

Year of the Golden Cycads

Jody Haynes¹ Photos by Jody Haynes (unless otherwise noted)

The Year 2002 marks the Cycad Society's 25th anniversary. According to tradition, this is supposed to be a year of 'silver.' Rather, 2002 is proving to be a year of 'gold' for several cycad collectors around the world. Whether it is a coincidence, a worldwide conspiracy, or aliens at play, plants in disparate localities that normally flush green (Fig. 1) or gray-blue (Fig. 2) have, instead, been throwing flushes of incredibly vibrant-colored leaves this year, in colors ranging from lemon yellow (Fig. 3) to deep golden yellow (Fig. 4) to burnt orange (Fig. 5).

Although this phenomenon has primarily been in *Encephalartos*, a few plants in other genera have also been affected. A wide range of explanations for these off-color leaf flushes has been put forth by some of the members of the [cycad] Yahoo group². One person even jokingly implied that one of his plants that recently flushed bright orange was exhibiting a form of mimicry, since he had been wearing a bright orange t-shirt in the vicinity of the plant just prior to the flush! Another person suggested that global warming or an enlarging ozone hole might be the cause. I don't know if he was joking or not!

Occam's razor suggests that the simplest of several possible explanations is most likely the correct one. As such, I'm pretty sure that aliens and global conspiracies can safely be ruled out! However, that still leaves several possible causes for the observed off-color flushes. I am writing this article to address some of these issues, as well as to provide some nice color photos. It seems fitting that this article should follow Tom Broome's article entitled "A Celebration of Red- and Brown-Emergent Cycad Leaves" in the June 2002 issue of the *Cycad Newsletter*.

Before I continue, I feel obligated to state the following two caveats: (1) I do not pretend to be an expert in the biology or cultivation of cycads, and (2)

this article is by no means meant to be completely comprehensive. My primary objective in writing this article is to initiate thought and/or discussion from some of the more knowledgeable cycad growers and collectors so that I, and others, can better understand the biology and culture of these remarkable plants. My contact information is provided at the end of this article, and I welcome additional input on this topic.

Pests & Diseases

The recent discussion on the [cycad] Yahoo group about off-color leaf flushes was initiated by a collector in Germany who was concerned that his *Encephalartos horridus* might have a disease because it was flushing a brilliant orange color (Fig. 6). Since the plant had never done this before, he figured it must be sick. As far as I know, there aren't any diseases that would cause new leaves to flush off color. Certain pest insects, such as *Aulacaspis* scale, can cause leaves to turn yellow and then brown if left untreated (Fig. 7). However, an infestation that would cause complete chlorosis of an entire set of leaves would be quite obvious and unmistakable (Fig. 8), and I am not aware of any such pests that affect *Encephalartos* plants the way the aulacaspis scale affects plants of the genus *Cycas*. Furthermore, insects just would not cause the vibrant colors in newly emerging leaves in the manner being discussed here. A final thought is that some people may consider nutrient deficiencies to be some sort of disease, or they may not know the difference between a deficiency and a disease. For



Lemon yellow flush of *Encephalartos senticosus*



Golden yellow flush of *Encephalartos horridus* (photo courtesy Jungle Music)



Normal green flush of *Encephalartos ferox*



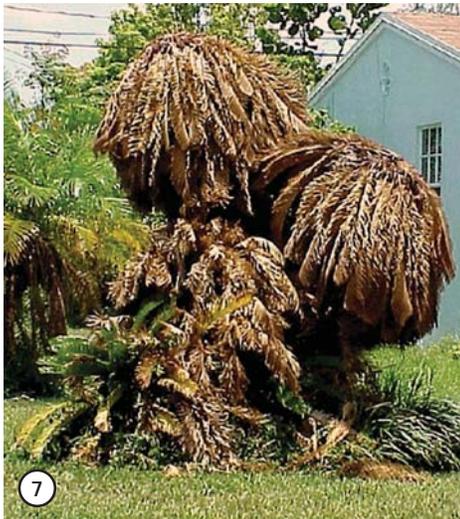
Normal gray-blue flush of *Encephalartos horridus* (photo by Jungle Music)



Burnt orange flush of *Encephalartos whitelockii* seedling



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Orange flush of *Encephalartos horridus* (photo by Udo Kuenzel)



7
Cycas revoluta with a heavy infestation of *Aulacaspis* scale.



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An untreated infestation of *Aulacaspis* scale can cause fairly rapid death of the plant, as in this *Cycas revoluta* in Homestead, FL

the record, a deficiency is definitely not a disease, and it is important to be able to tell the difference. I will address nutrient deficiencies in a later section.

Light

Some cycad species tolerate a wide range of light conditions (*i.e.*, from full sun to full shade), whereas others have very narrow light requirements. When plants are grown under light conditions that are dramatically different from their preferred or optimal conditions, the result can be an overall yellowing of the leaves. This type of chlorosis generally affects all leaves equally, and is not manifested only in newly emerging leaves. In extreme cases of shade-loving plants being grown in full sun, the leaves that are exposed to the sun can become sunburned, and these symptoms are quite obvious (Fig. 9). In my opinion, light imbalance can also be ruled out as a cause for the off-color flushes discussed in this article.

Temperature

Temperature requirements of cycads also vary. Some prefer hot, dry, desert-like conditions, while others are best grown in damp, 'rainforest' type conditions. High temperatures can exacerbate sunburn, but a 'sunburn' type effect can also result from cold damage (Fig. 10). Once again, the symptoms of this type of burn are very obvious, and are not restricted to newly emerging leaves.

Temperature can also affect the ability of the roots to take up nutrients, especially if the plants are in pots that get very hot in the summer, or during the winter months when cooler temperatures reduce root activity. In either of these situations, it wouldn't matter how much or what kind of fertilizer is applied, because the plant would still not be getting the nutrients it needs to produce a healthy flush. This provides a nice segue into the next section on nutrients.

Nutrients

As mentioned above, nutrient availability—or lack thereof—can cause



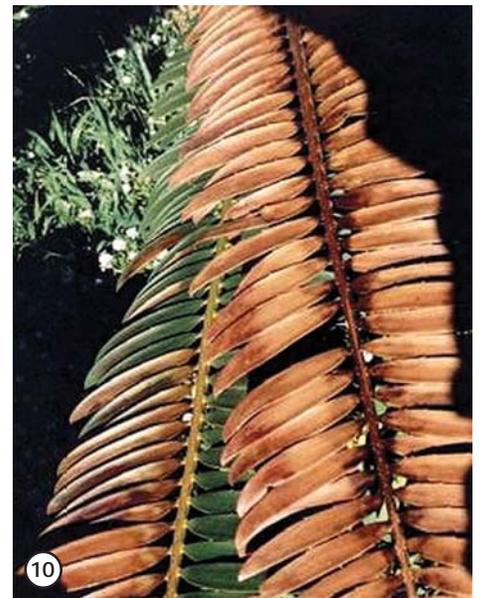
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Sunburn on an *Encephalartos ferox* leaf

problems with cycads, and this is the most probable explanation for the off-color flushes illustrated in this article. If a nutrient deficiency is, indeed, the cause, then there are two separate issues that need to be addressed: (1) which nutrient is deficient, and (2) what is ultimately causing the deficiency?

Donaldson & Winter (1998) stated that "[n]ew leaves that are yellow when they emerge suggest a shortage of zinc," whereas Whitelock (2002) suggested that "[e]mergent leaves that are yellow or white instead of green generally indicate a deficiency of manganese" (Fig. 11). To add to the confusion, Eric Shroyer, Cycad Horticulturist at Montgomery Botanical Center in Miami, FL, told me that when new leaves emerge uniformly yellow (Fig. 12), this is usually due to a nitrogen deficiency, while a newly emerging flush of leaves that has yellow leaflets and a green or orange rachis/petiole (Fig. 13) is usually indicative of iron deficiency.

Thus, the experts agree that off-color flushes are most likely the result of some sort of nutrient deficiency. Yet, it is still unclear—quite foggy, in fact—as to the actual nutrient(s) that might be involved. From my basic understanding of plant physiology, I would like to propose the following two scenarios. For plants that flush off-color but whose leaves harden the correct color, I would think this is caused by a deficiency of a readily transportable nutrient, like nitrogen or iron. On the other hand, in plants that flush off-color and whose leaves harden and remain off-color, this is more likely due to a non-transportable nutrient, such as manganese or zinc.

For the former scenario, if the newly emerging leaves have yellow leaflets and green or orange rachis/petioles upon



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Cold burn on an *Encephalartos* sp. leaf

emerging, a nutritional spray or drench of chelated iron should do the trick. On the other hand, if the leaves are uniformly yellow, addition of a high nitrogen fertilizer should correct the problem. Another issue here is the importance and health of coralloid roots in reducing nitrogen deficiency in cycads...but perhaps this would best be addressed in a later article.

For the latter scenario, adding the correct micronutrient will not 'fix' the immediate problem, as the discoloration or chlorosis is permanent. However, it may prevent the problem from occurring in subsequent flushes. In the case of early manganese deficiency – which can result in yellow or white new leaves (Fig. 11) – this problem **must** be addressed quickly because advanced cases will cause leaves to emerge brown and shriveled (hence the common name 'frizzletop' for this deficiency; Fig. 14), and highly advanced manganese deficiency, if left untreated, can kill the plant. Manganese sulfate (which is sold under the trade name TechMangum™) can be applied to treat manganese deficiency, while zinc sulfate should be used for zinc deficiency.

As for the ultimate cause of nutrient deficiencies, we already saw that temperature extremes can reduce the ability of roots to uptake nutrients. Another very important factor is soil pH. Most cycads prefer a slightly acidic (pH 6.5) or neutral (pH 7.0) pH, and anything outside of this range can cause or greatly exacerbate nutrient deficiencies (Jones, 1993; Whitelock, 2002; Wrinkle, 1995). Highly alkaline soils (pH 8.0 and above) lock up micronutrients (such as manganese, iron, and zinc) and make them unavailable to plant roots. Overly acidic soils (below pH 6.0) can likewise prevent good growth and proper nutrient uptake.

If you are having nutrient problems with any of your cycads, take a sample of your soil in to get it tested. You may be able to get this done at your local county Cooperative Extension Service; if not, they should be able to direct you to the correct place. You may also want to get a tissue analysis on the leaves of the affected plant. It is better to know exactly what the problem is

and to treat it correctly than to haphazardly dump chemicals or fertilizers on the plant and hope that it works. If the soil pH is off, then you should either try to adjust it by adding sulfur to decrease the pH, or by adding lime, limestone, or dolomite to increase the pH...or, better yet, repot the plant in a better soil. If the problem is nutritional and the pH of the soil is fine, then you will need to add the appropriate nutrient to correct the deficiency. Keep in mind, though, that prevention of nutrient deficiencies is preferable to correction. If you keep your plants properly fertilized and watered and in soil that is within the acceptable range of pH values, then your plants should be safe from most nutrient deficiencies.

Acknowledgments

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Footnotes

- ¹ Jody Haynes is the Secretary of The Cycad Society. He can be reached by e-mail (jody@cycadconservation.org).
- ² The "cycad" Yahoo group is an online e-mail list dedicated to the discussion of cycads. To sign up for this group, simply go to <http://groups.yahoo.com/group/cycad/>.



Nearly white flush of *Dioon mejiae*



Uniform yellow flush of *Macrozamia sp.* (photo by Scott Gordin)



New flush of *Encephalartos senticosus* with yellow leaflets and orange petioles



Frizzletop on *Cycas revoluta* in Hawaii (photo by Greg Holzman)

Dear Fellow Coneheads, (Ed.'s Note: This is the name of the Yahoo Discussion Group for the Cycad Society's Board of Directors)

I want to thank all of you for the friendship and support I have enjoyed while a member of the Cycad Society Board of Directors. Throughout my time as a frequent author of many articles for The Cycad Newsletter, Board Member, President, and then Board Member again, I have always put my heart and soul into my service to The Cycad Society. Our plants, and our Society, have always been, and will continue to be, a very important part of my life. I will always be there if I can help in any way.

Thank you again for your friendship and support.

Don Kurth