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Review

Physiological blockage in plants in response to postharvest stress

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Flowers have been designed primarily for cutting because of the diversity of shapes, colors and also durability. However, ornamental plants are used in floral arrangements in vases and have limited shelf-life. Thus, this study showed that one of the factors contributing to this limitation is the physiological blockage that occurs in plants in response to stress imposed by harvest.

Key words: Flowers, stress, physiological blockage, harvest.

INTRODUCTION

The main cause of deterioration in cut flowers is the blockage of vessels from xylem by microorganisms which accumulate in solution from the vessel or vessel conductors. Other less important causes of vascular occlusion are air embolism and the physiological response of the plant to cut stem (Ichimura et al., 1999). When the vessel is blocked, the sweating process occurs continuously and there is no net gain of water by the fabric or flower stem. Germicides can be applied to inhibit the growth of microorganisms in the vessels conductive rod. Thus, stimulates the absorption of water by the reduction of vascular blockage, helping to maintain the turgor of flowers (Nowak et al., 1991).

Types of physiological blockade

The study of postharvest physiology of flowers involves metabolic processes and their changes in various parts of plants from the time it was harvested until senescence completes. The deterioration processes occur as a result of complex physiological changes, such as depletion of reserves by breathing as a result of excessive water loss through transpiration and the occlusion of the stem after cutting plugging the vessels conductors, the air and causing embolism deposition of chemicals (Ferronato, 2000).

Factors causing physiological blockade

The decrease in water uptake, depending on species, may be due to a number of factors, which are classified as inherent to the rod, also called lock physiological blockage due to microbial growth and blockage caused by formation of air bubbles (embolism) (Van Doorn, 1999; He et al., 2006). With the blocking of conducting vessels, the development of negative water balances, because the rate of water absorption is less than the rate of perspiration (Van Meeteren et al., 2006).

The blockage occurs in response to physiological stress imposed by picking through the deposition of material from the surface of the cut, which depending on their composition, are called latex, gum, resin or mucilage (Guimarães et al., 2010). Another type of physiological blocking can be caused by the formation of tyloses, which

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is defined as uncontrolled growth of cells which protrude into the vessel lumen xylem whose shape is similar to a balloon. These ''balloons'' cannot occur in adequate numbers to explain the blockade, but their formation is accompanied by the production of substances of high molecular weight, which can cause a lack of fluidity of the water rods (Van Doorn, 1999).

The blockade physiologically is found in some species of flowers, for example chrysanthemums in cv. Viking. In this cultivar, Van Doorn and Cruz (2000) investigated the involvement of bacteria, cavitation and physiological response to court, concluding that the blockade was not caused by bacteria because they come in contact in the store, at levels below the critical, the same occurring in relation embolism, since the air drawn on the cut ceased before the reduction of water consumption. After removal of emboli, some species are able to restore normal water potential, while others do not. Generally, when the flowers are cut and placed in water, the most common cause of disposal is wilting; it would be a sign of water stress and not natural senescence (Van Doorn and Witte, 1997). In the genus *Phalaenopsis orchids*, were highlighted problems of water relations, as the fast withering was associated with occlusion of the stem and a high rate of transpiration (Van Doorn, 1999).

One way to reverse or ameliorate the water stress suffered by many cut flowers is to make periodic cutting of the base of the stem in water, favoring the absorption rate and avoiding cavitation (Van Doorn and Witte, 1997; Bleeksma and Van Doorn, 2003). This effect was observed in flowers, *Zinnia elegans*, indicating a prolongation of vase life due to increased hydration (Carneiro et al., 2002). Moreover, according to Faragher et al. (2002), the periodic cutting is not always practical and, moreover, in some species, performing the cutting base did not keep quality and the vase life of flowers, as was observed in roses by Leonard et al. (2001). Van Meeteren et al. (2001) also observed that after removal of emboli, some species were not able to recover and restore their normal water potential. Previously, Marques (2008) concluded that the blockade rods in *Strelitzia reginae* were physiological in nature involving the activity of peroxidase and polyphenoloxidase. According to Boerjan et al. (2003), peroxidase and polyphenoloxidase enzymes are involved in vascular blockage of some species of flowers, through the oxidation of alcohols ρ-coumaryl, coniferyl and sinapil which are precursors of lignin, or by embolism when after cutting, the air flowing into the conductive elements open (Van Doorn, 1999). Once the vessel is blocked, the water absorption is limited due to the high hydraulic resistance, however, the sweating process continues, which leads to an imbalance water, and the early wilting occurs as a result of the premature loss of turgor of the cell (Van Meeteren et al., 2001). Van Ieperen et al. (2002) reported that the formation of xylem blockage depends on factors such as height of water in the vessel, vessel diameter xylem, duration of exposure of the rods, stress situation (Van Doorn and Jones, 1994) and cutting height of the base of the stem (Van Doorn, 1999), besides genetic factors (Guimarães et al., 2010).

Another cause of blockage of vessels xilematic is the presence of bacteria in the water, due to the deposition of extracellular polysaccharides produced, as well as products from dead bacteria and macromolecules that are formed on the degradation of these bacteria which can cover the cut surface of the stem. Similarly, the cut surface may contain substrates for bacterial growth, such as sugary substances which may flow out for some time; the phloem open and although the bacterial occlusion occurs in all the flowers, species and even cultivars may respond differently (Van Doorn, 1999). One or more types of blockade can exist in a single species (Van Meeteren et al., 2006).

Other factors such as anatomical conditions in the pre- and post-harvest can also determine whether a species or even a cultivar may or may not be capable of blocking.

SUGGESTIONS

The compound 8-hydroxyquinoline (8-HQ) is known as a potent bactericide and fungicide, and the esters, citrate 8-hydroxyquinoline (8-HQC), 8-hydroxyquinoline sulfate (8-HQS) and chlorine, are used to assess its actions in the microorganisms of preservative solutions.

CONCLUSION

With large variations between species and even cultivars of flowers, blockage of blood vessels xilematic are not completely understood; however, transpiration rate, the product surface and stomatal opening may be related.

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