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Longevity of torch ginger inflorescences with 1-methylcyclopropene and preservative solutions

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ABTRACT. This work aimed at the assessment of the influence of 1-MCP on ethrel action and on its association with preservative solutions on torch ginger. In the first experiment, the inflorescences were pre-treated with 1-MCP in sealed chambers at concentrations of 0, 1, 1.5, and 2.0 g m^{-3}, for 24 hours. Later, the inflorescences were submitted to the treatment with ethrel (100 μL L^{-1}) in sealed chamber for 24 hours. In the second experiment, the inflorescences were pre-treated with 1.5 g m^{-3} of 1-MCP for 24 hours, being posteriorly transferred to vases containing water, Flower®, Florissant®, and water without 1-MCP pre-treatment. The fresh matter and the quality of the inflorescence were daily appraised using the scale grading. The best results were obtained for 1.5 g m^{-3} of 1-MCP. The association between 1-MCP and Florissant® provided larger longevity and quality in the postharvest conservation, increasing in five days the longevity in relation to those kept only in water.

Keywords: tropical flower, Zingiberaceae, 1-MCP.

RESUMO. Longevidade de inflorescências de bastão do imperador com 1-metilciclopropeno e soluções conservantes. O objetivo deste trabalho foi avaliar a influência do 1-MCP na ação do ethrel e associado a soluções conservantes em bastão do imperador. No primeiro experimento, as inflorescências foram pré- tratadas com 1-MCP em câmaras herméticas nas concentrações 0; 1; 1,5 e 2,0 g m^{-3} por 24h. Posteriormente foram submetidas ao tratamento com ethrel (100 μL L^{-1}) em câmaras herméticas pelo mesmo período. No segundo experimento as inflorescências foram pré- tratadas em 1,5 g m^{-3} de 1-MCP por 24h e posteriormente transferidas para as soluções: água; Flower®, Florissant® e água sem pré-tratamento com 1-MCP. Diariamente foram avaliadas a massa fresca e a qualidade das inflorescências utilizando-se escala de notas. Os melhores resultados foram obtidos com 1,5 g m^{-3} de 1-MCP, que, associado ao Florissant® proporcionou maior longevidade e qualidade na conservação pós- colheita prolongando a vida de vaso em 5 dias em relação às mantidas somente em água.

Palavras-chave: flores tropicais, Zingiberaceae, 1-MCP.

Introduction

The tropical flowers yield is under expansion and stands out as employment and income generator in the national agribusiness. Besides the beauty – attested by the diversity of colours and shapes – the tropical flowers offer also more durability and resistance. However, the yield displacement, many times, is a critical factor since it requires efficiency in the preparation and storage conditions of plants, as they will endure long distances until their final destination.

Among the tropical flowers, the torch ginger [*Etlingera elatior* (Jack) R. M. Smith], which is from Malaysia and belongs to the family Zingiberaceae, presents attractive inflorescences with a considerable commercial appeal and has been under cultivation for several years in Brazil (BEZERRA; LOGES, 2005). Its inflorescence is comprised of distinct morphological units such bracts, petals, gynaecium, androecium, which may interact causing effect upon the floral longevity, according to Mattiuz et al. (2005), what would provoke different senescence and developmental symptoms from which occurs in true flowers such roses (*Rosa* spp.) and carnations (*Dianthus caryophyllus)*.

Generally, the cut flowers present a limited postharvest life due to its physiological and morphological traits – being subjected to deterioration processes similar to fruits (PETRY et al., 2000). According to Sousa et al. (2002), the quality maintenance is due to postharvest storage

techniques, which may reduce the respiratory rates, delay the senescence, and act in the prevention of physiological disorders.

The postharvest life of many plant species may be extended by the use of compounds that either inhibits the biosynthesis or the ethylene action. Preservative solutions are used to keep the quality and to prolong the life of cut flowers; they contain mainly sugars and germicides (TAGLIACOZZO et al., 2003). Almeida et al. (2008) also mentioned the presence of ethylene inhibitors, growth regulators and some mineral compounds.

The abscission and senescence processes may be accelerated by the increase of the ethylene yield (SANTOS et al., 2005), which exerts influence upon the tissue turgidity, accelerating the flower wilt (MAYAK et al., 1977). According to Ciardi and Klee (2001), the sensitivity and response level to the ethylene are dependent on the developmental and perceptive stage of the plant's organ.

The 1-metlcyclopropene (1-MCP) is a nontoxic volatile compound considered as a strong ethylene-action inhibitor in the senescence (ÇELIKEL et al., 2002b; SEREK et al., 1995) and is used at low concentrations adding its powder formulation to water (40 - 60ºC), releasing the active ingredient (BENASSI et al., 2003). This product has been used successfully in several species of ornamental values such *Rosa* spp., *Cymbidium* (Orchidaceae), *Petunia* sp., and *Lillium* spp.; moreover, it is also used to delay the ripening process of several fruits (TEIXEIRA; DURIGAN, 2006).

Thus, this work had as aim the assessment of the influence of 1-metylcyclopropene on the ethrel action and on its association with the preservative solutions regarding the longevity of torch ginger.

Material and methods

The inflorescences were harvested in the morning at the experimental field (23°23'S Longitude 51°11'W; mean altitude of 566 m). Pink torch ginger inflorescences with 50% bract aperture were used. The inflorescences were immersed in water until selection and standardization of the stems in 80 cm through the cut at the basal portion.

The first assay was comprised of treatment with 1-metylcyclopropene (1-MCP) supplied by Rohm and Hass Quimica Ltda. - AgroFresh and ethrel. They were placed in glass vases (80 x 40 cm) containing 1 L of tap water (pH 6.17) and transferred to the plastic chambers (0,144 m^{-3}). A glass Becker containing the respective concentrations of 1-MCP – 0, 1, 1.5, and 2 g m^{-3} – was placed inside each chamber. For the 1-MCP release, 50 mL of warm water (40°C) was injected into the Becker, being the chambers sealed.

After 24 hours, the chambers were open for ventilation for 3 hours and again sealed for the treatment with 100 μL L^{-1} of ethrel. Passed 24 hours, the chambers were newly open and the vases were transferred to a bench in a room with temperature of 23°C, humidity of 57% and natural illumination.

The experiment delineation was completed randomized with five repetitions, being four concentrations of 1-MCP and one check comprised of water only (without the ethrel and 1-MCP treatment). Each treatment was comprised of four vases with three inflorescences each.

During 15 days, daily assessments were carried with regard to the fresh matter mass of the inflorescences and to the quality through a grading scale, in which attributed 3 as excellent (bright and turgid inflorescences), 2 as regular (bright inflorescences, but with slightly bract dryness), and 1 as bad (dull inflorescences, with loss of turgidity and dryness at the borders of the bracts), and 0 as discard (wilt and dried bracts).

The same procedures described for the standardization and pre-treatment of the inflorescences with 1.5 g m^{-3} of 1-MCP were used in the second experiment. After opening the chambers, the inflorescences were transferred to vases containing the following solutions: water (pH 6.17); Flower® (15 mL L^{-1}), T3- Florissant® (5 g L^{-1}); water without pre-treatment with 1-MCP (check).

The experiment presented a completely randomized design with four treatments comprised of four vases with three inflorescences each. The fresh matter mass and the inflorescence quality were daily assessed using the same ranking criterion previously described.

The data were submitted to analysis of variance and regression, being the means compared by the Tukey test at 5%.

Results and discussion

In the first experiment, the ethrel action was evidenced by the rapid decrease in the inflorescence quality (Figure 1).

The application of 100 μL L^{-1} of ethrel caused wilt, followed by the dryness and bract darkening, which were discarded from the sixth day of treatment on and totally discarded on the eighth day. The pre-treatment with o 1-MCP has shown efficiency to hinder the deleterious action triggered by the ethrel in torch ginger inflorescences, keeping them with good appearance and extending their longevity at least for more seven days.

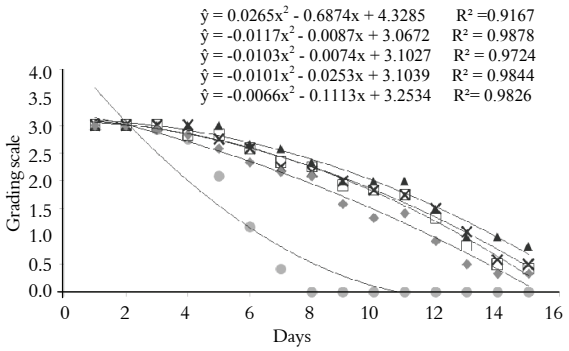

Figure 1. Ranking of visual analysis of torch ginger inflorescences.
◆ 0 μL L^{-1} ethrel/ 0 g m^{-3}. 1-MCP (check); ● 100 μL L^{-1} ethrel/ 0 g m^{-3} 1-MCP; □ 100 μL L^{-1} ethrel/ 1 g m^{-3} 1-MCP; ▲ 100 μL L^{-1} ethrel/ 1.5 g m^{-3} 1-MCP; **X** 100 μL L^{-1} ethrel/ 2 g m^{-3} 1-MCP.

Similar behaviour was noticed regarding the inflorescences among different treatments until the fourth day; after the fifth day, the inflorescences submitted only to ethrel started a sudden quality decrease. The inflorescences have shown similar behaviour with regard to the ethrel blockage among the different concentrations of 1-MCP. Despite such similarity, after the fifth assessing day, the treatments with 1-MCP promoted superior preservative conditions in relation to the check treatment.

Santos et al. (2005) after assessing different concentrations of 1-MCP, emphasized that the concentration of 0.5 g m^{-3} was efficient to hinder the ethrel action (100 mg L^{-1}) increasing 33% the longevity of inflorescences of *Consolida ajacis*. Çelikel et al. (2002a) observed the complete stem abscission (100%) in *Matthiola incana* in the presence of 1 mL L^{-1} of ethylene. Such response was not verified when the flowers were pre-treated with 500 nL L^{-1} of 1-MCP for 6 hours.

Regarding the fresh matter mass, Çelikel et al. (1995) emphasized that it is an important physical trait, which determines the longevity and postharvest quality of inflorescences.

In the Figure 2, it is noticeable that the check treatment (without 1-MCP and without ethrel) has presented insignificant mass gain of 1%, whereas the treatment with ethrel, only, presented an increase of 5%; but not significant in relation to the initial value.

The inflorescences submitted to the pre-treatment with 1, 1.5 and 2 g m^{-3} of 1-MCP have presented significant mass gain of 6, 7, and 6%, respectively. The losses were significant for all treatments; the check presented 16% of loss; but the greatest loss (30%) was reported for the inflorescences submitted to treatment with ethrel and without pre-treatment with 1-MCP. The treatments with 1, 1.5, and 2 g m^{-3} of 1-MCP presented mass loss of 11, 10 and 12%, respectively. Thus, the treatments with 1-MCP have presented the greatest gain and lowest loss of mass during the assessing period.

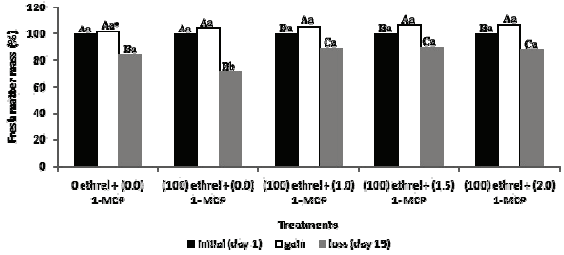

Figure 2. Fresh matter mass gain and loss (%) in torch ginger inflorescences along 15 days.
*Capital letters compared the initial values, gain and loss of mass among each treatment; small letters compare the values among the treatments by the Tukey test at 5%.

Mattiuz et al. (2005) in postharvest studies of *Alpinia purpurata* reported that the treatment of inflorescences with 500 ppb of 1-MCP promoted lower loss of fresh matter mass (11.46%). The water excessive loss through transpiration and/or obstructions of the xylem vessels cause the wilt, reducing the longevity. Thus, the flowers that loose between 10 and 15% of fresh matter mass may be considered wilt (NOWAK; RUDNICKI, 1990).

In several ornamental species, the end of the vessel life is characterised by its abscission, while other presents the wilt characterizes the initial symptom of senescence (VAN DOORN, 1997). The torch ginger presents its senescence process characterized by the loss of turgidity of its bracts, followed by the loss of brightness and progressive dryness of the bracts, starting from the borders inwards.

Despite of the similarity of the results between the concentrations of 1, 1.5 and 2 g m^{-3} of 1-MCP for visual assessment and the fresh matter mass of the inflorescences, the concentration of 1.5 g m^{-3} has shown equal or superior results in relation to the other concentrations in the ranking.

The postharvest preservation using the pre-treatment with 1-MCP associated with the preservative solutions is represented in the Figure 3. The total lasting time of the inflorescences in water and without 1-MCP treatment was 17 days, whereas those kept in water with 1-MCP treatment lasted 19 days. The inflorescences kept in Flower® presented similar results – 19 days. Among the tested solutions, the treatment with Florissant® has promoted better postharvest preservation of the torch ginger, lasting more than 20 days.

Independent of the type of preservative solution, the flowers with 1-MCP treatment presented more

flower opening and conservation, whereas the treatment with water and without 1-MCP presented flowers with dryness and darkening – a negative aspect to inflorescences.

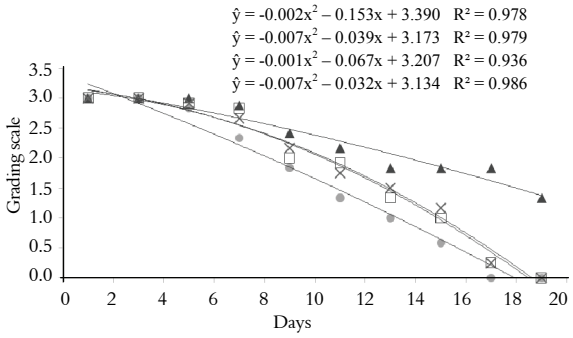

Figure 3. Ranking of the visual analyses of torch ginger pre-treated with 1-MCP and kept in preservative solutions. ● 0 g m^{-3} 1-MCP/ water; □ 1.5 g m^{-3} 1-MCP/ Flower®; ▲ 1.5 g m^{-3} 1-MCP/ Florissant®; X 1.5 g m^{-3} 1-MCP/ water.

According to Lamas (2004), the torch ginger inflorescences last approximately 15 days, being necessary special care, since they are sensitive to cold and dehydration.

According to Mattiuz et al. (2005), the treatment of *Alpinia purpurata* using 1-MCP has promoted better inflorescence quality after 12 days due to the reduction of the respiratory rates that has decreased the use of reserves as respiratory substrate, allowing, therefore, the maintenance of the inflorescence quality.

The Figure 4 indicates that the mass gain with water was not significant (2%), but in the treatments Flower® and Florissant®, the gains were 5 and 9%, respectively. All treatments have presented significant losses. When compared, it is evident that the lowest loss occurred in Florissant® (7.5%), whereas in other treatments with water (either with or without 1-MCP) and Flower®, the losses were respectively, 20, 22, and 18%.

Mattiuz et al. (2005) when assessing the inhibitory effect of ethylene and bactericide compounds in postharvest solution of *Alpinia purpurata,* emphasizes that the treatment with 1-MCP (500 ppb) has promoted lower loss of fresh mass and better inflorescence preservation.

Çelikel et al. (2002b) assessed the use of 1-MCP associated with Promalin (1.8% GA_{4+7} + 1.8% BAP) in the postharvest preservation of lilies and observed the superiority in the preservation of such plants. According to Nowak and Rudnicki (1990), the use of commercial preservative products promotes practicality, since it eliminates the frequent need of solution change during storage. Furthermore, the quality increase implies both economic empowerment and product expansion to consumers (PRADO et al., 2005).

This experiment has shown that the use of 1-MCP associated with preservative solutions, promoted favourable results for the postharvest maintenance of torch ginger, which promoted superior quality of torch ginger inflorescence when associated with the preservative Florissant®.

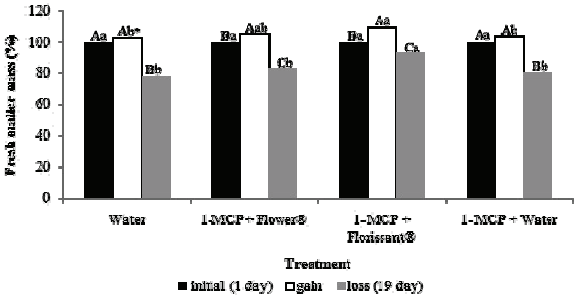

Figure 4. Gain and loss of fresh mass in torch ginger inflorescences observed along 19 days.
*Capital letters compared the initial values, the gain, and the loss of mass among each treatment; small letters compared the values among the treatments by the Tukey test at 5%.

Conclusion

The 1-MCP was efficient against the actions caused by ethrel, being therefore recommend its use at the concentration of 1.5 g m^{-3}. The association between the 1-MCP and Florissant® has promoted greater longevity and greater quality in the postharvest conservation of torch ginger for additional 3 days when compared to those kept in water only.

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