New Artificial Hybrids in *Chrysalidocarpus* (Arecaceae). Part 1. The Tri-Bear Palm: *Chrysalidocarpus* x *leptocaryi*

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Abstract

This article, the first in an occasional series about the hybrid palms in *Chrysalidocarpus* (Arecaceae) that co-author Justen B. Dobbs is developing in Florida, U. S. A., addresses the tri-bear palm, *Chrysalidocarpus* × *leptocaryi*, a stunningly handsome hybrid in tropical and subtropical private collections and botanical gardens. This new hybrid palm is formally named, described, and illustrated, compared to its parents, and its cultivation and landscape use discussed.

Introduction

In 2004, co-author Dobbs viewed a remarkably handsome palm referred to as "triangle-Teddy bear palm" on the website of Daryl O'Connor, an Australian palm collector and grower. The palm, in O'Connor's Queensland garden, was considered an inadvertent, unintentional, or chance hybrid of *Chrysalidocarpus decaryi* (triangle palm) and *C. leptocheilos* (Teddy bear palm) (both then in the genus *Dypsis*), a hybrid that had likely existed as early as the late 1990s. In addition to the inadvertent appearance of this hybrid in Australia, it might have also existed in the palm breeding program at Nong Nooch Tropical Botanical Gardens in Thailand, a program that might be no longer extant.

Dobbs was so smitten with this hybrid that he made an intentional attempt to create it in 2004 while living in California, U. S. A. In this first documented intentional attempt, he used *Chrysalidocarpus leptocheilos* as the staminate or pollen parent and *C. decaryi* as the pistillate or seed parent but was unsuccessful. Dobbs theorized that *C. decaryi* likely could not be the seed parent but could serve as the pollen parent (see later for a discussion of this possible phenomenon).

In 2007, Dobbs moved to Florida, U. S. A. and established Seabreeze Nurseries with Derek Batke in Fort Myers on the west coast. In early 2008, Dobbs and Batke, while visiting nurseries in South Florida, again came across inadvertent hybrids of *Chrysalidocarpus decaryi* and *C. leptocheilos* at

1. This tri-bear palm, *Chrysalidocarpus* × *leptocaryi*, is in co-author Robert Burtscher's garden in Fullerton, California. Note the twisted leaves.

Searle Brothers Nursery and Rainforest Collection in Fort Lauderdale and at Redland Nursery near Miami and brought them to the attention of the nursery owners.

In 2010 and 2011, inspired by the inadvertent hybrids of *Chrysalidocarpus decaryi* and *C. leptocheilos* they had seen in South Florida nurseries, Dobbs and Batke made the first documented, successful, intentional cross of these two species, using *C. decaryi* as the pollen parent and *C. leptocheilos* as the seed parent and coined it with the moniker "tri-bear palm," the "tri" from triangle palm and the "bear" from Teddy bear palm.

Seabreeze Nurseries has been the primary developer of the tri-bear palm and distributes it through two nurseries, one in California and one in Florida. Because the tri-bear palm is becoming more common in palm collections in California (**Figs. 1–4**), Florida, Australia, and elsewhere, here we formally name, describe, and copiously illustrate it, compare it to its parents, and discuss its landscape use and cultivation. The description is mostly from fresh, non-dried material of the type plant grown in Fullerton, California and supplemented from fresh material in Florida.

Taxonomy

Chrysalidocarpus × leptocaryi Hodel, J. B. Dobbs & R. H. Burtscher sp. hyb. nov.

[*Chrysalidocarpus leptocheilos* (Hodel) Eiserhardt & W. J. Baker × *Chrysalidocarpus decaryi* (Jum.) Eiserhardt & W. J. Baker]. Type: CULTIVATED. U. S. A., California, Orange County: Fullerton, garden of Robert and Judy Burtscher, 1 September 2025, *D. R. Hodel 4083* (Holotype LASCA, Isotype BH). **Figs. 1–35**.

Diagnosis: *Chrysalidocarpus* × *leptocaryi* displays a range of characters with its parents (*C. decaryi* and *C. leptocheilos*), some intermediate, a few greater or larger than either parent (heterosis or hybrid vigor), a few lesser or smaller than either parent, a few unique that both parents lack, and some shared with one parent but not the other. For example, this hybrid is intermediate with its parents in trunk diameter, internode length, leaf rachis length, pinnae disposition, peduncular bract length, and fruit and seed size. *Chrysalidocarpus* × *leptocaryi* has characters greater than either parent (hybrid vigor), including leaf base length, pistillode size, and growth rate. In contrast, its inflorescence rachis length is shorter than that of either parent. A unique character of *Chrysalidocarpus* × *leptocaryi* that both parents lack is the distally twisted leaf rachis/blade. Some characters it shares with one parent but not the other, including with *C. leptocheilos* the white-waxy trunk, straight leaves, and the reddish to orangish brown tomentum on the leaf base and peduncular bract; and with *C. decaryi* the staminate petal length and the bifid eophyll. **Table 1** (see page 30) summarizes these and other differences between *Chrysalidocarpus* × *leptocaryi* and its parents.

2. Co-author Burtscher stands with a tri-bear palm in Len Geiger's garden, Vista, California.

3. A splendid tri-bear palm grows in Bob DeJong's garden in Vista, California.

4. A young but robust tri-bear palm grows in Gary Levine's garden in Escondido, California.

5. The trunk of the tri-bear palm is robust, strikingly white, and one of its most handsome features, as here in Len Geiger's garden in Vista, California.

6. Trunk internodes of the tri-bear palm are green but covered with white wax, as here in Bob DeJong's garden in Vista, California.

7. Here is the trunk of the type plant of the tri-bear palm in Robert Burtscher's garden, Fullerton, California. *Hodel 4083*, holotype.

8. Leaf bases of the tri-bear palm are a large, attractive feature of the palm. *Hodel 4083*, holotype.

9. In this adaxial view, a "shoulder" near its apex and just below and on either side of the petiole attachment is a typical feature of the tri-bear palm. *Hodel 4083*, holotype.

10. In this abaxial view of the leaf base "shoulder" of the tri-bear palm, note the thick, reddish brown tomentum. *Hodel 4083*, holotype.

11. The abaxial surface of tri-bear leaf bases is covered with reddish brown tomentum, as here in Bob DeJong's garden in Vista, California.

12. Abaxially, the tri-bear leaf base is densely covered with reddish brown tomentum. *Hodel 4083*, holotype.

Etymology: Because the pistillate or seed parent is typically listed first and the staminate or pollen parent second in a hybrid name, we have combined the first two syllables of the seed parent epithet *leptocheilos* and the last two of the staminate parent epithet *decaryi* to form the hybrid species epithet, *leptocaryi*.

Habit: Solitary, moderate to robust, monoecious, unarmed, pleonanthic, tree palm to at least 15 m tall (**Figs. 1–4**).

Trunk/Stem: to at least 10 m tall, 20–30 cm DSH, internodes 8–12 cm, smooth, green with a waxy-white bloom, leaf scars 1–1.5 cm wide, tan (**Figs. 5–7**).

Leaves: ca. 12, pinnate, subtristichous to tristichous, ascending, straight, sometimes twisted distally (**Figs. 1–4**); **base/sheath** ca. 75 cm long (**Fig. 8**), ca. 73 cm circumference at base where clasping trunk and there 1 cm thick, margins tapering to 7 mm thick at apex, thick-leathery (drying woody), a broad "shoulder" 2.5–3 cm high near apex and just below and on either side of the petiole attachment (**Figs. 9–10**), abaxially densely covered with reddish brown tomentum (**Figs. 11–12**), adaxially smooth, glabrous, red to pinkish with green distally on either side of petiole attachment (**Figs. 13–14**); **petiole** relatively short, 14–16 cm long, ca. 10 cm wide and 7–8 cm thick at base, ca. 7 cm wide and 5–5.5 cm thick at apex, abaxially rounded, adaxially concave and broadly channeled , margins sharp, knife-like, green but overlain with thick, reddish brown tomentum; **rachis** 3.2–3.3 m long, tapering to 2 mm diam. at apex, abaxially rounded, adaxially shallowly channeled proximally progressively transitioning to a flat, low, broad ridge and then a narrow, knife-like ridge distally, green, abaxially with indument as petiole but transitioning to nearly glabrous at apex, adaxially glabrous; **blade** 3.4–3.5 m long, ca. 1.5 m wide at mid-blade; rachis/blade conspicuously twisted distally (**Fig. 15**); **pinnae** 90–92 per side, regular arranged, close-set (**Fig. 16**), and in same plane on one side, pinnae on the two sides held nearly in the same plane to form a flat blade, rigid, spaced ca. 4 cm apart proximally, 3 cm apart mid-blade, and 2 cm apart distally, most proximal 66–76 × 1.3–1.5 cm, mid-blade largest, 91–95 × 4.25–5 cm, most distal 24–41 ×1.3–1.4 cm, mostly straight, rarely only very slightly and briefly falcate, constricted at attachment point and 4–5 mm wide proximally, 1 cm wide mid-blade (**Fig. 17**), 5 mm distally, abaxially and adaxially midrib prominent and elevated (**Fig. 17**), marginal nerves conspicuous, distal marginal nerve swollen, lesser nerves numerous, visible, few to several grayish ramenta on abaxial midrib mostly within about 10–20 cm of rachis, these up to 1 cm long, scurfy (**Fig. 17**).

Inflorescences: 3, interfoliar in flower (**Fig. 18**), inter- or infrafoliar in fruit, 170 × 75 cm (**Fig. 19**), ascending, branched to 3 orders; **peduncle** ca. 78 cm long (**Fig. 19**), base 50 cm long/wide where clasping but not encircling trunk in its entirety, ca. 10 cm wide and 2.5 cm thick at prophyll attachment, tapering to 5 cm wide and 2.5–3 cm thick at apex, with sparse to dense, reddish brown tomentum; **prophyll** ca. 58 cm long, ca. equaling most proximal branch (**Fig. 19**), attached c. 18

13. Adaxially, tri-bear leaf bases are glabrous and can be bright red. *Hodel 4083*, holotype.

14. Adaxially, tri-bear leaf bases can be pink with green on either side near the petiole sometimes. *Hodel 4083*, holotype.

15. The typically twisted leaf blade/rachis of the tri-bear palm is a good diagnostic character, as here in the Robert Burtscher garden in Fullerton, California.

16. Tri-bear pinnae are numerous, regularly arranged, and close set, as here in the Robert Burtscher garden, Fullerton, California.

17. Tri-bear pinnae are constricted at the base and have a prominently elevated midrib. Note the ramenta on the abaxial midrib. *Hodel 4083*, holotype.

18. Inflorescences of the tri-bear palm are interfolia in flower. *Hodel 4083*, holotype.

19. The inflorescence of the tri-bear palm is ascending and branched to three orders. Note the peduncle with sheathing prophyll. *Hodel 4083*, holotype.

cm distal of peduncle base, bicarinate, leathery, obliquely open and acute apically, reddish, abaxially with scurfy, relatively long, reddish brown tomentum, adaxially mostly glabrous and copper colored (**Fig. 20**); **peduncular bract** ca. 63 cm long, exceeding prophyll and 2 most proximal branches (**Fig. 19**), attached ca. 33 cm distal of peduncle base, bicarinate, thin-leathery, obliquely open and acute-acuminate apically, abaxially densely covered with relatively long, sometimes scurfy, reddish brown tomentum **(Fig. 21**); **rachis** ca. 90 cam long, tapering to 4 mm diam. at apex, green with scattered, light, reddish brown tomentum (**Fig. 22**); ca. 19 **branches** and 13 simple rachillae, most proximal branches largest and most complex, to 60 cm long, branches and rachillae subtended by **rachis bracts**, these low, crescent-shaped but with mucronate center tip to 1.5 cm tall at the most proximal branches (**Fig. 23**) to barely discernable distally; **rachillae** 16–17 cm long, 3–3.5 mm diameter at base, tapering to a 2 × 2 mm pointed tip, green, minutely white-spotted.

Flowers: arranged in **triads** of a center, later-opening pistillate flower flanked on each of two sides by earlier-opening staminate flowers with solitary or paired staminate flowers only in distal 1/5 of rachilla, triads in two spirals, each with 7–8 triads in 1 revolution, triads 4 mm distant within a spiral and spirals 2 mm distant proximally becoming closer distally; triads and solitary and paired staminate flowers in clefts 2 mm long, 3 mm wide, 1 mm deep, proximal lip 0.75 mm high, crescent-shaped, broadly rounded with acute margin or angle; **staminate flowers** 4 × 2.5 mm, yellow-cream colored **(Fig. 24**); **calyx** 1.75 × 2.5 mm, cup-like, **sepals** imbricate nearly to apex and there broadly rounded to truncate, yellowish green; **petals** 3.5 × 2 mm, ovate, erect and free apically, valvate, creamy yellowish; **stamens** 6(?), 3.5 mm high, ca. equaling petals, filaments 3.5 mm long, 0.6 mm wide, clear-colored to white, anthers 1 × 0.7 mm, medifixed, white; **pistillode** large, 4 × 2–2.5 mm, slightly exceeding petals, broadly columnar to conic; **pistillate flowers** subtended by 1–2 bracteoles, these 0.5 mm high, imbricate, thin, nearly transparent, forming a cup-like structure 1.5 mm wide, light green; individual pistillate flowers 4–4.5 × 3 mm, ovoid (**Fig. 25**); **calyx** 1.75 × 2–2.5 mm, cup-like, **sepals** imbricate in proximal 4/5, broadly rounded triangular distally, green; **petals** 3.5–3.75 × 3–3.5 mm, broadly ovate, imbricate nearly to apex and with a slightly mucronate tip, light green; **gynoecium** 4 × 2.75 mm, ovoid, white, stigma lobes 3-parted, erect, pointed, slightly exceeding petals.

Fruit: 12–13 × 15–17 mm, globose-ovoid, greenish brown with slight glaucous bloom (**Fig. 26** ; **seed:** 9.5–10 × 13–15 mm, globose-ovoid with a flat spot adjacent to the embryo; endosperm ruminate (**Fig. 27**); eophyll bifid (**Fig. 28**).

20. The tri-bear prophyll is bicarinate, leathery, and adaxially mostly glabrous and coppery colored. *Hodel 4083*, holotype.

21. The abaxial surface of the tri-bear peduncular bract is densely covered with reddish brown tomentum. *Hodel 4083*, holotype.

22. Like the peduncle, the inflorescence of the tri-bear palm is green with scattered, light, reddish brown tomentum. *Hodel 4083*, holotype.

23. Inflorescence rachis bracts of the tri-bear palm at the most proximal branches are crescent-shaped but with a mucronate center tip. *Hodel 4083*, holotype.

24. Staminate flowers of the tri-bear palm are yellow cream-colored but seem defective and non-functional. *Hodel 4083*, holotype.

25. Pistillate flowers of the tri-bear palm are greenish with a white gynoecium with the stigmatic tips exserted beyond the petals. *Hodel 4083*, holotype.

26. Nearly mature, ripe fruits of the tri-bear palm on *Chrysalidocarpus leptocheilos* are globose-ovoid and greenish with a slight glaucous bloom. Note the protective poly screen mesh bag. © 2025 J. B. Dobbs.

27. The seed of the tri-bear palm has ruminate endosperm. © 2025 J. B. Dobbs.

28. The bifid eophyll of the tri-bear palm (right) contrasts with the pinnate eophyll of *Chrysalidocarpus leptocheilos* (left). The eophyll of *C. decaryi* is also bifid. © 2025 J. B. Dobbs.

Discussion

Co-author Dobbs, who has been making many hybrids in *Chrysalidocarpus* for about 20 years (**Fig. 29**) , feels that most but not all hybrids in the genus are self-sterile. The tri-bear palm is self-sterile; it will not produce viable seeds when self-pollinated, a condition found in many hybrid plants. The reasons for hybrid self-sterility are several and are typically related to the chromosomes of each parent. One of the primary reasons is that the two parents of a hybrid have different chromosome numbers, which means that during meiosis they do not pair correctly, resulting in the failure to produce gametes with the correct number of chromosomes to produce viable offspring (Blackwell 2025, Velos 2022).

However, Dransfield et al. (2008) noted that nearly all species of *Chrysalidocarpus* (as *Dypsis*) have a chromosome number of 2n = 32, a common number in subfamily Arecoideae and the pre-

29. Co-author Dobbs stands with a tri-bear palm at his Florida nursery, one of the first that he ever produced. Note the black poly mesh bag protecting the infructescence. © 2025 J. B. Dobbs.

dominant number in the tribe Areceae in which *Chrysalidocarpus* is placed. Thus, differences in chromosome numbers do not seem to be the reason for tri-bear's self-sterility.

Another possible reason for hybrid sterility is the occurrence of micro- and macro-gene inversions, which reorder the genes, so they do not match up well. Other genetic discrepancies,aberrations, and mutations can also be responsible for self-sterility, and more work is needed to resolve this phenomenon.

Thus, to produce fruits with viable seeds of the tri-bear palm, pollen from another species (not a hybrid) must be used, and pollen from the hybrid's staminate parent, *Chrysalidocarpus decaryi*, seems to be the most compatible and effective. However, the resulting offspring will not be an authentic or true tri-bear palm. If authentic tri-bear palm is desired, the original F1 cross must be made (pollen of *C. decaryi* placed on pistillate flowers of *C. leptocheilos*).

Through trial and error, Dobbs has also determined that tri-bear hybrids are only successfully produced if the pollen source is *Chrysalidocarpus decaryi*, not *C. leptocheilos*. He suspects that, for an unknown reason, *C. decaryi* has pollen that makes it a successful staminate or pollen parent in a hybrid, a suspicion that is borne out by other hybrids of *C. decaryi* that Dobbs has made. Similarly, in oil palms (*Elaeis guineensis*), Criollo-Escobar and Dominguez (2018) found that the genotype of the pollen provider determines pollen quality, especially viability and germinability, which are critical for proper pollination and fruit and seed development. More work is needed to resolve this phenomenon, too.

In a perhaps related phenomenon, staminate flowers of the type plant of the tri-bear palm in co-author Burtscher's garden in Fullerton, California appear unusually small, misshapen, malformed, and non-functional (**Fig. 24**). They never open fully like those of either parent, abort prematurely, and drop from the inflorescence. The stamens especially are deformed and appear to lack pollen. Thus, at least for the tri-bear palm, the lack of proper development of functional staminate flowers seems to be a barrier to self-compatibility. On the other hand, pistillate flowers of the type plant appear to be normal.

The tri-bear palm displays a range of characters with its parents, some intermediate, a few greater or larger than either parent (heterosis or hybrid vigor), a few lesser or smaller than either parent, one unique that both parents lack, and some shared with one parent but not the other. An unusual but inconsistent tri-bear character is that sometimes leaves on young, trunkless plants emerge bright red (**Fig. 30**). The earlier diagnosis and **Table 1** summarize critical character differences between the tri-bear palm and its parents.

30. Sometimes small juvenile tri-bear plants produce strikingly red, new leaves. © 2025 J. B. Dobbs.

Table 1. Summary of critical character differences between *Chrysalidocarpus* × *leptocaryi* (tri-bear palm) and its two parents: *C. decaryi* and *C. leptocheilos*[z].

Character	C. decaryi	C. × leptocaryi	C. leptocheilos
Trunk			
Diam. standard height (cm)	30–40	20–30	25
Internode length(cm)/color	3–10/gray	8–12/white waxy	12/white-waxy
Leaf			
Disposition	arching	mostly straight	straight
Leaf base length (cm)	30–45	75	62
Indument	white waxy with reddish pubescence	reddish brown tomentum	rusty brown tomentum
Rachis length (m)	2.2–3	3.3–3.4	4
Blade twisted distally	no	yes	no
Pinnae disposition	ascending	flat	slightly drooping
Inflorescence			
Position	interfoliar	interfoliar then infrafoliar	infrafoliar
Peduncular bract length (cm)	40–55	63	70
Peduncular bract indument	scattered scales	reddish brown tomentum	reddish brown tomentum
Rachis length (cm)	118	90	100
Flowers			
Staminate color	yellow to orange	yellow to yellow-cream	yellow
Pistillate color	green	green with white gynoecium	green
Staminate petals (mm)	3.2–3.5 × 1.8–2.3	3.5 × 2	2 × 1.5–1.75
Pistillode (mm)	1.6 × 1	4 × 2–2.5	1.75–2
Fruit			
Size (mm)/shape	15–22 × 12–19 mm/ovoid to subglobose	12–13 × 15–17 mm/globose-ovoid	10–12 mm diam., globose
Seed size (mm)/shape	17–19 × 16–18 mm/subglobose to ellipsoid	9.5–10 × 13–15 mm/ globose-ovoid	8.5–10 × 8.5–9 mm/ globose
Eophyll	bifid	bifid	pinnate

[z]Characters for both parents taken mostly from Dransfield and Beentje (1995).

On the occasion that flowers of *Chrysalidocarpus* × *leptocaryi* self-pollinate, it develops fruit that inexorably aborts when about 0.5 cm in diameter, being either parthenocarpic or containing brown endosperm void of any embryo.

The tri-bear palm clearly exhibits hybrid vigor, surpassing both parents in its growth rate. Once trunk forms in California, it produces about three leaves and 30 to 35 cm of trunk annually until flowering commences, at which time trunk production slows slightly because internodes become shorter. Growth rates can be greater in tropical regions with year-round warmth. Under optimal summer growing conditions, growth can be phenomenal, with new leaves and attendant trunk seemingly telescoping vigorously upwards out of the top. Indeed, growth is so vigorous that the new leaves, including their bases and the even newer leaves ensconced within them, sometimes list or lean slightly in one direction (**Figs. 31–32**). This trunk listing or leaning is similar to leaning crown syndrome, which has been linked to boron deficiency (Hodel 2012) but, in this instance, might occur because the rapid, heavy, new leaf and trunk growth cannot completely support itself. Hodel (2012) and Tomlinson (1990, 2006) discussed the phenomenon of palm trunks or stems strengthening as they age. The hardest, strongest tissues are in the proximal portions of the trunk, which are the oldest, while the softest, weaker tissues are in the distal portions of the trunk, which are the youngest. Thus, the young, soft tissues of the new growth have not yet attained anywhere near their maximum strength and can be subject to listing or leaning. We have noticed this phenomenon with other hybrids in *Chrysalidocarpus*.

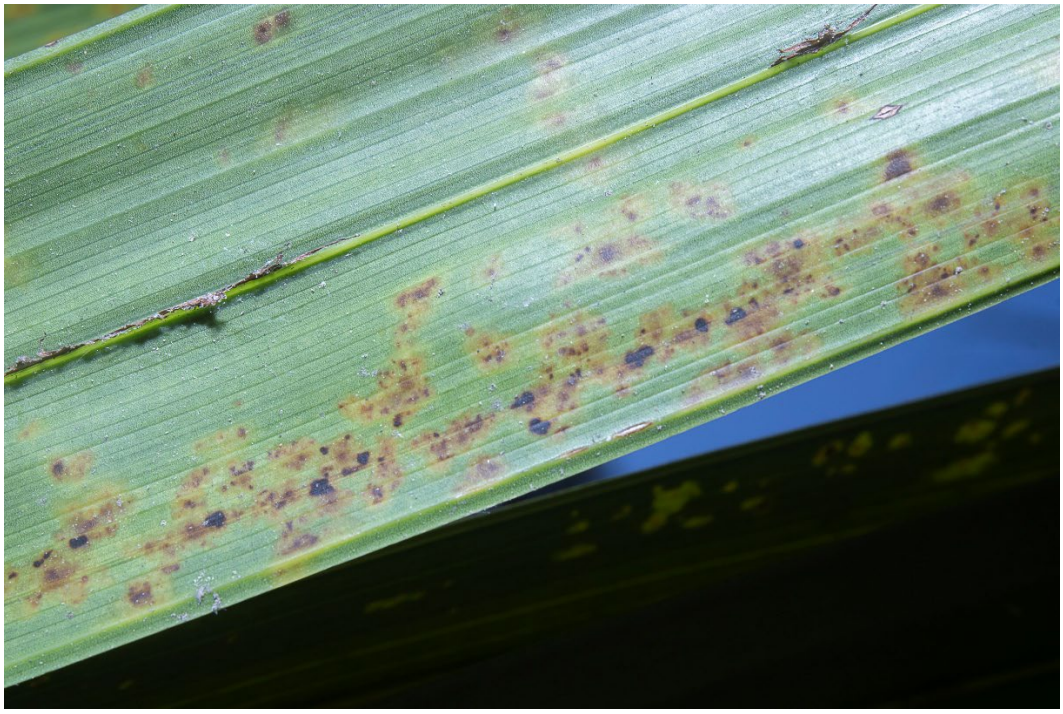
Another possible byproduct of hybridization in tri-bear palms in California is the yellow and brown splotching that appears on lower or older leaves in the canopy. This splotching is more evident with a backlit leaf (**Figs. 33–35**). One's first inclination might be to diagnosis this splotching as a nutrient disorder, such as potassium deficiency (Broschat et al.2014, Hodel 2012), and, indeed, these symptoms can fit this disorder. Another explanation could be lesion mimic mutants, which are a result of the hybridization process and can become sufficiently severe to kill some palms, such as the mule palm (×*Butiagrus nabonnandii*) (Dhillon et al. 2024). Lesion mimic mutants do not respond to fertilizer or pesticide and fungicide applications because they are the result of genetic anomalies in the hybridization process.

That tri-bear hybrids were being inadvertently produced in palm collections and nurseries in Australia as early as the late 1990s and later in Florida is more evidence that supports the possibility or even likelihood that cultivated collections of numerous, closely related palm species might be a source of hybrid progeny unless pollen-exclusion techniques are employed, rather than being a typically, long-touted method to perpetuate and conserve species and genetic material. This inadvertent, undocumented, and mostly unwanted hybridization, to which Hodel (2023, 2025) alluded, is worrisome and disconcerting. While hybrids can expand and enhance our palette of

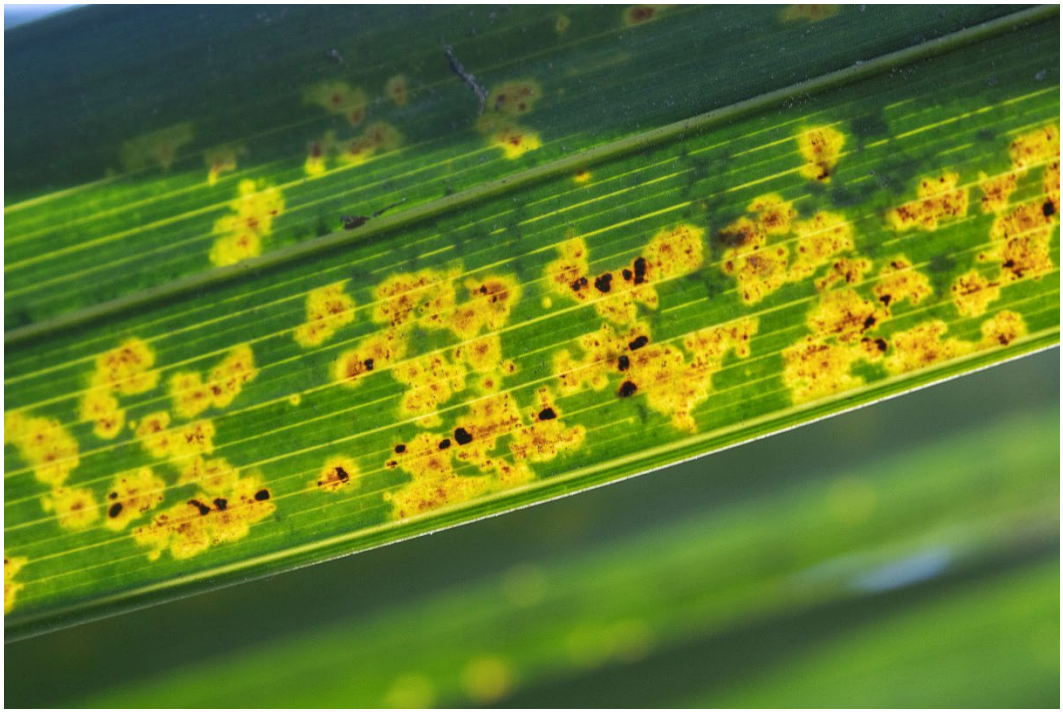
31. Exceptionally fast growth might be responsible for the leaning of the distal part of the trunk of this tri-bear palm in the Robert Burtscher garden, Fullerton.

32. Another tri-bear in the Robert Burtscher garden in Fullerton, California shows listing or leaning of the distal part of the trunk, perhaps the result of hybrid vigor.

33. Yellow or dark splotching on the older or lower leaves in the canopy of the tri-bear palm could be a potassium deficiency or a lesion mimic mutant disorder.



34. Yellow or dark splotching on the older or lower leaves in the canopy of the tri-bear palm could be a potassium deficiency or a lesion mimic mutant disorder.



35. Yellow or dark splotching on the older or lower leaves in the canopy of the tri-bear palm, especially conspicuous when backlit, could be a potassium deficiency or a lesion mimic mutant disorder.

landscape palms, we feel that they should be well documented, typified, described, and supported with meticulous notes, photographs, and records.

In *Chrysalidocarpus*, inadvertent hybrids seem to occur in South Florida in the most commonly cultivated species, such as *C. lutescens*, which is grown by the millions for the nursery andlandscape trades in Florida and for export. J & K Plant Distributors in Miami, Florida reported in 2024 (pers. comm.) that *C. lutescens* and *C. decaryi* will occasionally and inadvertently hybridize in their nursery; the hybridized nature of some open-pollinated, seed-grown plants will become evident as they grow and develop. These occasional hybrids are seen as a novelty by some nursery growers and sold to local collectors while others simply sell them unknowingly as "pure" species.

Cultivation

For comprehensive reviews of palm horticulture and landscape management, see Broschat et al. (2014) and Hodel (2012).

Tri-bear palms seem well adapted to a variety of subtropical and tropical climates and regions around the world. They seem adapted to tropical and warm subtropical, moist to wet conditions, like those of southern Florida, northern Australia, Thailand, and elsewhere. They are tolerant and grow unusually well in warm or slightly cooler, drier, and more arid subtropical conditions, like the Mediterranean-climate regions of southern California, southern Europe, southern Africa, parts of Australia, and elsewhere. One of tri-bear's parents, *Chrysalidocarpus decaryi*, likely imparts heat, cool, drought, wind, and arid tolerance to tri-bear palms. Despite this drought tolerance, tri-bear palms perform best with occasional irrigation during dry, rainless periods (see later).

Tri-bear palms will tolerate hot temperatures, likely as warm as 45 C, especially if given some afternoon shade and occasional irrigation. They will also tolerate short, overnight periods of near-freezing and slightly sub-freezing temperatures to ¯2 C with little or no damage.

Propagation of tri-bear palms is by seed, which can be produced on *Chrysalidocarpus leptocheilos* whose pistillate flowers are pollinated with pollen from *C. decaryi*. Measures should be taken to emasculate the inflorescence. Remove staminate flowers of *C. leptocheilos* pre-anthesis to exclude unwanted pollen, which is critical to maximize hybrid fruit production and prevent self-pollination. To remove staminate flowers mechanically, simply rub them off with your fingers beginning at the distal end of each rachilla and moving toward the proximal end. Removal should be done well before staminate anthesis to eliminate the chance of stray pollen escaping the flower during removal and lodging on the pistillate flower. It is helpful to start by cutting off or

removing the distal portion of each rachilla, which contains only solitary or paired staminate flowers anyway and no pistillate flowers. Then remove the staminate flowers in triads with a pistillate flower in the more proximal portion of the rachilla. Be careful not to damage pistillate flowers when removing staminate flowers. After removal of staminate flowers, spray the entire inflorescence with a mixture of water, a denaturing agent, and a surfactant to wash off any escaped pollen. Also, the now emasculated inflorescence must be protected to exclude unwanted, foreign pollen spread by wind and/or insects from adjacent or nearby individuals of *Chrysalidocarpus*, which can be done by emasculating or removing inflorescences on other palms or enclosing securely the just emasculated inflorescence in a protective bag of cheesecloth, poly screen mesh (**Fig. 29**), or specialized pollination bags used in the date and oil palm industries. The poly mesh bags also provide protection of the developing fruits against marauding herbivores.

When fruits are mature and soft ripe, they can be collected from the palm, cleaned of their pulp, and planted in a clean, moist, porous, well aerated medium composed of about 25% organic matter like peatmoss or coir and 75% inorganic matter like perlite, pumice, or sand. Plant the seeds, barely covering them with about 5 to 10 mm of medium. Place the clean, planted containers off the ground and keep them clean. Keep the medium moist but not soggy wet and maintain temperatures of from 24 to 32 C.

When the first eophyll has appeared, pot up seedlings into appropriately sized, clean containers using the same or similar mix used for germination, only now incorporate dolomite lime and a palm-special fertilizer into the mix following recommended rates. Keep plants off the ground and in light shade, especially in the afternoon. As root fill out their containers, move up young plants into larger containers and gradually decrease any shade until they are in full sun. Keep the potting medium evenly moist.

When the plants are of sufficient size, they can be planted out into the ground. Tri-bear palms perform well in just about any type of soil, from the clays, sandy loams, and decomposed granites of southern California to the limestone soils of Florida, as long as the soil environment is managed properly, especially as it pertains to irrigation.

Situate tri-bear palms in full sun or with some light, afternoon shade in the hottest, driest regions. Dig a whole as deep as the root ball is high and twice as wide. Place an appropriate amount of palm-special fertilizer in the bottom of the hole. Remove the container and place the palm in the hole. Backfill with the same soil that was dug out of the hole without amending it, tamp firmly, apply about five cm of good quality mulch from the palm's stem out to 60 cm, and irrigate thoroughly. If rain is insufficient, irrigate when the palm needs it by checking the original root ball, backfill, and surrounding site soil. Whichever one of these zones first dries out at a depth of about three to five cm under the soil surface (not counting the mulch), then immediately apply

sufficient water to moisten the upper 30 cm of the root zone. Irrigate again only when the root zone dries out again to a depth of three to five cm and continue this irrigation regimen.

Fertilize with a palm-special fertilize following label recommendations. Yellow and dark splotching sometimes occurs on older or lower leaves in the canopy of tri-bear palms, which could indicate potassium deficiency. However, because tri-bear is a hybrid, this condition might

also be the disorder lesion mimic mutant (see earlier discussion of this phenomenon). Leaning crown syndrome, long theorized to be a boron deficiency (Hodel 2012), has appeared in many tri-bear palms at the end of the growing season in California and might be related to hybrid vigor (see earlier discussion of this phenomenon).

Tri-bear palms are sufficiently handsome and imposing to make a statement in any landscape. Their whitish trunk, reddish fuzzy crownshaft, and splendid canopy of dark green leaves is sure to draw attention. Its appearance is sufficiently powerful to stand alone as a single specimen or for added emphasis, plant three or five well spaced individuals in a group. Companion plants should be kept at least 60 cm away from the trunk and low, so as not to hide or obscure the handsome, colorful trunk.

We feel that tri-bear palms have their maximum appeal and ornamental value when they have just initiated flowering and have about three to four m of trunk. They will continue to reward for many more years, but then unusually tall specimens tend to lose some of their allure and replacement becomes a consideration.

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