

Orchids

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Introduction

For years, potted orchids were produced mainly for hobbyists. They are usually shipped in containers and arrive in buyers' hands by overnight delivery or within a few days. Many orchid growers do not ship orchids during winter months to avoid chilling or freezing injury to the plants. However, during the past decade, there has been a tremendous worldwide boom in orchid production for sale as potted blooming plants for the public, particularly the *Phalaenopsis* and *Dendrobium* orchids. Potted, blooming orchids represent a \$100 million industry in the United States alone (NASS 2001). However, for the most part, research in proper postharvest handling of orchids has lagged behind the increase in production and demand.

Ethylene Sensitivity

Orchid flowers are extremely sensitive to ethylene, even at very low levels (Davison 1949, Beyer 1976, Goh et al. 1985). Pollination and removal of pollen caps (emasculation) trigger ethylene production by flowers and result in rapid wilting. Blooming orchids should be handled carefully so that accidental pollination and emasculation do not occur. Accelerated flower wilting as a result of ethylene evolution following pollination in *Cymbidium*, *Dortitaenopsis*, *Dendrobium*, and *Phalaenopsis* orchids is induced by a loss of water from cells of the upper layer of the petals, leading to their in-folding and water-soaked appearance (Lee and Lin 1992, Porat et. al. 1994). Treating orchid flowers with the ethylene biosynthesis inhibitor aminooxyacetic acid (AOA) did not alter their sensitivity to ethylene. Recent research also showed that pulsing excised *Dendrobium* flowers with 0.5 mM AOA for 24 h before exposing them to 0.2 $\mu\text{L L}^{-1}$ ethylene did not prolong their life (Wang and Wang 2000); all treated flowers wilted within 3 days after exposure. Thus, AOA has no effect on longevity when wilting is triggered by exogenous ethylene.

Treatments for Extending Shelf-life

It was found that shelf-life of *Oncidium* Goldiana cut sprays increased after pulsing with silver nitrate for 30 min (Ong and Lim 1983). Pulsing *Arranda* cut inflorescences for a short 10 min with a 4 mM solution of STS prolonged their display-life (Hew et al. 1987). Exposing excised *Dendrobium* and *Phalaenopsis* flowers to 0.1 $\mu\text{L L}^{-1}$ 1-methylcyclopropene (1-MCP, an ethylene action inhibitor) for 12 h, or pulsing them with 0.5 mM silver thiosulfate (STS, an ethylene inhibitor) for 24 h completely blocked the deleterious effect of ethylene (Wang and Wang 2000). *Phalaenopsis* flowers that were treated with 0.1 to 0.4 $\mu\text{L L}^{-1}$ of 1-MCP are protected against ethylene as high as 10 $\mu\text{L L}^{-1}$. However, the protective effect of 1-MCP lasts for no longer than 7 days at room temperature. Commercially, cut *Phalaenopsis* inflorescences are pulsed with 0.5 mM STS immediately following cutting.

When used at 50 to 100 mg L⁻¹, 8-hydroxyquinoline sulfate (8-HQS) extended shelf-life of *Dendrobium* Pompadour cut flowers (Kesta and Amutiratana 1986). Conflicting results were reported on the effect of sucrose in keeping solutions as a carbon source for extending vase life of cut orchid flowers.

Sprays of tropical orchids should be stored and transported at 12 to 18 °C (54 to 64 °F) (Akamine 1976), whereas flowers of temperate orchids such as *Cymbidium* may be stored at temperatures as low as 5 °C (41 °F) (Sheehan 1954).

Optimum Storage Conditions

Minimal research has been conducted on optimum orchid storage conditions. In one study (Wang 1997a), bare-root *Phalaenopsis* plants were packed in boxes and subjected to temperatures of 15, 20, 25, or 30 °C (59, 68, 77, or 86 °F) for 4, 7, or 14 days. Weight loss from plants increased with increasing temperature and storage duration. Symptoms of chilling injury were inversely related to 15 and 20 °C storage temperatures. Chilling injury became more severe as storage duration increased. Plants had little or no chilling injury at 25 or 30 °C, regardless of the duration. Leaf loss was most severe on plants stored at 15 °C for 7 or 14 days or 30 °C for 14 days. Plants that have severe leaf loss after storing at 30 °C have delayed spiking and flowering.

Preconditioning greenhouse-grown potted *Phalaenopsis* plants at 25 °C (77 °F) for 10 days, followed by another 10 days at 20 °C (68 °F), reduced severity of chilling injury after storage at 15 °C (59 °F) for 2 weeks. Therefore, *Phalaenopsis* orchids harvested during the warm period of the year should be held above 20 °C (68 °F), and preferably closer to 25 °C (77 °F), during shipping. Under such conditions, plants can lose as much as 20% of their fresh weight at harvest without subsequent performance being adversely affected. While most *Phalaenopsis* species and hybrids need relatively cool air to initiate the flowering process, plants do not respond to cool air while being shipped in the absence of light (Wang 1995).

Although prolonged duration in complete darkness is not recommended for keeping plants in bloom (Wang and Blessington 1989), *Phalaenopsis* orchids tolerate low light levels once they have started flowering. One study show that exposing them to irradiance levels between 10 and 50 μmol m⁻² sec⁻¹ for 12 h daily produced orchids with similar longevity (individual flowers lasting over 120 days) and flower size (Wang 1997b). Therefore, most retail stores have adequate light levels to maintain blooming *Phalaenopsis* while they are being marketed.

Shipping Information

Because of quarantine regulations, internationally shipped orchids are often removed from their potting medium. The bare-root plants are allowed to dehydrate slightly before packing. This is done for several reasons. Slight dehydration allows for packing more plants per box, avoids breaking leaves, and reduces the chances of moisture buildup to weaken shipping boxes. Drier plants also reduce incidence of rotting before boxes are opened. Plants are usually packed in layers alternating with shredded paper or other material. Often, plants are individually wrapped in newspaper, particularly those that have developed inflorescences.

Millions of bare-root *Phalaenopsis* orchids are shipped domestically and internationally each year. After the orchids are planted in pots and placed on greenhouse benches, yellow spots occasionally develop on either side of the mid-rib near the base of leaves due to chilling injury. Irregular yellow blotches also occur on other parts of leaf blades. Other times, leaves turn yellow and fall off, resulting in weak plants that do not produce flowers.

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