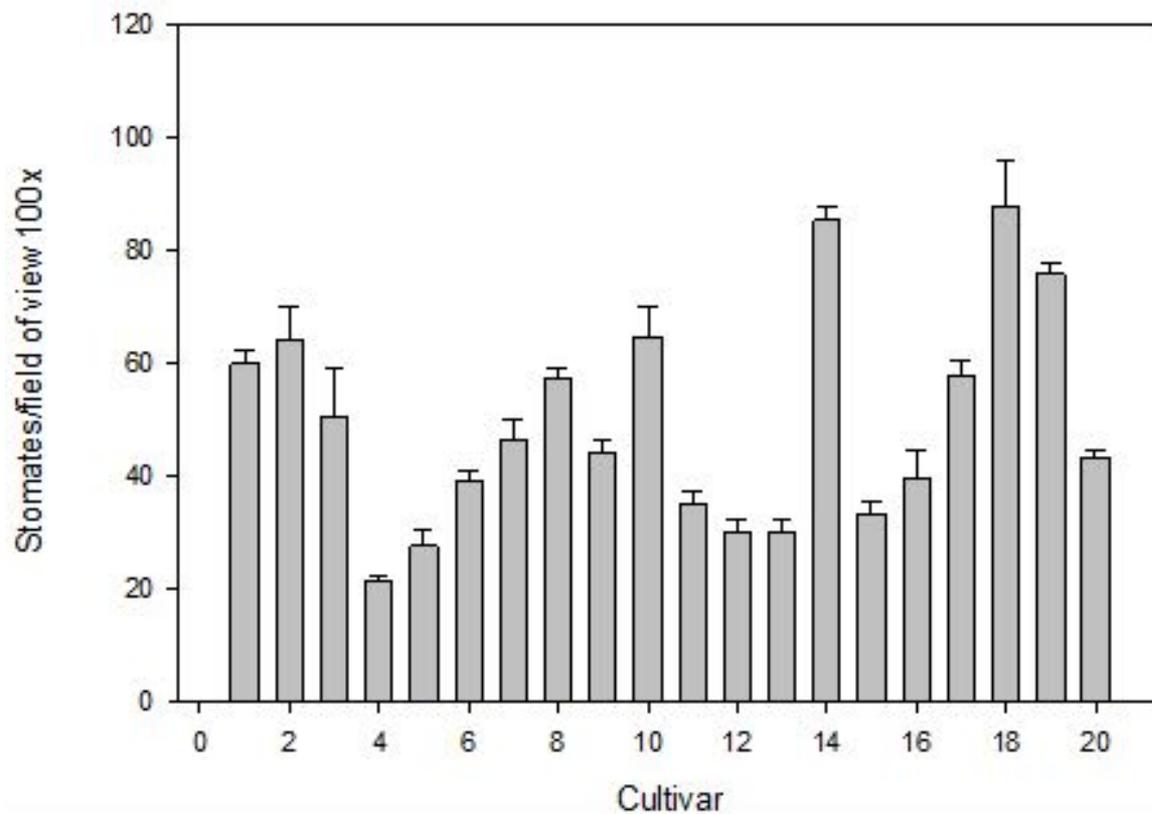
- Damages the cladodes
- May cause an entry point for other fungal pathogens
- Is a symptom that roots may not be healthy



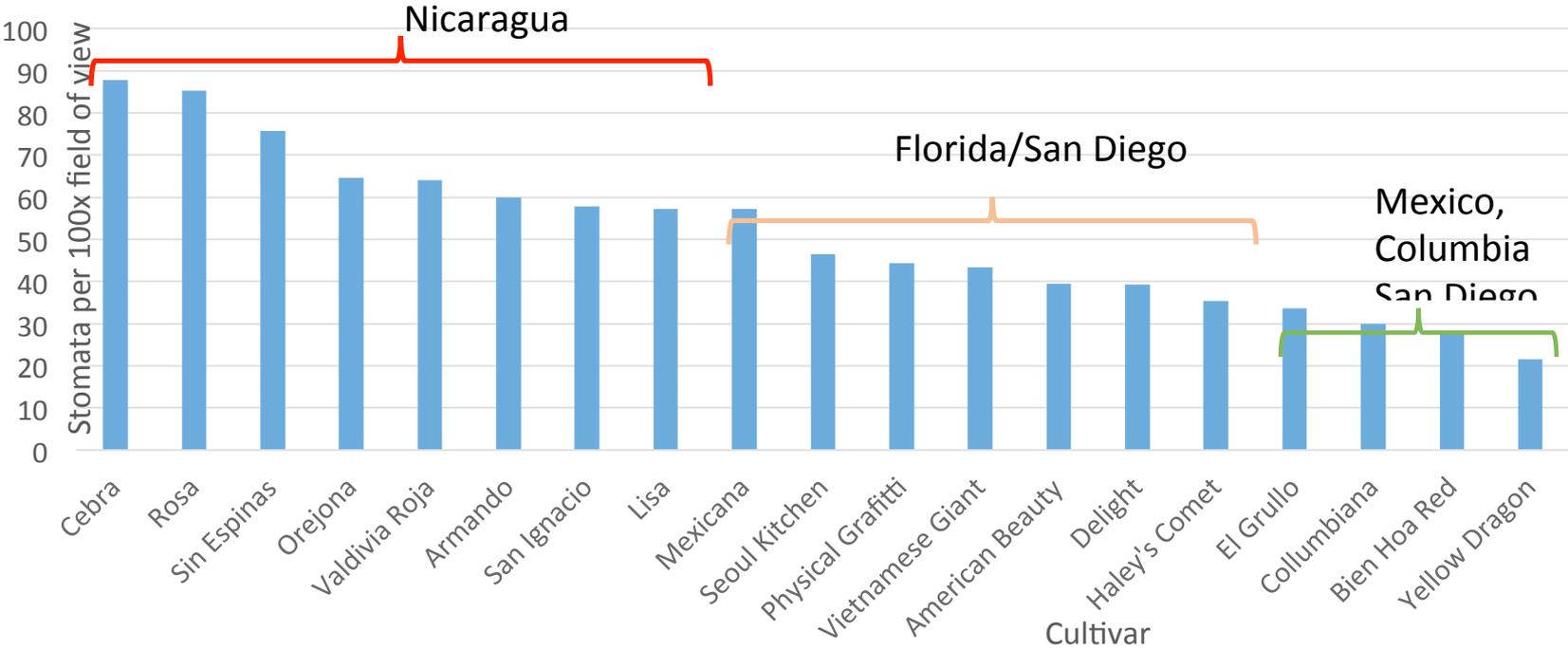
Stomata of Pitahaya



Pitahaya Cultivars Stomatal Densities



Stomata in Pitahaya cultivars and species



Thank you!



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