PP265

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Physiological Disorders in Orchids: Mesophyll Cell Collapse[1]

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Introduction

Mesophyll cell collapse is a condition that affects many different orchid genera. This physiological disorder can be caused by exposure to low water temperatures or low air temperatures, which leads to damage to the mesophyll cells within the leaf (Sheehan, 2002). For many growers, this is a difficult condition to identify because the symptoms frequently show up 6-8 weeks after exposure to damaging temperatures (Jones, 2004; Sheehan, 2002).

Symptoms

Initial symptoms include localized or wide-spread sunken/yellow areas (Fig. 1,2,3) which later may turn dry and necrotic (Fig. 3). Once a leaf is damaged, it is permanent. Injured leaves may be colonized by saprophytic fungi, which can lead some growers to believe the disorder is caused by a fungus, prompting them to apply chemicals unnecessarily.

Figure 1. *Laelia anceps* with symptoms of mesophyll cell collapse. Credits: R. A. Cating.

Diagnosis, Cause, and Control

Very little scientific data have been reported concerning this condition. However, the data available do suggest that the severity of symptoms is related to several different factors: temperature, length of exposure to low temperature, and age of leaves (McConnell and Sheehan, 1978). Young leaves appear to be more susceptible to chilling injury, while mature leaves appear resistant

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Figure 2. Close-up view of *Laelia anceps* in Figure 1. Credits: R. A. Cating

Figure 3. *Phalaenopsis* orchid with symptoms of mesophyll cell collapse. Credits: R. A. Cating

(McConnell and Sheehan, 1978). Sheehan (1987) reports that temperatures of 35-45°F can cause mesophyll cell collapse in young *Phalaenopsis* leaves. Sheehan (2002) also states that young leaves will show symptoms after 2 hours at 45°F, with lower temperatures causing more rapid development; however mature leaves can withstand longer exposure at 35°F without detrimental effects.

In contrast, Yamada et. al (2002) reported that no damage occurred to "orchid" leaves when exposed to chilling at 28.4°F after an entire day of exposure, prompting them to conclude that the orchid was chilling-resistant. However, assessment of damage was made at the ultrastrucutural level, with no long-term assessment of changes in the tissue. In addition, the orchid chosen for the study, *Paphiopedilum insigne* can frequently withstand cool temperatures and requires cooler temperatures in order to grow and flower properly (Bechtel et al., 1992). Mesophyll cell collapse occurs more frequently in orchids that have thick, fleshy leaves (such as *Phalaenopsis)*; *P. insigne* has relatively thin leaves, and therefore, may not be as prone to this condition. Therefore, these data cannot be used to establish guidelines for other orchid genera, which may have much higher temperature requirements.

Blanchard and Runkle (2006) found that mesophyll cell collapse occurred in *Phalaenopsis* Miva Smartissimo X Canberra '450' at day/night temperatures of 68/57.2, 78.8/57.2, 78.8/68, and 84.2/62.6°F, but not when held at a constant temperature. It may be that changes in day/night temperature may play a role in the development of mesophyll cell collapse.

In order to properly diagnose mesophyll cell collapse, a thorough history of the growing conditions is crucial. High-low thermometers placed at various places around the greenhouse can record temperature variance and may indicate areas that are prone to drafts or low temperatures. In Florida, daily temperature records can be obtained through the FAWN weather data system (fawn.ifas.ufl.edu) and may also be helpful in making a diagnosis. In some cases, weather/environmental data may not be available and a more thorough examination of the plant may be required to rule out pathogens as the cause. However, if no fungal, bacterial, or viral pathogens are found, then environmental conditions may be the cause of the observed damage.

After a diagnosis is made, the causal agent should then be identified in order to prevent recurrences of the condition. When one suspects mesophyll cell collapse, it is important to:

1. Examine temperature records for the previous 6 weeks and look for cool temperature or drastic fluctuation in day/night temperatures.
2. Determine if there are areas in the greenhouse or growing area that are prone to drafts.
3. Make sure that when watering, the water is not too cold, which can also cause mesophyll cell collapse (Jones, 2004).

When in doubt, visit the Florida Plant Diagnostic Network http://fpdn.ifas.ufl.edu/ for contact information and direct links to one of the Florida Extension Plant Diagnostic Clinics (FEPDC). However, keep in mind thorough records are essential to diagnose this condition properly, and this information should be provided to the diagnosticians.

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