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ENH1269

Chilling Injury in Tropical Foliage Plants: III. Dieffenbachia[1]

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A chilling temperature is any temperature that is cold enough to cause plant injury but not cold enough to freeze the plant. These temperatures usually range from just above 32°F to about 59°F. Chilling injury to tropical foliage plants is also dependent on the duration of exposure to a chilling temperature.

Chilling injury can occur to tropical foliage plants if greenhouses become too cold. Chilling injury can also occur if plants are exposed to chilling temperatures outside of the greenhouse during packing and shipping. During winter months, if plants are transported in unheated trucks, left exposed on shipping docks, or if retail display merchants do not sufficiently maintain warm environments, foliage may be damaged (Chen et al. 2005). Commercial interiorscapes (e.g., design, installation, and maintenance of live plants in airports, hotels, malls, and restaurants) and retail consumers may also report chilling injury to tropical foliage plants if indoor temperatures fall low enough and for long enough for damage to occur (Chen et al. 2005).

Dieffenbachia, commonly known as dumb cane, belongs to the plant family Araceae and ranks among the top five most popular foliage plant genera produced and sold in the United States, based on the annual wholesale value (USDA 2014).

Since the aesthetic appearance of *Dieffenbachia* is directly related to foliage color and quality, any damage on leaves caused by chilling, regardless of severity, can greatly reduce its ornamental value in the market place.

Chilling Injury Symptoms

Chilling injury in *Dieffenbachia* is first indicated by visual foliar blemishes. Leaf injury symptoms include yellowing (chlorosis) (Figure 1), water-soaked patches (Figure 2), and wilted leaves (Figure 3). Young leaves are injured first and show the most severe damage.

Figure 1. *Dieffenbachia* 'Octopus' showing leaf yellowing from chilling injury.
Credits: Jianjun Chen, UF/IFAS

Stem injury may also occur when *Dieffenbachia* is subject to chilling temperatures. Damage may be seen at the base of the stem and appear as a reddish-brown color (Figure 4). As damage progresses, the entire stem may be affected, becoming water-soaked and collapsing (necrosis) (Figure 5).

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Figure 2. *Dieffenbachia* 'Camille' showing water-soaked patches from chilling injury.
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Figure 3. *Dieffenbachia* 'Tropic Honey' showing wilted leaves due to chilling injury.
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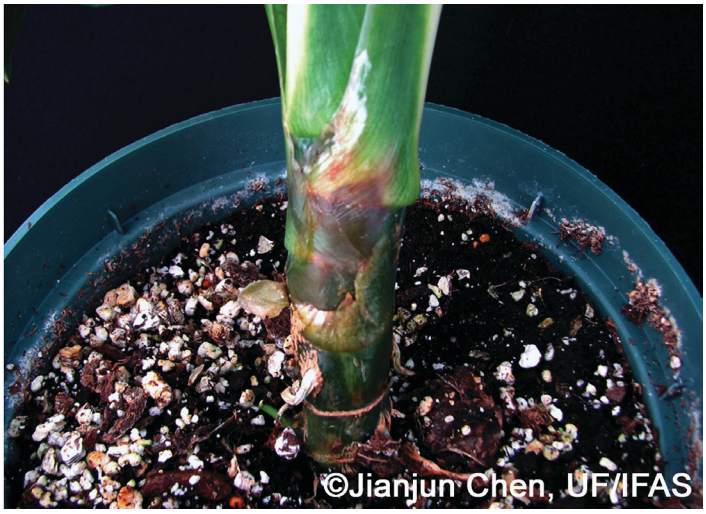

Figure 4. *Dieffenbachia* 'Carina' showing stem damage due to chilling injury.
Credits: Jianjun Chen, UF/IFAS

Figure 5. *Dieffenbachia* 'Tropic Honey' showing stem collapse and plant death following chilling injury.
Credits: Jianjun Chen, UF/IFAS

Cultivar Responses to Chilling Temperatures

There are about 30 recognized *Dieffenbachia* species native to South and Central America. Because of its tropical lowland origin, *Dieffenbachia* is considered one of the most sensitive foliage plant genera for chilling injury. Commercially available *Dieffenbachia* cultivars are largely derived from *D. amoena* Hort. ex Gentil and *D. maculata* (Lodd.) G. Don via interspecific hybridization and from somaclonal variation produced by tissue culture (Henny and Chen 2004). About 100 cultivars have been introduced, but commercial production has been limited to about 20 cultivars.

A study at the UF/IFAS Mid-Florida Research and Education Center-Apopka evaluated chilling responses of eight popular *Dieffenbachia* cultivars: Camille, Camouflage, Carina, Octopus, Panther, Star Bright, Sterling, and Tropic Honey (Li et al. 2008).

Visible injury and growth index data generated in that study (Table 1) indicate that *Dieffenbachia* cultivars that are chilled at 35°F for 24 hours show great variation in the degree of chilling injury. No cultivars exhibited leaf injury after chilling at 45°F or 55°F except 'Tropic Honey,' which had 26% of leaves injured after being chilled at 45°F for 6 hours. Of the cultivars tested, 'Panther' was the most chilling tolerant cultivar because it had no leaf injury 5 days to 12 days after chilling. 'Tropic Honey' was the most sensitive cultivar as all plants died after being chilled at 35°F for 6 hours.

Relative chilling tolerance of the eight cultivars are ranked as follows: Panther (most tolerant) > Star Bright> Camouflage> Camille> Octopus> Carina> Sterling> Tropic Honey (least tolerant).

'Panther'

No injury was observed in 'Panther' irrespective of the tested chilling temperatures and duration. Twelve days after chilling at 35°F for 24 hours, no injured leaves were observed. No stem injury occurred in 'Panther' after chilling at 35°F for 24 hours. During the subsequent three-month growth period, plant growth indices were not significantly different from respective controls after chilling at 35°F, 45°F, or 55°F.

'Star Bright'

There was no increase in injured leaves in 'Star Bright' from 5 days to 12 days after chilling at 35°F for 24 hours. No stem injury occurred in 'Star Bright' after chilling at 35°F for 24 hours. Growth indices of 'Star Bright' chilled at 35°F for 24 hours were significantly reduced compared to those of the controls or those chilled at 45°F or 55°F during the subsequent three-month growth period.

'Camouflage'

The percentage of injured leaves in 'Camouflage' significantly increased from 5 days to 12 days after chilling at 35°F for 24 hours. No stem injury occurred in 'Camouflage' after chilling at 35°F for 24 hours. Reduction of growth occurred after chilling at 35°F for 24 hours and at 35°F for 12 hours. Plant growth indices were not significantly different from respective untreated controls after chilling at 45°F or 55°F.

'Camille'

Leaf injury occurred after chilling at 35°F for 12 hours. Stem injury occurred after chilling at 35°F for 24 hours. During the subsequent three-month growth period, growth after chilling at 35°F for 24 hours was significantly reduced compared to plants chilled at 45°F or 55°F or to untreated controls.

'Octopus'

Leaf injury occurred in 'Octopus' chilled at 35°F for 6 hours. Leaf injury occurred following chilling at 35°F for 12 hours, and the percentages of injured leaves significantly increased from 5 days to 12 days after chilling. No stem injury occurred in 'Octopus' after chilling at 35°F for 24 hours. During the subsequent three-month growth period, growth indices of 'Octopus' chilled at 35°F for 24 hours were significantly reduced compared to those of the controls or chilled at 45°F or 55°F. Plant growth indices were not significantly different from respective controls after chilling at 45°F or 55°F.

'Carina'

Leaf injury occurred in 'Carina' chilled at 35°F for 12 hours. The percentages of injured leaves in 'Carina' significantly increased from 5 days to 12 days after chilling. Stem injury occurred in 'Carina' after chilling at 35°F for 24 hours. The injury was characterized by a reddish-brown color at the stem base. Initially, this chilling exposure caused wilting of some leaves, and eventually entire shoots of 'Carina' collapsed. During the subsequent three-month growth period, growth indices of 'Carina' chilled at 35°F for 12 hours and at 35°F for 24 hours were significantly reduced compared to those chilled at 45°F or 55°F or to the controls. Plant growth indices were not significantly different from respective controls after chilling at 45°F or 55°F. It is interesting to note that there was no visible injury to 'Carina' chilled at 35°F for 6 hours, but growth indices decreased significantly.

'Sterling'

No immediately visible leaf injury occurring in 'Sterling' chilled at 35°F for 6 hours, but the percentages of injured leaves significantly increased from 5 days to 12 days after chilling, and subsequent growth indices decreased significantly. Visible leaf injury occurred, and there was a subsequent reduction in growth after chilling exposure at 35°F for 12 hours. Stem injury occurred in 'Sterling' after chilling at 35°F for 24 hours, eventually resulting in the collapse of the entire shoots.

'Tropic Honey'

All 'Tropic Honey' chilled at 35°F died regardless of the tested chilling durations. Young leaves of *Dieffenbachia* 'Tropic Honey' wilted within 3 hours. Water-soaked patches appeared in 2 days. All young leaves died (became necrotic), and older leaves wilted 3 days later. Entire shoots collapsed 10 days after chilling (Figure 5). Stem injury occurred in 'Tropic Honey' after chilling at 35°F for 24 hours. The entire stem became water-soaked and then collapsed. 'Topic Honey' had 30% less growth index after chilling at 45°F and 55°F than the control. Browning of the root system due to chilling exposure has been observed in *Dieffenbachia* 'Tropic Honey'.

Conclusion

Information presented here may assist growers to better manage greenhouse temperatures for the production of *Dieffenbachia* cultivars during winter months. Growers may

also incorporate chilling-tolerant cultivars into commercial foliage production schedules to conserve energy normally used for greenhouse heating. Additionally, chilling-tolerant tropical plant cultivars can be used in breeding programs in order to develop new cultivars with better chilling tolerance (Henny and Chen 2004).

References

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Table 1. *Dieffenbachia* cultivar responses to chilling temperature (Li et al. 2008).

Chilling temperature/duration	Cultivar chilling symptoms
35°F/ 6 hours	Octopus and Sterling—leaves injured. Carina—growth slowed. Tropic Honey—dead.
35°F/ 12 hours	Camille, Carina, Octopus, and Sterling—leaves injured. Camille, Carina, and Sterling—growth slowed
35°F/ 24 hours	Camouflage, Octopus, and Star Bright—leaves injured. Camille, Carina, and Sterling—stems injured. Camille, Carina, Octopus, Star Bright, and Sterling—growth slowed.
45°F/ 6 hours	No cultivars were visibly injured except Tropic Honey. Tropic Honey—leaves injured.
45°F/ 12 hours	No cultivars were visibly injured except Tropic Honey. Tropic Honey—leaves injured.
45°F/ 24 hours	No cultivars were visibly injured except Tropic Honey. Tropic Honey—leaves injured.
55° F/ 6 hours	No cultivars were visibly injured. Tropic Honey—growth reduced.
55°F/ 12 hours	No cultivars were visibly injured. Tropic Honey—growth reduced.
55°F/ 24 hours	No cultivars were visibly injured. Tropic Honey—growth reduced.