

2016 Pitahaya Seminar and Festival Field Day



Pitahaya or Dragon Fruit (*Hylocereus* spp.) Varieties – Morphology and Genetic Characterization

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Materials and Methods

- 20 pitahaya varieties planted in a randomized complete block design
 - 3 plants per treatment
 - 5 replications
- Single-post trellis system used based on reports from Florida & Nicaragua
- 726 plants acre based on 10 * 6 spacing
- Sprinkler irrigation weekly @ 2 hrs/week

Materials and Methods

20 Varieties in Original Study

- Cebra (Nic)
- Rosa (Nic)
- Orejona (Nic)
- Lisa (Nic)
- Sin Espinas (Nic)
- San Ignacio (Nic)
- Mexicana (Mex)²
- Colombiana (SD/Col)³
- Valdivia Roja (Mex)
- Bien Hoa Red (SD)¹
- Bien Hoa White (SD)²
- Delight (SD)
- American Beauty (FL)¹
- Haley's Comet (FL)
- Physical Graffiti (FL)
- Vietnamese Giant (FL)²
- Yellow Dragon (FL/Col)³
- Seoul Kitchen (FL)
- Armando (Nic)*
- El Grullo (Mex)*



Cebra (*H. polyrhizus*).

- Red-fleshed large fruit with thick rind and average flavor.
- Origin: Nicaragua.
- Fruit: oval; large, 468 g; skin and flesh red, rind thick; quality acceptable; 15.75 Brix; 46 days from bloom to harvest in Southern California; harvest from late June to late December or into January.
- Plant: stems intermediate in thickness and length; mature stems grayish green, usually bearing white stripes resembling a zebra pattern, hence the name; areoles have 4-6 spines arranged randomly, 3-7 mm long; segment between areoles slightly convex, 26 mm long. Flowers large, petals white; calyx yellow, with shades of red on the edges; anthers and stigma lobes yellow.
- Tolerance to cold and heat average; grows well in full sun; commercial potential good.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Rosa (H. polyrhizus).

- Red-fleshed fruit with average flavor and size, and red, thick rind.
- Origin: Nicaragua.
- Fruit: round; medium, 384 g; short, scattered bracts, resembling a rose when seen from the top; skin and flesh red; rind thinner than in other Nicaraguan cultivars, making this cultivar more susceptible to cracking when fully mature; quality acceptable; 16.05 Brix; 45 days from bloom to harvest in Southern California; harvest late June to late December or January.
- Plant: stems intermediate in thickness and length, grayish green; areoles have 8-9 spines in a random pattern, 4-6 mm long; segment between areoles slightly convex, 27.11 mm long; Flowers large, petals white, calyx yellow, with shades of red on edges, anthers bright yellow, stigma lobes lime green.
- Tolerance to cold and heat average; grows well in full sun; commercial potential good.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Orejona (*H. polyrhizus*).

- Red-fleshed fruit with average flavor and size, and numerous long bracts. Origin: Nicaragua.
- Fruit: oblong; medium large, 438 g; flesh red; skin thick, red; quality acceptable, 15.78 Brix; 45 days from bloom to harvest in Southern California; harvest late June to late December.
- Plant: stems thin, relatively short, grayish green; areoles have 6-8 spines in a random pattern, 3-8 mm long; segment between areoles straight to slightly concave, which exposes the spines and makes this cultivar look very spiny; flowers large, petals white, calyx yellow, with shades of red on the edges, anthers and stigma lobes yellow, stigma lobes are lighter than anthers.
- Tolerance to cold and heat average; grows well in full sun; commercial potential low because of spines.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Lisa (*H. polyrhizus*).

- Red-fleshed fruit with better than average flavor, large size; most productive of all red-fleshed Nicaraguan cultivars.
- Origin: Nicaragua.
- Fruit: oval; medium large, 465 g; skin red; rind thick, with a smooth, velvety feel, hence the name Lisa “Smooth”; flesh dark red, very firm; quality better than average, 17.02 Brix; 44 days from bloom to harvest in Southern California; harvest late June to late December or January.
- Plant: stems intermediate in thickness and length; mature stems grayish green; areoles have 3-5 spines, 3-7 mm long, usually arranged in a circular pattern; segment between areoles slightly convex, 23mm long; flowers largest of all, petals white, calyx yellow, with shades of red on the edges, anthers and stigma lobes bright yellow;
- Tolerance to cold and heat better than average; commercial potential excellent.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Sin Espinas (*H. sp.*)

- Red-fleshed fruit with glossy, pinkish-red skin and good flavor, suited to home gardens and indoor growing.
- Origin: Nicaragua.
- Fruit: round; medium, 393 g; skin thick, pinkish-red, glossy; flesh very firm, dark red when ripe; quality good; 16.5 Brix; 43 days from bloom to harvest in Southern California; harvest early June to December.
- Plant: stems thin and very light; mature stems brownish green; considered spineless, but has 1-2 very small spines per areole, 0.5-1 mm long; segment between areoles convex, 43 mm long; flowers small, petals white, calyx light yellow, anthers and stigma light yellow;
- Tolerance to cold and heat low; best suited to protected or indoor production.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



San Ignacio (*H. polyrhizus*).

- Large, red-fleshed fruit with red skin and average flavor.
- Origin: Nicaragua.
- Fruit: oval; large, 552 g; skin thick and red; flesh red; quality acceptable; 15.6 Brix; 48 days from bloom to harvest in Southern California; harvest late June to late December or January.
- Plant: stems thick, intermediate in length, dark green; areoles have 6-7 spines arranged randomly, 2-6 mm long, 4 of them consistently larger than the rest. Flowers large, petals white, calyx yellow, with shades of red on edges, anthers bright yellow, stigma lime green.
- Tolerance to cold and heat slightly better than average; grows well in full sun; commercial potential good.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



7- MEXICANA

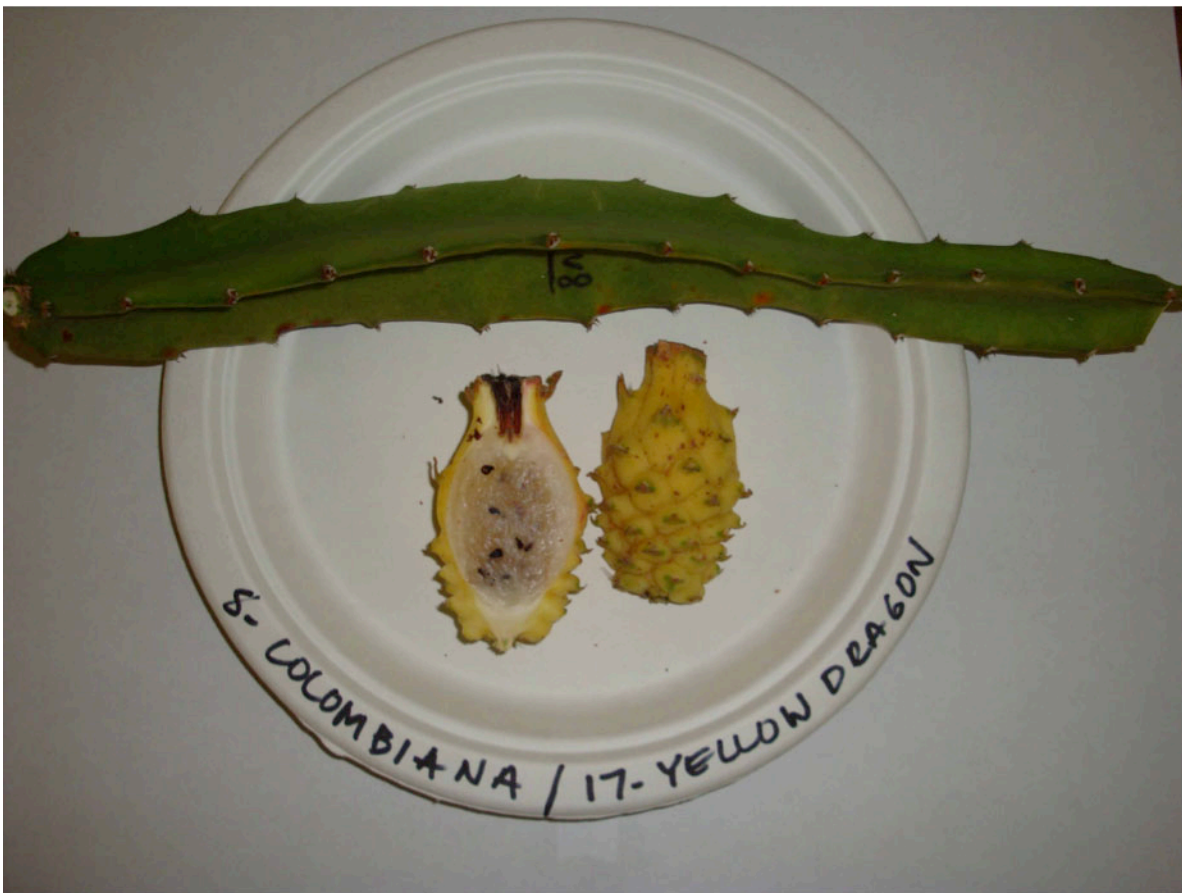


Mexicana (*H. undatus*).

- White-fleshed fruit with pinkish red skin, attractive appearance with long bracts.
- Origin: Mexico, introduced from Nicaragua.
- Fruit: oblong; large, 552 g; skin pinkish red, relatively thin; flesh very firm, white, with numerous small black seeds; quality acceptable for white-fleshed fruit, 14.04 Brix; 40 days from bloom to harvest in Southern California; harvest very compact, mid-July to mid-October.
- Plant: stems thin but wide, relatively long, triangular in shape with 3 distinct ridges; mature stems green, with a brown, hard stripe on the ridges; areoles have 3-5 conic spines, similarly sized and arranged in a triangular pattern, 3-5 mm long; segment between areoles convex, 53.3 mm long; flowers intermediate, petals white, calyx light yellow, anthers and stigma lobes bright yellow;
- Tolerance to cold and heat average; usually struggles in cold, damp conditions; good both for backyard growing and for commercial production.

*Captions from: Register of New Fruit and Nut Cultivars List 48.

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Colombiana (Yellow Dragon) (*H. megalanthus*).

- White-fleshed fruit with yellow skin and exceptional quality, considered the best flavored of all pitahayas.
- Origin: Colombia.
- Fruit: oblong; very small, 160 g, rarely reaching 200 g; skin yellow, flesh translucent white, seeds large; rind thick and spiny, with spines needing to be removed during harvest, and no bracts; pulp firm, extremely sweet, flavor excellent; 21 Brix; 150 to 180 days from bloom to harvest in Southern California; harvest November to February.
- Plant: stems thin and long, triangular, with 3 well-defined ridges, light green; areoles have 1-3 conic spines, 2-3 mm long; segment between areoles slightly concave, 36.27 mm long, giving the stem a “bony” appearance; flowers long and narrow, tubular, petals white, calyx light green; anthers light yellow, stigma lobes lime green;
- Tolerance to cold and heat low; usually struggles in full sun; commercial potential excellent because it fruits in the offseason; protected environment needed.

*Captions from:
Register of New
Fruit and Nut
Cultivars List 48.
HortScience Vol.
51(6) June 2016.



Valdivia Roja (*H. ocamponis*).

- Red-fleshed fruit with greenish red skin, excellent quality.
- Origin: Jalisco State, Mexico.
- Fruit: oblong; small, 250 g; flesh very firm, red; skin greenish, relatively thin, with very few, short bracts; quality one of the best among red-fleshed cultivars; 17.9 Brix; 40 days from bloom to harvest in Southern California; harvest July to late December or January.
- Plant: stems thick and fleshy, very heavy, with 3 well defined ridges when young, turning rounder as they mature; mature stems grayish because of waxy coating, tend to crack as they get older; areoles have 1-2 spines, 1-2 mm long; flowers large, attractive, petals white, calyx yellowish, with red shades on the edges, anthers and stigma lobes light yellow; very hardy,
- Tolerance to cold and heat high, so plant looks the same all year; grows well in full sun, but commercial potential limited because of inconsistent fruit set.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Bien Hoa Red (*H. guatemalensis*).

- Very flavorful fruit with fuchsia colored flesh and reddish green skin.
- Origin: Guatemala.
- Fruit: round; medium, 360 g, ideal for market; skin greenish-red; flesh fuchsia colored, pulp very juicy, lacks firmness; rind thin, with scattered compact bracts; quality exceptional; 18.9 Brix; 43 days from bloom to harvest in Southern California; harvest June to November.
- Plant: stems triangular, with 3 well-defined ridges, relatively thin and short, mature stems dark green and brittle, producing numerous shoots; pruning essential; areoles have 1-2 spines on average, 1-5 mm long; segment between areoles quite convex, 36.45 mm long; flowers small, petals white, calyx yellowish green, anthers and stigma lobes yellow;
- Tolerance to cold and hot weather average; struggles in full sun; lack of cold hardiness limits commercial potential or requires protected environments.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Bien Hoa White (*H. undatus*).

- White-fleshed fruit with pinkish red skin and long bracts.
- Origin: Bien Hoa Farms, Fallbrook, CA.
- Fruit: oblong; intermediate size, 388 g; skin relatively thin, pinkish-red; flesh very firm, white, with numerous small, black seeds; quality poor; 11.85 Brix; 40 d from bloom to harvest in Southern California; harvest time short, from mid-July to mid-October.
- Plant: stems thin but wide, relatively long, triangular, with 3 distinct ridges, when mature, green, with a brown, hard stripe on the ridges; areoles have 3-5 spines with conic shape, similarly sized and arranged in a triangular pattern, 3-5 mm long; segment between areoles convex, 53.3 mm long; flowers intermediate, petals white, calyx light yellow, anthers and stigma bright Yellow.
- Tolerance to cold and heat low; does not do well in full sun; good for backyard growing in warm areas, but little potential for commercial production.

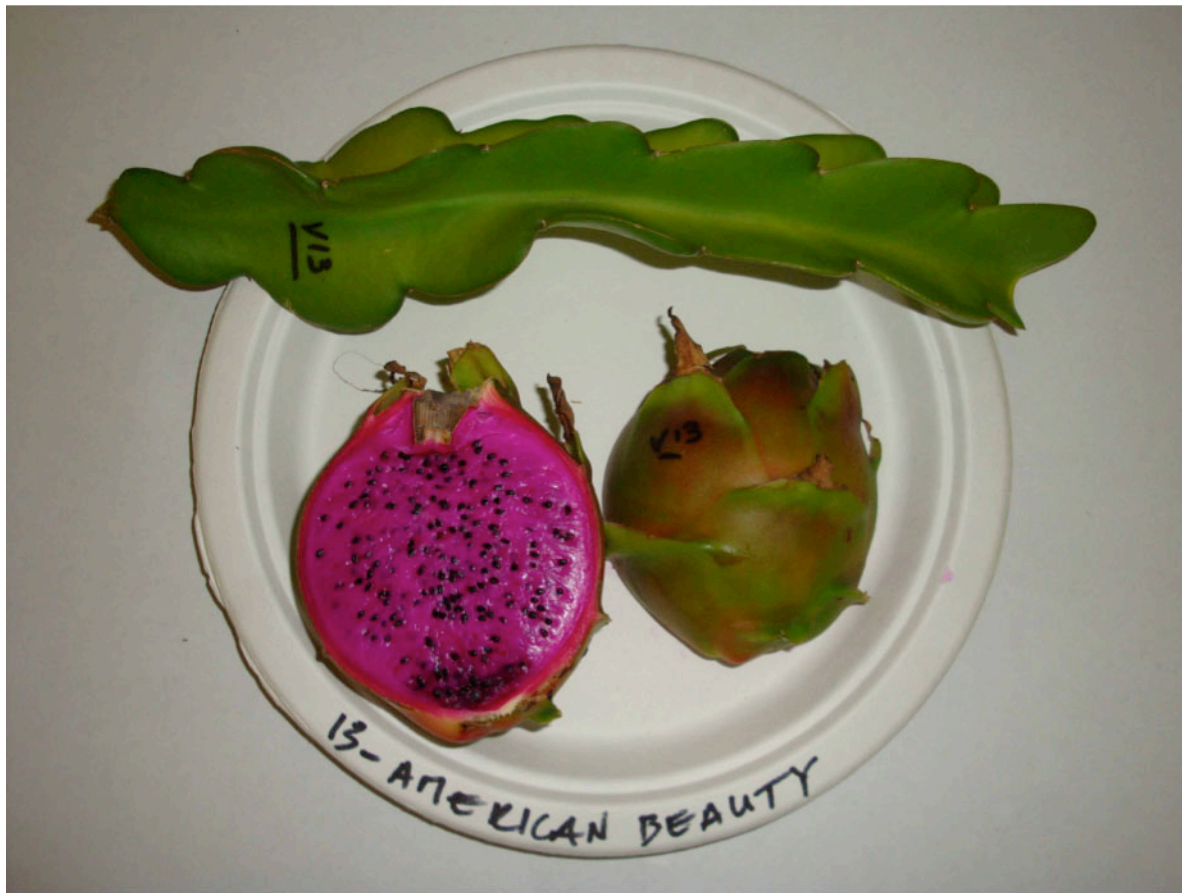
*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Delight (*Hylocereus* sp.).

- Pinkish-white- or light-pink-fleshed fruit with excellent flavor, well suited for backyard cultivation.
- Origin: bred and selected by Paul Thomson in San Diego County, early 1980s. Fruit: oval; medium, 371 g, ideal for marketing; quality excellent; flesh light pink or pinkish-white, seeds small; rind greenish red, of intermediate thickness; bracts short, scattered; 18.08 Brix; 41 days from bloom to harvest in Southern California; harvest late June to mid-December.
- Plant: very vigorous, stems triangular, with 3 well defined ridges; stems intermediate in thickness and length, very straight, green when mature; areoles have 1-3 thin spines, 1-3 mm long; segment between areoles convex, 43.3 mm long; flowers intermediate, petals white, calyx yellowish, anthers and stigma lobes yellow;
- Tolerance to cold and heat slightly better than average; does relatively well in full sun; commercial potential good.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



American Beauty (*Hylocereus guatemalensis*).

- Very flavorful fruit with fuchsia-colored flesh and reddish green skin. Thin rind and soft pulp make it susceptible to bruising; suitable for local marketing.
- Origin: Parentage unknown; introduced from Guatemala to Florida, and then to California. Fruit: round; medium, 380 g, ideal for market; skin greenish-red; flesh fuchsia-colored; quality exceptional, pulp very juicy, lacking firmness; rind thin, with scattered compact bracts; 18.51 Brix; 43 days from bloom to harvest in Southern California; harvest June to November.
- Plant: stems triangular, with 3 well defined ridges, relatively thin and short; mature stems dark green and brittle, producing numerous shoots; pruning essential; areoles have 1-2 spines, 1-5 mm long; segment between areoles quite convex, 36.45 mm long; flowers small, petals white, calyx yellowish green; anthers and stigma lobes yellow;
- Tolerance to cold and heat average; usually struggles in full sun; commercial potential excellent if grown in a protected environment.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Halley's Comet (*Hylocereus* sp.).

- Pink-fleshed fruit with excellent flavor; closely related to Physical Graffiti, but not as vigorous or productive.
- Origin: Paul Thomson, San Diego County, CA, early 1980s.
- Fruit: round; large, 482 g; flesh hot pink, seeds small; rind bright red, relatively thin, with an intermediate number of bracts; quality very good, 16.7 Brix; rated high in sensory evaluations; 38 days from bloom to harvest in Southern California; harvest July through December.
- Plant: stems intermediate in thickness, with 3 well defined ridges; stems relatively straight when mature, dark green; areoles have 1-3 spines, 2-4 mm long; segment between areoles convex, 53.6 mm long; flowers intermediate, petals white, calyx yellowish green, anthers and stigma lobes yellow;
- Tolerance to cold and heat good; grows well in full sun; commercial potential good.

*Captions from:
Register of New Fruit
and Nut Cultivars List
48. HortScience Vol.
51(6) June 2016.



Physical Graffiti (*Hylocereus* sp.).

- Vigorous, very productive, pink-fleshed fruit with excellent flavor, most preferred and widely planted in Southern California.
- Origin: Paul Thomson, San Diego County, CA, early 1980s.
- Fruit: oblong; medium, 374 g; flesh hot pink, seeds small; rind bright red, relatively thin, with few bracts; quality excellent, 17.93 Brix, rated highest in sensory evaluation; 40 days from bloom to harvest in Southern California; harvest July to December.
- Plant: very vigorous; stems thick, short, curvy, dark green, with 3 well-defined ridges; canopy management critical to keep this plant productive and to prevent overcrowding; areoles with 1-3 conic spines 1-3 mm long; segment between areoles convex, 46.5 mm long; flowers long and narrow, tubular, petals white, calyx light green, anthers light yellow, stigma lobes lime green;
- Tolerance to cold and heat good; grows very well in full sun; commercial potential excellent.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Vietnamese Giant (*H. undatus*).

- Attractive white-fleshed fruit with pinkish red skin and long bracts.
- Origin: Florida.
- Fruit: oval; medium, 338 g; skin pinkish red, relatively thin; flesh very firm, white; seeds numerous, small, black; quality excellent for white-fleshed cultivars; 15.6 Brix; 40 days from bloom to harvest in Southern California; harvest very compact, mid-July to mid-October.
- Plant: stems thin and intermediate in width and length, triangular, with 3 distinct ridges; mature stems green, with a brown, hard edge on the ridges; areoles have 4-6 spines, randomly arranged, 1-3 mm long; segment between areoles convex, 50.3 mm long; flowers intermediate, petals white, calyx light yellow, anthers and stigma bright yellow;
- Tolerance to cold and heat average; usually struggles in cold, damp conditions; potential for backyard growing and commercial production good.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Seoul Kitchen (*H. undatus*).

- White-fleshed, pinkish-red-skinned fruit with large fruit of marginal quality; vigorous, strong and prolific bloomer with longer fruiting season than other white fleshed cultivars.
- Origin: Florida, similar to George.
- Fruit: round; large, 518 g; flesh firm, white; skin thick, pinkish red, with numerous short, compact bracts; quality marginal; 12.18 Brix; 41 days from bloom to harvest in Southern California; harvest mid-July to December.
- Plant: stems thick and short; mature stems grayish green, with a striped pattern that resembles zebra stripes; stems have clusters of spines arranged in a circular pattern, 4-6 spines per cluster, 3-7 mm long; flowers long and narrow, tubular, petals white, calyx light green, anthers light yellow, stigma lobes lime green;
- Tolerance to cold and heat higher than average; usually grows well in full sun; limited potential for commercial production, but valuable as a pollinizer.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



Armando (*H. polyrhizus/costaricensis*).

- Red-fleshed, medium-sized fruit with red skin, good quality.
- Origin: collected by R. Lobo in Las Manos, near border of Honduras and Nicaragua.
- Fruit: round; medium, 390 g; quality acceptable; flesh very firm, red; skin purplish-red, intermediate in thickness, with numerous bracts; 16.11 Brix; 41 days from bloom to harvest in Southern California; harvest mid-June to January.
- Plant: stems thick and short, with 3 well-defined ridges, dark green spiny; areoles have 4-6 spines, arranged in a circular pattern, 3-8 mm long; flowers intermediate, petals white; calyx yellowish, with shades of red on the edges, anthers and stigma lobes yellow;
- Tolerant to cold and heat; grows well in full sun; commercial potential good.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.



El Grullo



El Grullo (*H. ocamponis*).

- Large, red-fleshed fruit with greenish red skin, excellent quality, thick and heavy plants, and great tolerance to heat and cold.
- Origin: unnamed selection collected by R. Lobo in El Grullo, Jalisco State, Mexico.
- Fruit: oval; large, 489 g; quality acceptable; flesh dark red; rind purplish-red, thick and hard with numerous compact bracts; 18.11 Brix; 40 days from bloom to harvest in Southern California; harvest mid-July to December.
- Plant: stems thick, heavy, fleshy and long, exceeding 2 m in length when fully grown; young shoots lime green, triangular, with well-defined ridges; mature stems turn grayish and fill in the section between the ridges, becoming almost a solid triangle; spines very numerous and long, each areole having 8-13 needle-like spines randomly arranged, 3 to 14 mm long; flowers large and narrow, tubular, petals white, calyx yellowish red, anthers and stigma lobes light yellow;
- Tolerance to cold and heat exceptional; grows well in full sun, maintaining the same appearance year-round.

*Captions from: Register of New Fruit and Nut Cultivars List 48. HortScience Vol. 51(6) June 2016.

Results

- Most varieties in trial adapted well to growing conditions at SCREC
 - Valdivia Roja, El Grullo*, Physical Graffiti, Haley's Comet and Lisa most tolerant to heat and cold
- Most selections set fruit **WITHOUT** hand pollination
 - Physical Graffiti, Seoul Kitchen, Delight, Lisa and San Ignacio top producing varieties

Results

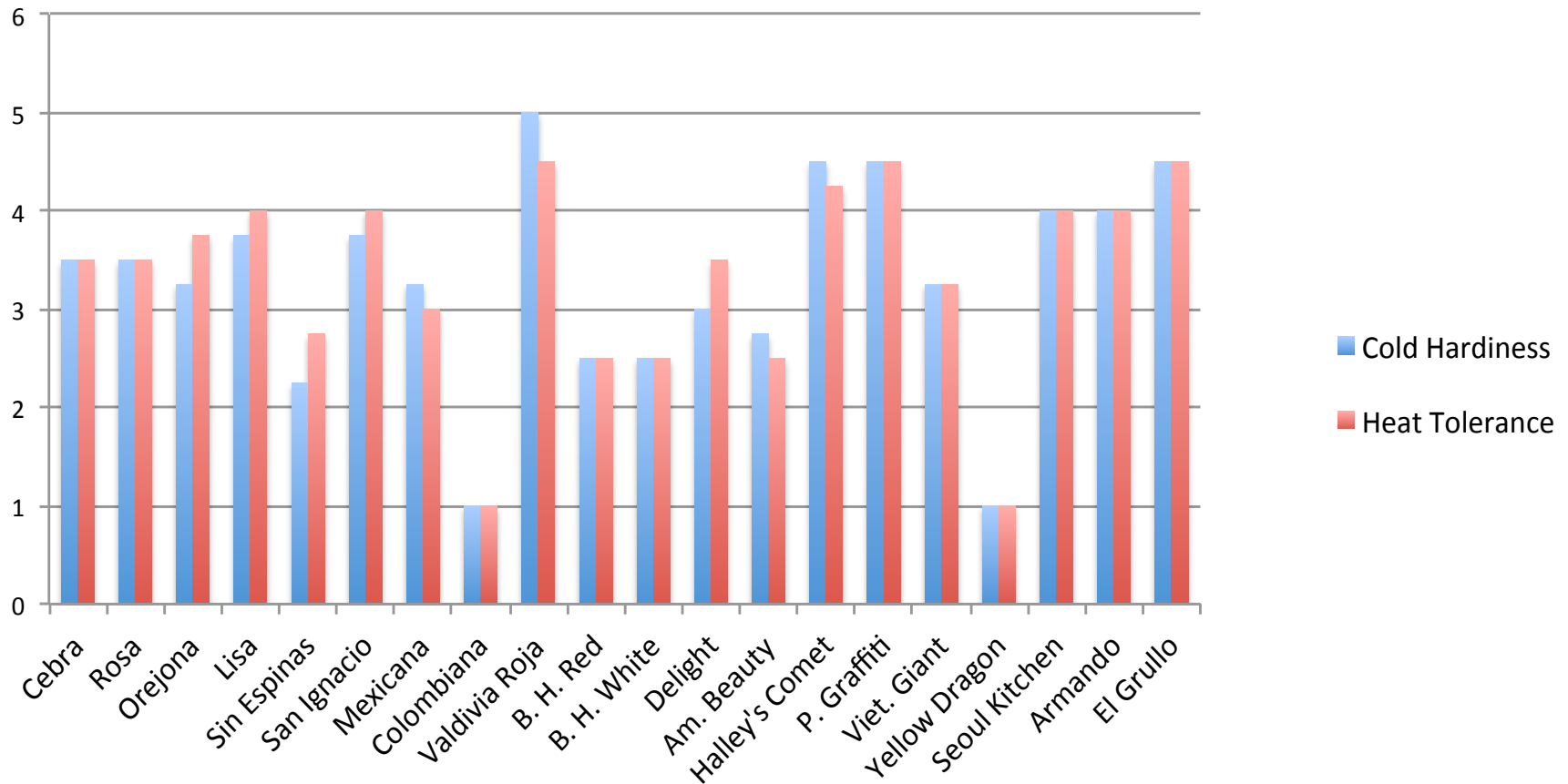
- Most varieties in trial produce well WITHOUT shade, some would benefit from it.
- Fruit size & quality very good, good marketable yields
 - Except for Colombiana/Yellow Dragon, all varieties produced fruit with good market weight
 - Colombiana/Yellow Dragon, Bien Hoa Red/American Beauty, Delight, Physical Graffiti, Valdivia Roja & El Grullo* had the highest brix scores

Pitahaya or Dragon Fruit Variety Evaluation Chart

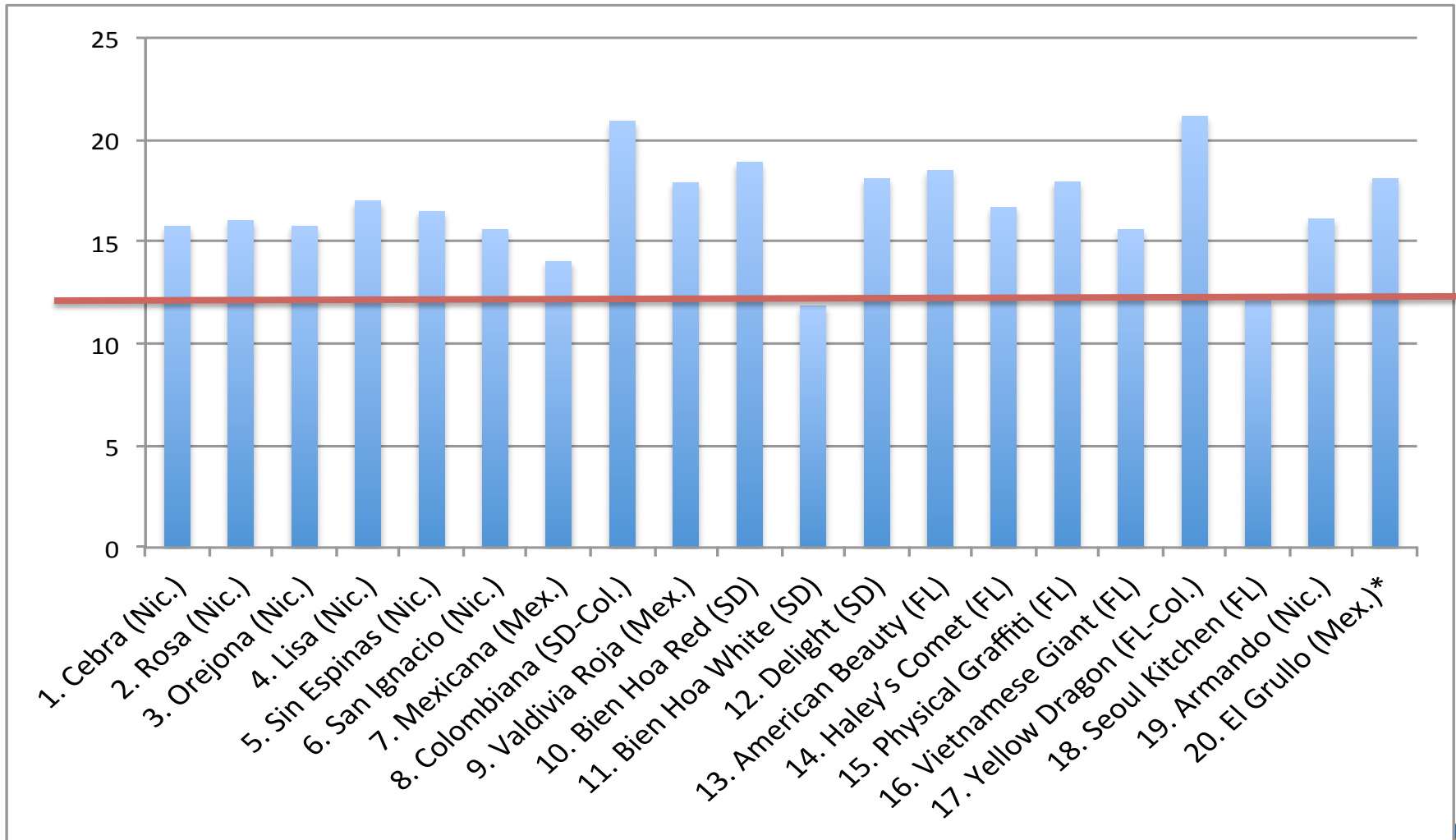
(For Cold Hardiness & Heat Tolerance: 1 = low tolerance & 5 = High Tolerance)

Variety/Origin	Color Skin/Flesh	Cold Hardiness	Heat Tolerance	Avg. Wt. (grams)	Brix Score	Mkt Wt/Plant (grams)	Days to Harvest
1. Cebra (Nic.)	R/R	3.5	3.5	468	15.75	8746	46
2. Rosa (Nic.)	R/R	3.5	3.5	384	16.05	7217	45
3. Orejona (Nic.)	R/R	3.25	3.75	438	15.78	4598	45
4. Lisa (Nic.)	R/R	3.75	4	465	17.02	13319	44
5. Sin Espinas (Nic.)	P/R	2.25	2.75	393	16.5	3527	43
6. San Ignacio (Nic.)	R/R	3.75	4	552	15.6	12712	48
7. Mexicana (Mex.)	P/W	3.25	3	495	14.04	9165	40
8. Colombiana (SD-Col.)	Y/W	1	1	< 200	20.90	0	150-180
9. Valdivia Roja (Mex.)	R/R	5	4.5	250	17.9	8588	40
10. Bien Hoa Red (SD)	GR/F	1.75	1.75	360	18.9	1477	41
11. Bien Hoa White (SD)	P/W	2.5	2.5	388	11.85	7394	37
12. Delight (SD)	R/PW	3	3.5	371	18.08	14931	41
13. American Beauty (FL)	GR/F	2.75	2.5	380	18.51	5566	43
14. Haley's Comet (FL)	R/F	4.5	4.25	482	16.7	5979	38
15. Physical Graffiti (FL)	R/P	4.5	4.5	374	17.93	23429	40
16. Vietnamese Giant (FL)	PR/W	3.25	3.25	338	15.6	6511	41
17. Yellow Dragon (FL-Col.)	Y/W	1	1	< 200	21.15	0	150-180
18. Seoul Kitchen (FL)	PR/W	4	4	518	12.18	15379	41
19. Armando (Nic.)	R/R	4	4	390.5	16.11	4881	41
20. El Grullo (Mex.)*	R/R	4.5*	4.5*	489*	18.11*	U/K	40

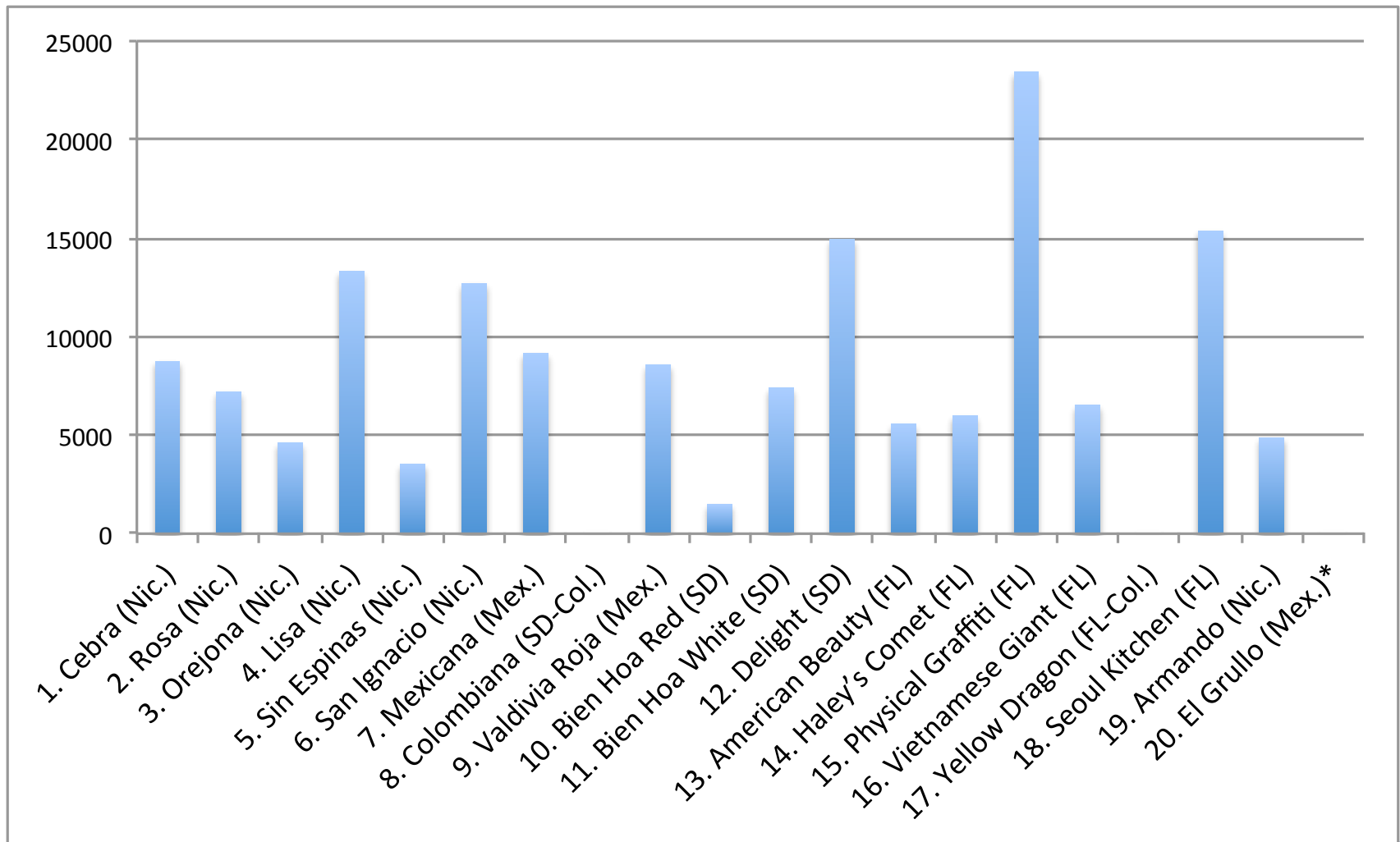
Relative Cold & Heat Tolerance



Brix Scores



Fruit Production/Plant



Consumer Preferences?

- External appearance:
 - Sin Espinas, Lisa, Physical Graffiti, Delight, American Beauty and Bien Hoa Red
- Flavor where flesh color is visible:
 - American Beauty, Bien Hoa Red, Physical Graffiti, Delight, Sin Espinas and Lisa
- Flavor in a blind test, flesh color masked with light:
 - Bien Hoa Red, American Beauty, Physical Graffiti, Sin Espinas and Lisa
- Clear differences among varieties in terms of sugars, acids, and antioxidant content

Genetic Characterization of dragon fruit UC germplasm collection

280 accessions: California, Florida, Nicaragua, Mexico, and Columbia

Ramiro Lobo-SD Farmer Advisor, Deborah Pagliacia/Georgios Vidalakis-UCR



Pitahaya Types

- Several species of *Hylocereus* identified, but there is uncertainty about proper identification
- Differentiated by stem & fruit characteristics (bracts, shape and fruit color - skin and flesh)
- Two commonly available in CA:
 - *Hylocereus undatus* (red skin, white flesh)
 - *Hylocereus* sp. (primarily red skin & red flesh)
- Many *Hylocereus* hybrids (several skin and flesh colors combinations, from yellow to deep magenta or dark red)
- *Selenicereus megalanthus* - Yellow or Colombian, yellow, thorny skin and white, translucent flesh

Commercial Varieties?

- Pitahaya hybridizes quite easily so large number of hybrids or clones produced by breeders
- Several clones promoted as “superior” but no replicated research data available
- Improved, proprietary varieties available from Israel, Taiwan and private breeders in US
- **Big challenge for commercial production is confusion and duplication on named varieties so DNA needed to clarify things**

The Problem

- **“2-3 years into the trial when plants grew and started fruiting, we started noticing great variability among plants within the same variety and great similarities among plants from different varieties.”**

Big challenge for commercial production is confusion and duplication on named varieties so DNA needed to clarify things

Varieties Under Study

- Cebra (Nic)
- Rosa (Nic)
- Orejona (Nic)
- Lisa (Nic)
- Sin Espinas (Nic)
- San Ignacio (Nic)
- Mexicana (Mex)
- Colombiana (SD/Col)
- Valdivia Roja (Mex)
- Bien Hoa Red (SD)
- Bien Hoa White (SD)
- Delight (SD)
- American Beauty (FL)
- Haley's Comet (FL)
- Physical Graffiti (FL)
- Vietnamese Giant (FL)
- Yellow Dragon (FL/Col)
- Seoul Kitchen (FL)
- Armando (Nic)
- El Grullo (Mex) added late

- **All accessions were collected from the South Coast Research and Extension Center**
- **The collection consists of 5 ‘species’**
 - *H. undatas*, *H. guatemalensis*, *H. costaricensis/polyrhizus*, *H. ocamponis*, *H. megalanthus*, + hybrids

Dragon Fruit Accessions

- **SCREC- 20 ‘named’ varieties planted from multiple sources**



Methods and Materials

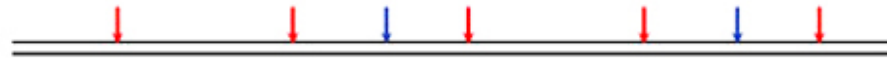
- Actively growing shoots were sampled (278 plants)
- Surfaces sterilized using 70% ethanol
- DNA extracted using a Qiagen kit

Methods

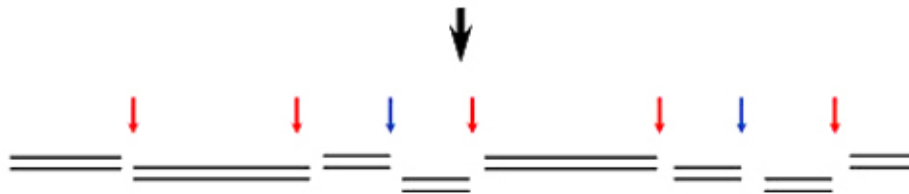
- **Accessions were genotyped using Amplified Fragment Length Polymorphism (AFLP) technique**



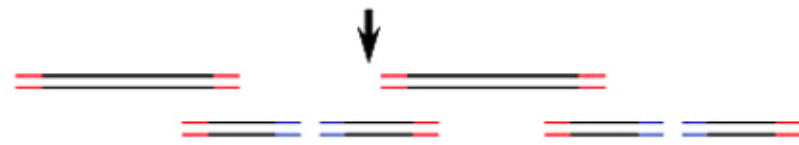
Total genomic DNA



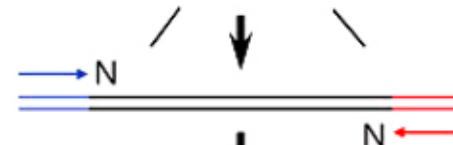
(1) Restriction digestion



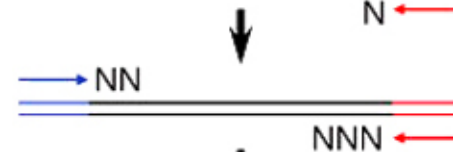
(2) Adapter ligation



(3) Pre-amplification

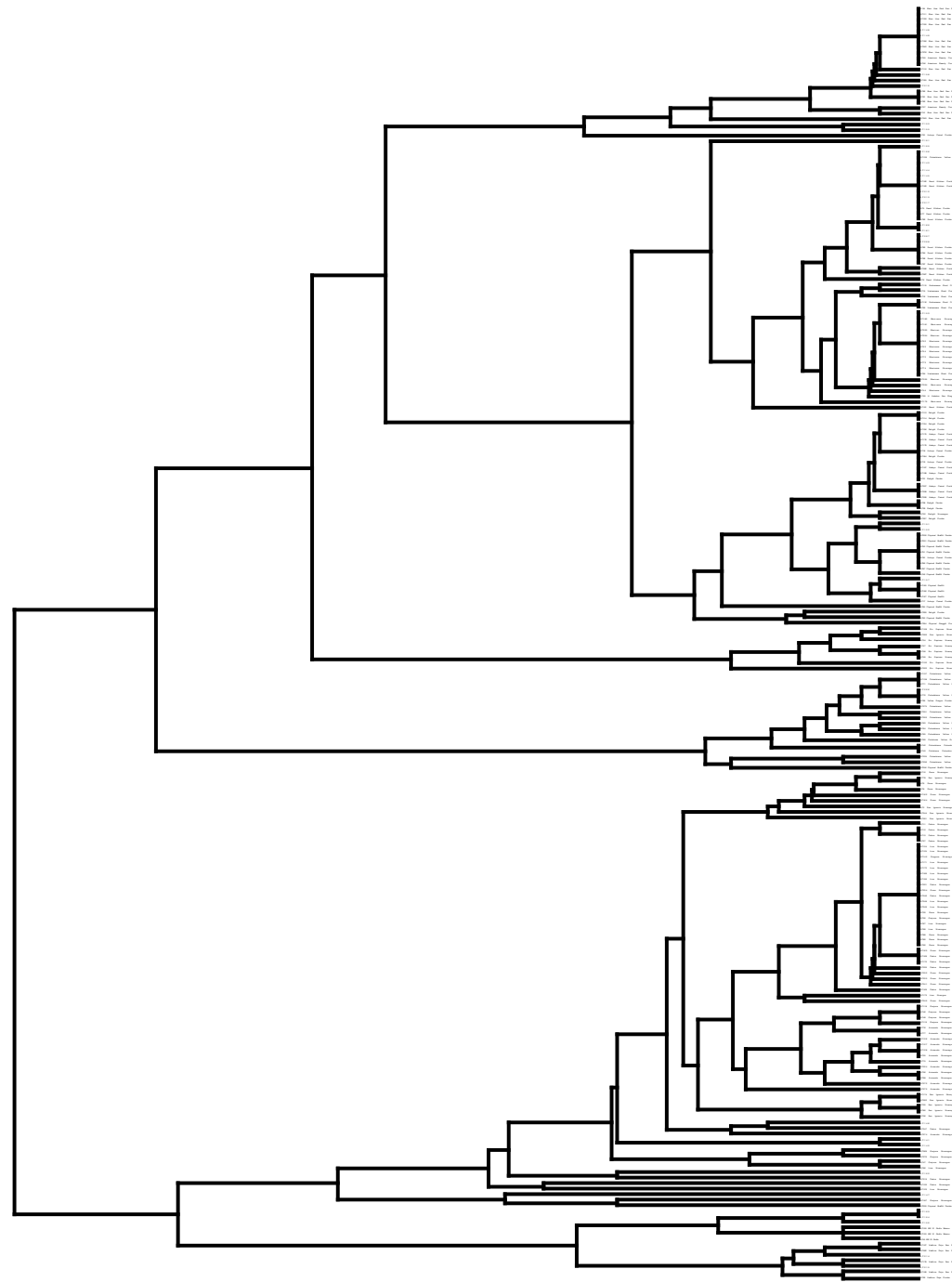


(4) Selective amplification



(5) Gel electrophoresis



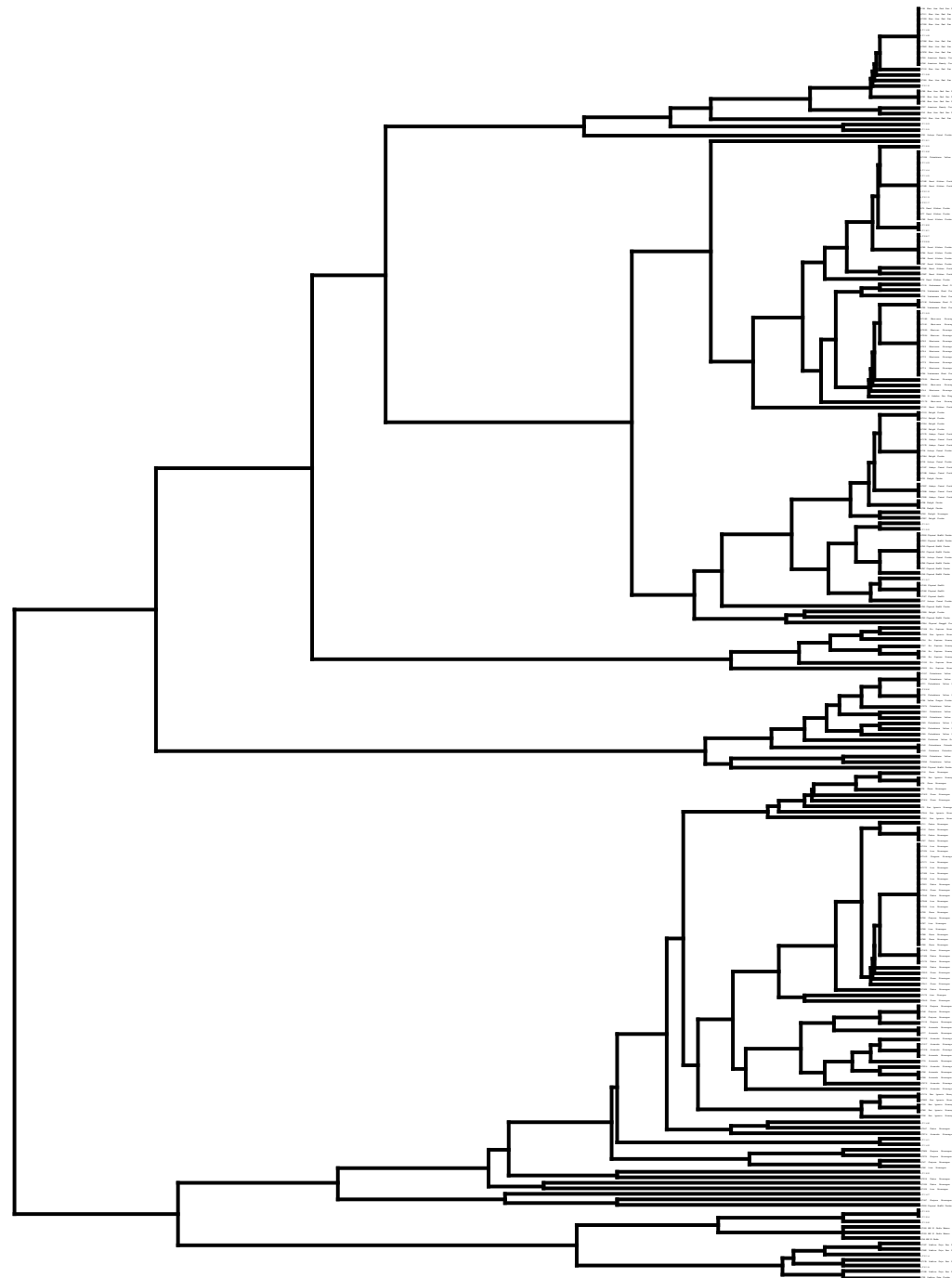


— 0.01 changes



H. guatemalensis

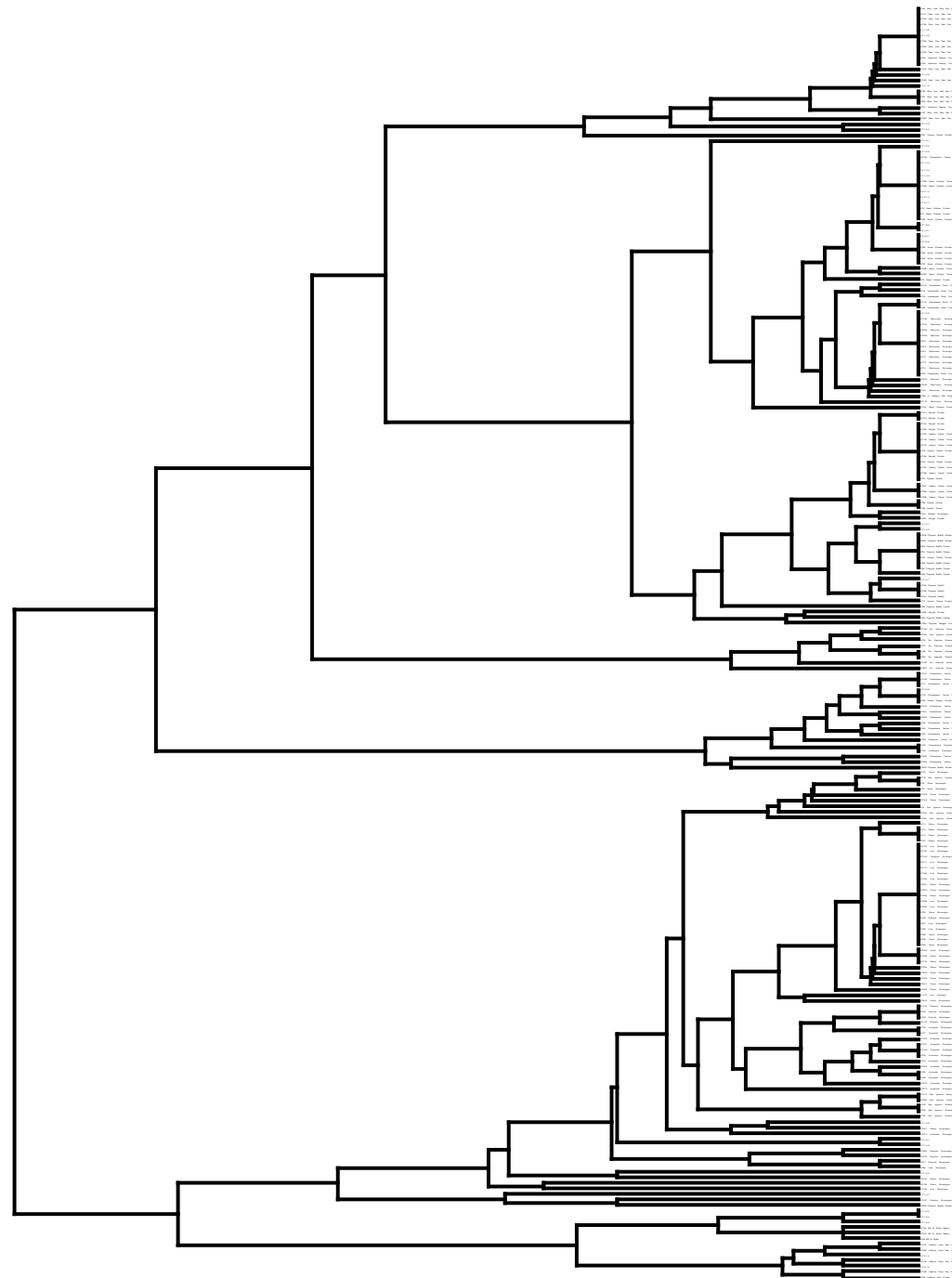




H. guatemalensis

H. undatus





H. guatemalensis

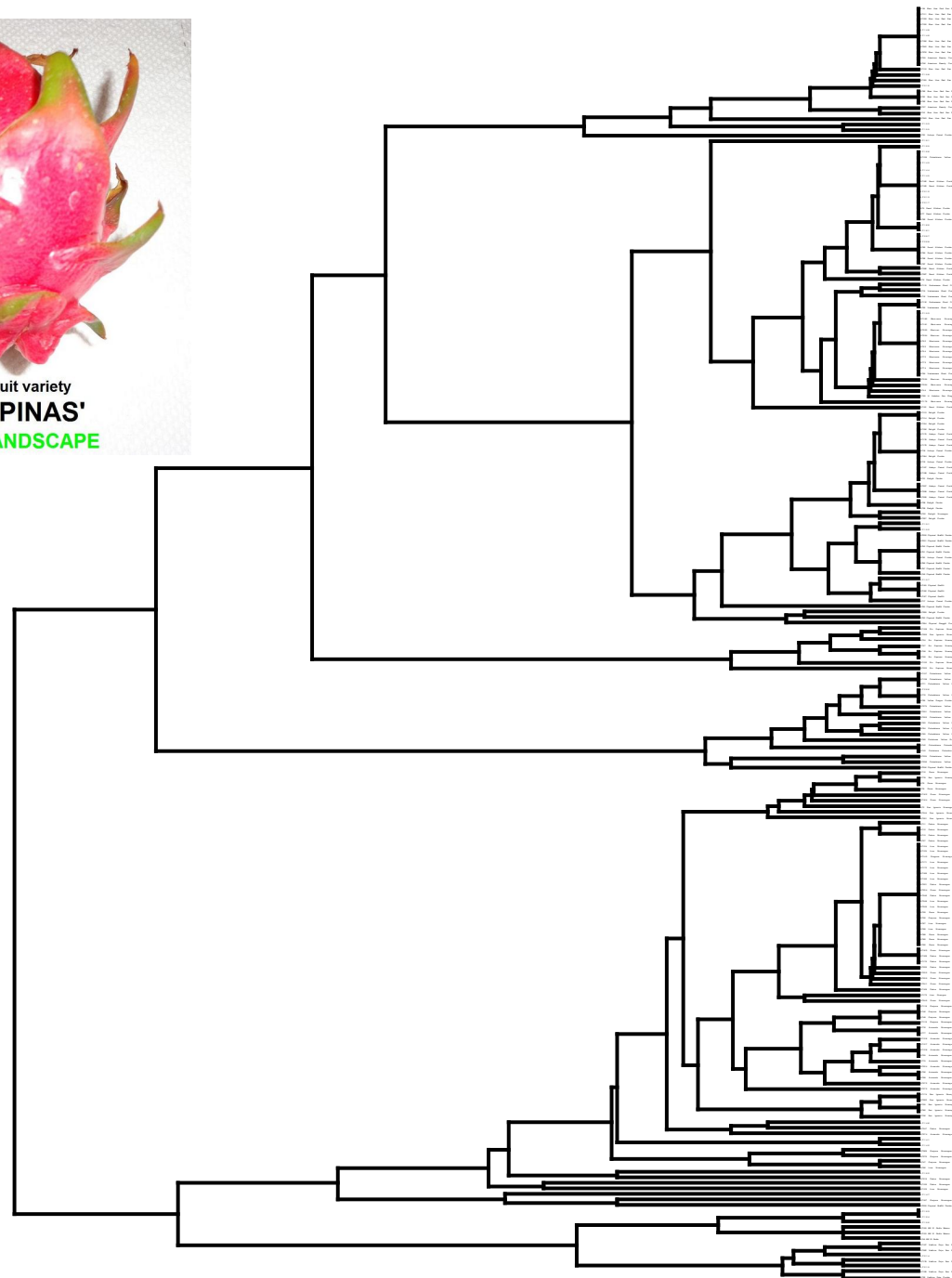
H. undatas

Hybrids



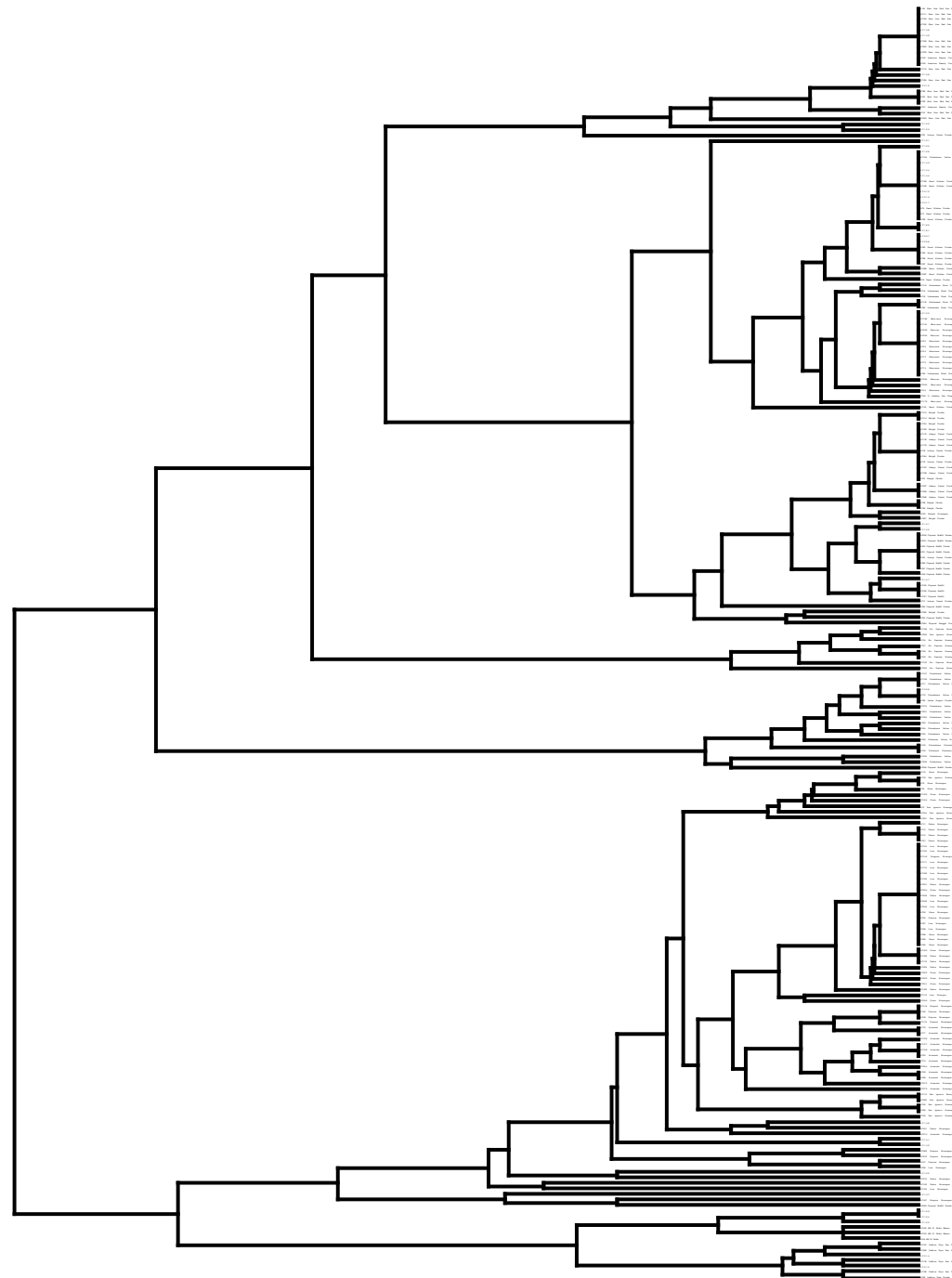
— 0.01 changes





- H. guatemalensis*
- H. undatas*
- Hybrids
- Hylocereus* sp.





H. guatemalensis

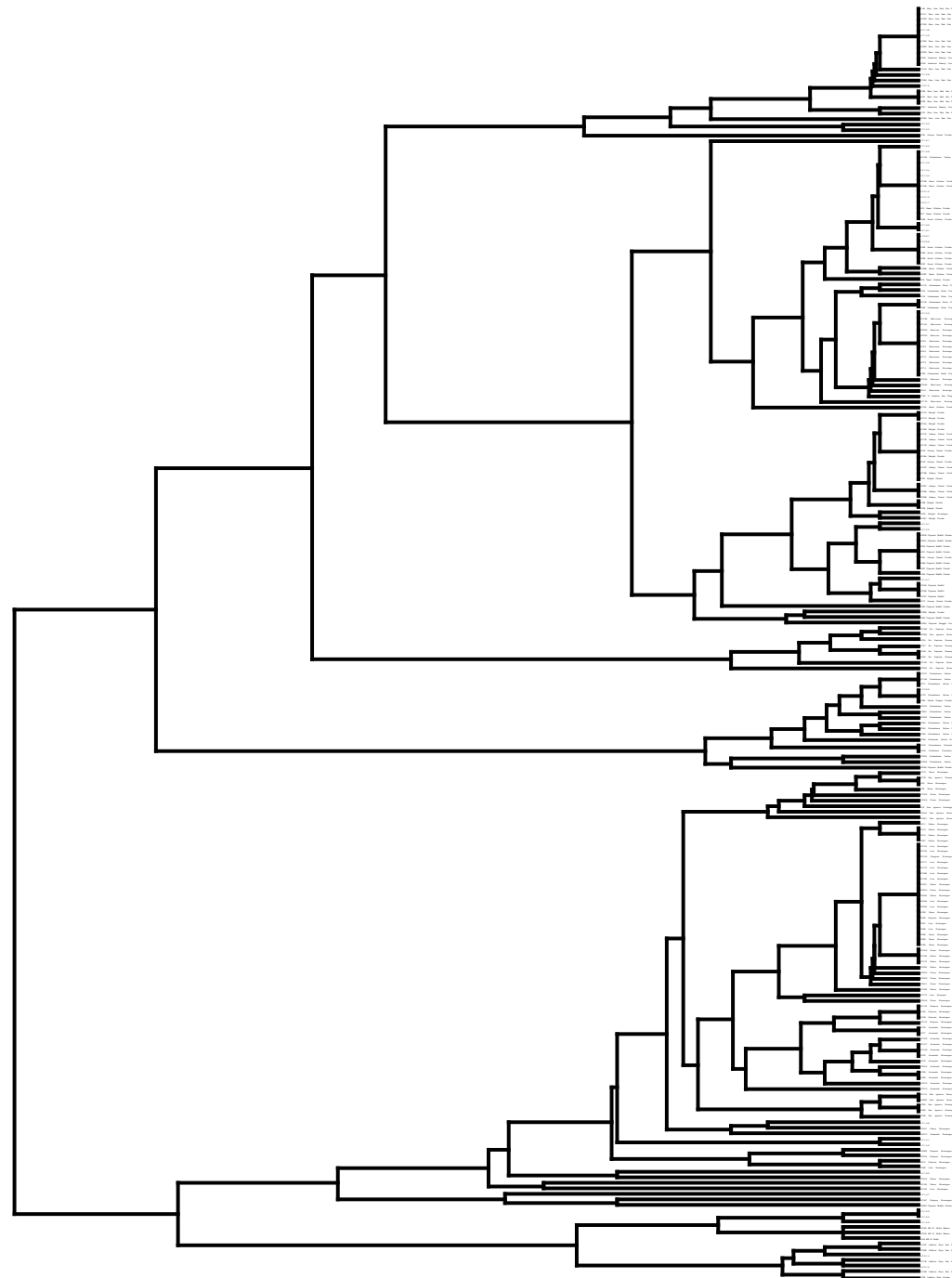
H. undatas

Hybrids

Hylocereus sp.

H. megalanthus

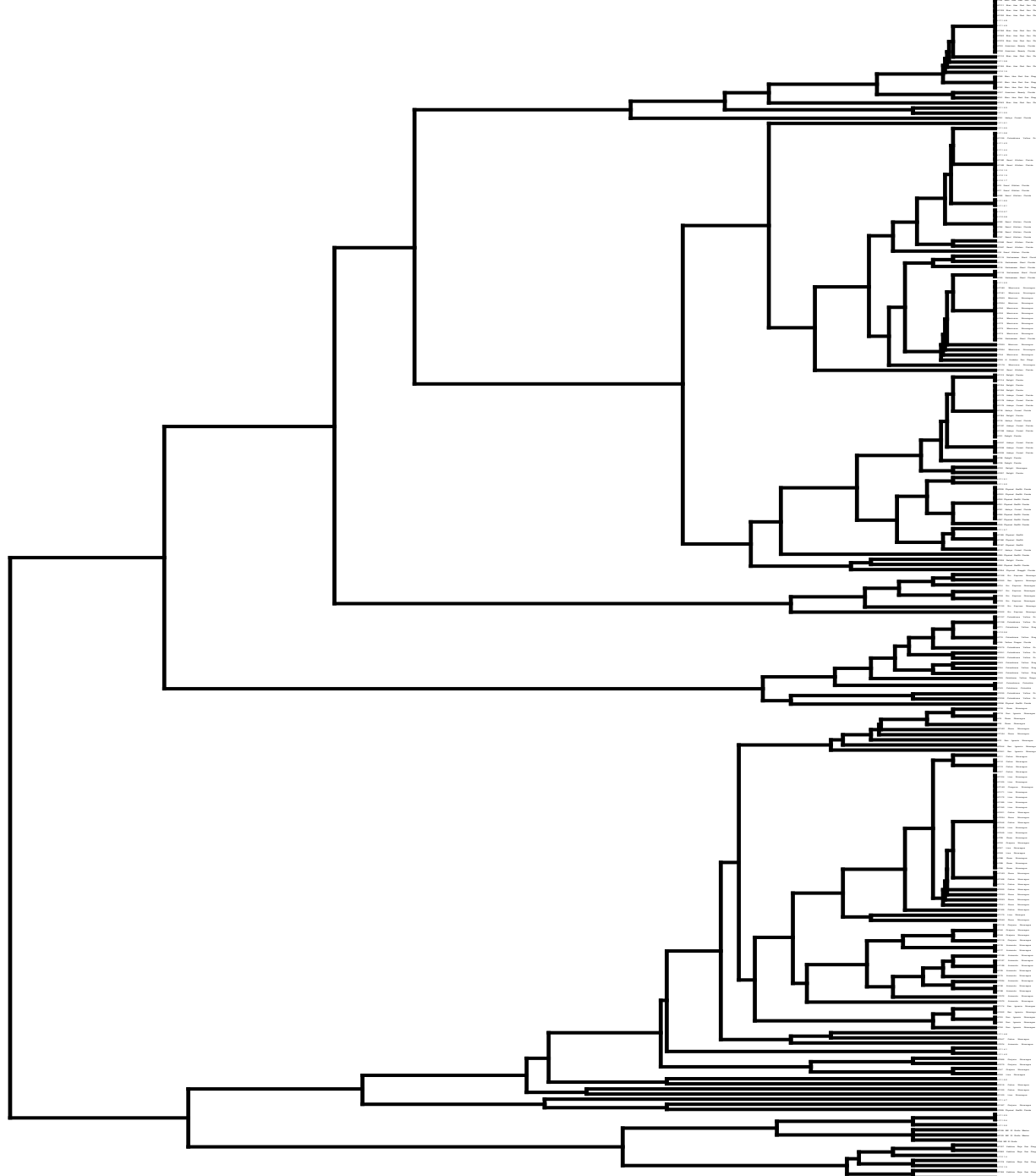




H. guatemalensis



H. polyrhizus



H. guatemalensis

H. undatus

Hybrids

H. megalanthus

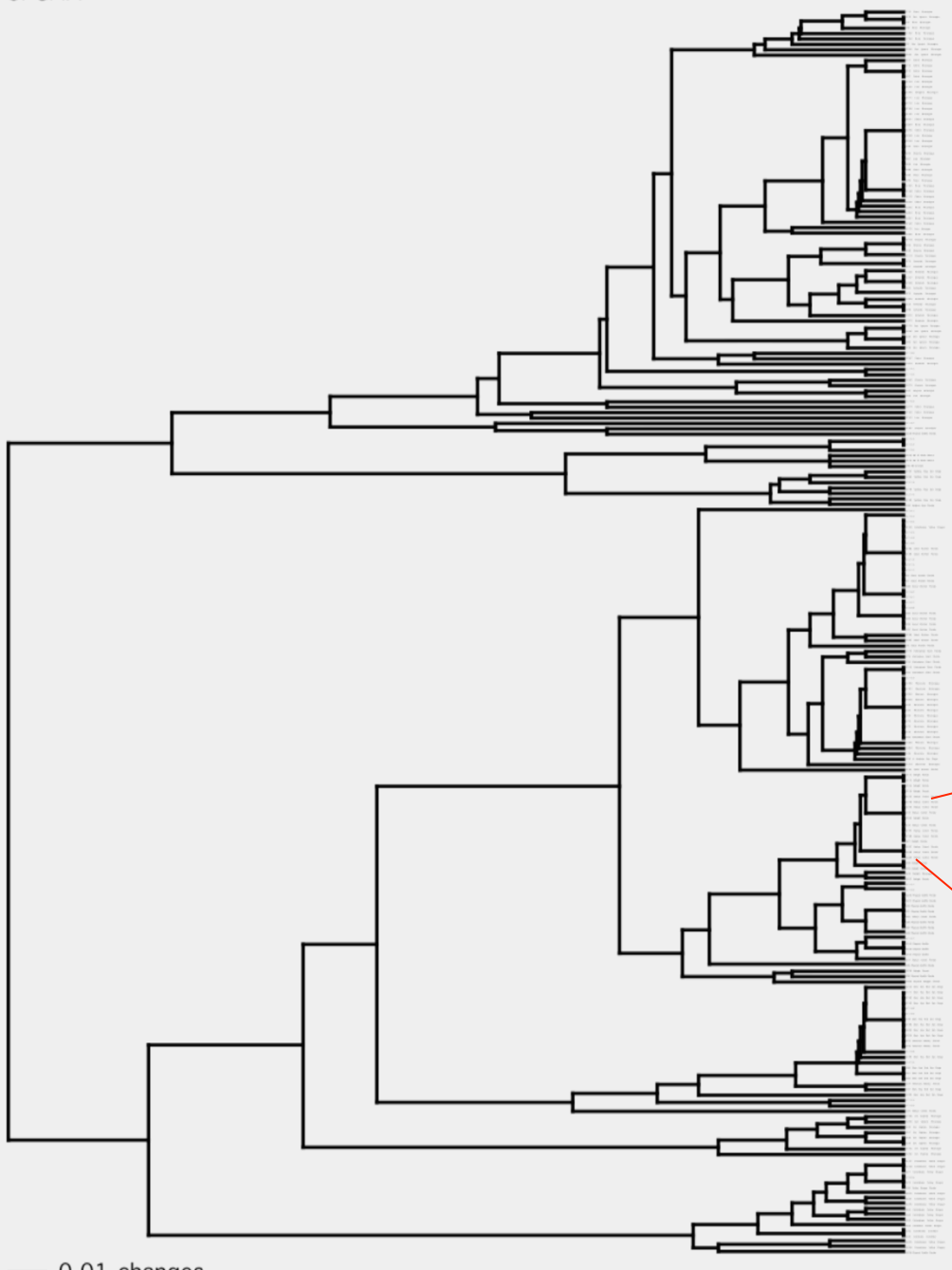
Hylocereus sp.

H. Polyrhizus

H. Costaricensis

H. ocamponis

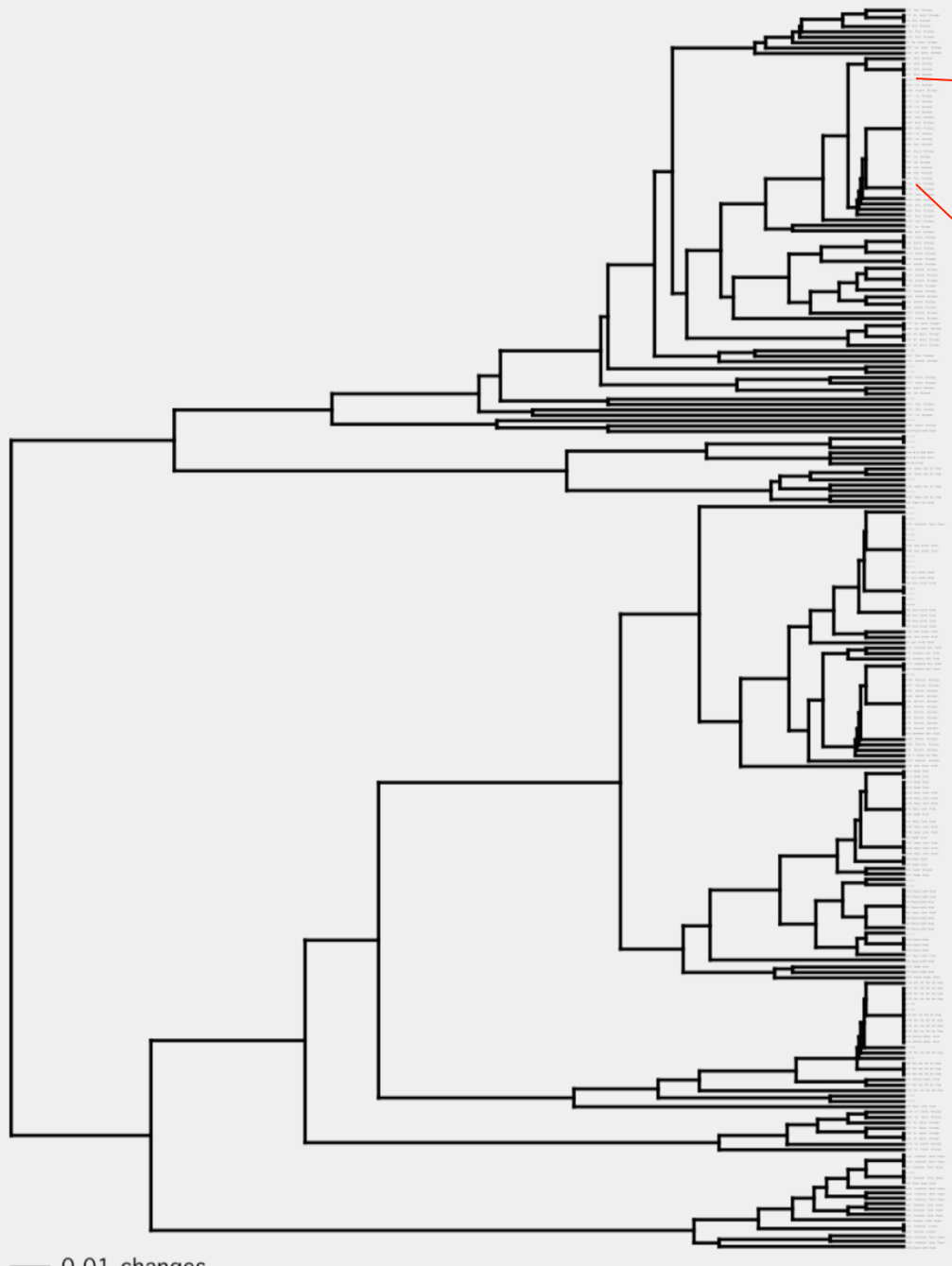
— 0.01 changes



American Beauty

Bien Hoa Red

UPGMA



**Lisa
Rosa
Oregona
Cebra**

DNA Work Results

- Seoul Kitchen, Vietnamese Giant, Bien Hoa White and Mexicana - White fleshed varieties, closely related-grouped as *Hylocereus undatus*
- Bien Hoa Red and American Beauty – identical, grouped as *Hylocereus guatemalensis* species from Guatemala
- Delight, Haley' s Comet and Physical Graffiti - very closely related hybrids
- Yellow Dragon and Colombiana – identical, grouped as *Hylocereus megalanthus* from Northern South America

DNA Work Results, Cont' d.

- All red-fleshed accessions originating from Nicaragua are very closely related. However, two clusters were found with Lisa, Rosa and Cebra in one cluster and Armando and San Ignacio in another. These accessions could be grouped under *Hylocereus costaricensis* or *Hylocereus polyrhizus*.
- Sin Espinas, originally from Nicaragua is the only thornless variety and appears to be different from other Nicaraguan accessions (putatively undescribed *Hylocereus* sp.)
- Valdivia Roja, El Grullo and other similarly looking accessions from Mexico are very closely related and could be grouped as *Hylocereus ocamponis*.

DNA Work Results, Cont' d.

- DNA Analysis confirmed suspicions about duplication of entries among named varieties based on field observations and data collected from our field trials
- With the exception of Sin Espinas, all accessions cluster based on geographic origin and match the descriptions of species identified in those regions
- More work needed to identify specific markers for each of the species reported/identified in order to classify all accessions properly

Pitahaya Guide



Several Others Cultivars Under Observation

