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Comparison Tea Extract, 8-Hydroxy Quinoline Sulfate and Rifampicin on the Vase Life of Cut Chrysanthemum (*Denderanthema grandiflorum* L. cv. Purple)

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Abstract

Maintaining quality and longevity of cut flowers is one of the critical issues in the floriculture industry, especially in cut flowers; and one of the most important problems in chrysanthemum, as one of the most popular cut flowers. Therefore, an experiment was conducted based on completely randomized design as pulse treatment with the three factors: tea extracts with 4 levels (5, 10, 20, and 40 %), 8-hydroxy quinoline sulfate with 4 levels (100, 200, and 400 mg l^{-1}), and rifampicin with 3 levels (100, 200, and 400 mg l^{-1}) on spray chrysanthemum (cv. Purple) with three replications. According to the results, the 20% tea extract treatment and 100 mg l^{-1} 8-hydroxy quinoline sulfate treatment showed the highest vase life, petal protein, total chlorophyll, water absorption, and petal carotenoid.

Keywords: Petal protein, Petals carotenoid, Solution uptake, Total chlorophyll, Vase life.

INTRODUCTION

Chrysanthemum (*Denderanthema grandiflorum*) from Asteraceae family is one of the most important cut flowers in the world (Edmond *et al.,* 1957). Cut chrysanthemum is a non – climacteric flower with relatively long life and low ethylene production (Bartoli *et al.*, 1996). Senescence of chrysanthemum is its reaction to the changes that occur in the level of carbohydrates (Adachi *et al.,* 1999) and ethylene has not significant impact in this process. Decrease in quality of cut chrysanthemum is mostly due to its leaves' yellowing (Halevy and Mayak, 1981) which is accompanied by the degradation of chlorophyll that causes earlier senescence of petals compared to petals (van Leperen *et al.,* 2001). Thus, delay in petals' wilting and, consequently delay in senescence, will elongate the vase life of cut chrysanthemum (Petridou *et al.*, 2001). Jiao (2009) in cut gladiolus said that antibiotics enhanced vase life and water relations and increase wet and dry weights. Cang *et al.* (2010) studied on the influence of tetracycline, sucrose and 8-hydroxy quinoline sulfate on the vase life of *Gladiolus grandiflorus* and found that 500 mg l^{-1} of 8-hydroxy quinoline sulfate and tetracycline enhanced the quality of cut flowers through improving the fresh weight and water relations. In this research, effects of different levels of tea extracts, 8-hydroxy quinoline sulfate and rifampicin will compared for maintaining quality of cut chrysanthemum cv. 'Purple'.

MATERIALS AND METHODS

Cut chrysanthemum were harvested at commercial stage from a greenhouse in Mahallat and were transfered to the postharvest laboratory. This experiment was conducted in completely randomized design as pulse treatment with three factors of tea extract (5, 10, 20 and 40%), 8-hydroxy quinoline sulfate (100, 200 and 400 mg l^{-1}) and rifampin (100, 200 and 400 mg l^{-1}) in three replications. Vase life room conditions was 12 hours day length, 20±2 °C, 60 to 70% RH and 12 µmol s^{-1} m^{-2} light intensity and traits such as: vase life, petals carotenoid, petals protein, total chlorophyll content and water uptake were measured. Vase life measured as flower wilting (Ferrant *et al*., 2002). For measurement of petal's protein, in 5th day sampling was done and protein content was evaluated by Bradford (1976) method. In 5th of experiment, sampling for total chlorophyll and petal carotenoids was done and these traits measured by Mazumdar and Majumdar (2003) method. Data were analyzed using SPSS statistical software and mean comparison was performed by LSD test.

RESULTS AND DISCUSSION

Vase Life

Analysis of variance showed that effect of different compounds on vase life were significant ($p \leq 0.05$). Mean comparisons showed that the 20% tea extract with 18.86 days increased the vase

Table 1. Mean comparison of different concentrations of tea extract, 8-hydroxyquinoline sulfate and rifampin on the measured traits.

Treatment	Vase life (days)	Water uptake (ml g^{-1} FW)	Total chlorophyll content (mg g^{-1} FW)	Petals protein (%)	Petals Carotenoids (µg g^{-1}FW)
(Tea extract 5%) E1	14.7200 ab	14.7200 ab	14.7200 ab	14.7200 ab	14.7200 ab
(Tea extract 10%) E2	17.5633 a	17.5633 a	17.5633 a	17.5633 a	17.5633 a
(Tea extract 20%) E3	18.8600 a	18.8600 a	18.8600 a	18.8600 a	18.8600 a
(Tea extract 40%) E4	17.7000 a	17.7000 a	17.7000 a	17.7000 a	17.7000 a
(100 mg l-18- HQS) H1	17.8733 a	17.8733 a	17.8733 a	17.8733 a	17.8733 a
(200 mg l-18- HQS) H2	15.5733 ab	15.5733 ab	15.5733 ab	15.5733 ab	15.5733 ab
(400 mg l-18- HQS) H3	17.4267 a	17.4267 a	17.4267 a	17.4267 a	17.4267 a
(Rifampin100 mg l^{-1}) R1	18.2133 a	18.2133 a	18.2133 a	18.2133 a	18.2133 a
(Rifampin 200 mg l^{-l}) R2	16.1067 ab	16.1067 ab	16.1067 ab	16.1067 ab	16.1067 ab
(Rifampin 400 mg l^{-1}) R3	16.5967 ab	16.5967 ab	16.5967 ab	16.5967 ab	16.5967 ab
Control	9.6433 b	9.6433 b	9.6433 b	9.6433 b	9.6433 b

*Similar letters in each column indicate not significant difference at 1% and 5% (LSD test).

life for 9.2 days as compared to the control (9.64 days) (Table 1). All treatments were better than control, but difference between them was not significant.

One of the most important problems in postharvest physiology of cut flowers, is the vascular blockage. This problem might be due to air embolism or growth of bacteria. Another reason for vascular blockage is reaction of the plant to cutting. Certain enzymes are stimulated in reaction to cutting and sent to the cut area to block it (Loubaud and Van Doorn, 2004). Therefore, antibacterial compounds enhance water relations and prevent wilting and delay senescence through preventing microorganisms' accumulation in the vessels. Also, blockage of the vessels in cut chrysanthemum can be stimulated by the plant itself. According to the obtained results, biocides have not only prevented the vascular obstruction caused by the microorganisms, but also prevented the blockage stimulated by the plant itself and these results are consistent with reports by Kim and Lee (2002).

Petal's Protein

The influence of various levels of treatments on the petal protein content was significant in 1% probability. Mean comparisons showed that the 20% tea extract with 8.74% and 200 mg l^{-1} 8-hydroxy quinoline sulfate with 10.32% were the best treatments compared to the control (1.62%) (Table 1). The senescence of cut flowers has the hormonal regulatory mechanism and this process is involved in changing the physical and biochemical features in cellular membrane (Buchanan Wollaston, 1997). One of the reasons for beginning senescence in plant tissues, is increasing the activity of ROS like H_2O_2 that causes senescence by degrading proteins, lipids, and nucleic acids. Maintaining of the petals' protein can be due to decreasing in activities of enzymes that decompose protein and increasing the water absorption which maintened the stability of membrane and prevent protein degradation (Sood and Nagar, 2003; Lerslerwonga *et al*., 2009).

Solution uptake

The effect of various levels of treatments on water uptake was significant in the statistical level of 5%. Mean comparisons showed that the 20% tea extract with 0.77 ml g^{-1} FW and the 100 mg l^{-1} 8-hydroxy quinoline sulfate with 0.71 ml g^{-1} FW, and the 100 mg l^{-1} rifampicin with 0.64 ml g^{-1} FW had highest water uptake and control (0.34 ml g^{-1} FW) had lowest water uptake. Cut flowers' wilting during vase life might be caused by insufficient water absorption due to vascular blockage that can be the result of growth of bacteria and accumulation of microorganisms in vessels.

Stem end blockage and inhibition of water relations, decreased vase life of cut flowers (Silva, 2003). Therefore, providing energy and preserving the water absorption power of the plant are two main factors for extending vase life of cut flowers, so these compounds maintain constant flow of water in the cut stems by controlling the activity of microorganisms (such as bacteria and fungi) and preventing the vessel blockage (Monshizadeh *et al*., 2011; Figueroa *et al.*, 2005). These results are consistent with Jalili Marandi *et al.* (2011) and Burt (2004). Similar results were reported by Zadeh Bagheri *et al*. (2011) about the positive effect of herbal essences and antibiotic compounds that are consistent with results of the present study. Kim and Lee (2002) reported that 8-hydroxy quinoline sulfate, as a common antibiotic, has germicidal properties and improves longevity by enhancing water absorption. Nabigol *et al*. (2006) found that antiseptic, anti-ethylene and antibiotics compounds significantly improve the water absorption in plants; and their results are consistent with results of this study.

Petal's Carotenoids

The effect of different treatments on amount of the petal's carotenoid was significant ($p \leq 0.01$). Results showed that the 20% tea extract with 5.95 µg g^{-1} FW and 100 mg l^{-1} rifampicin with 3.28 µg g^{-1} FW and 100 mg l^{-1} 8-hydroxy quinoline sulfate with 5.39 µg g^{-1} FW, were the best treatments (Table1). Petal's discoloring is one of the postharvest problems for cut flowers that reduces quality of flowers and this problem has significant effect on senescence. Carotenoids and anthocyanins are two great important pigments in cut flowers (Amarjit, 2000; Hasanpour Asil and Karimi, 2010). Antibacterial compounds prevent from degredation of flavonoids and enhance flowers' freshness by improving the water uptake.

Total Chlorophyll

The effect of treatments on the total chlorophyll was significant in 5% probability. The 20% tea extract with 3.19 mg g^{-1} FW and the 100 mg l^{-1} 8-hydroxy quinoline sulfate with 4.57 mg g^{-1} FW were the best treatments compared to control (2.32 mg g^{-1} FW) (Table1). These compounds prevent senescence and wilting by their antibacterial property and reducing the pH of the environment; they extend the vase life by controlling vascular obstructions and enhancing the water absorption (Elgimabi and Ahmad, 2009; Edrisi, 2009). Controlling activity of chlorophyll decomposing enzymes is one of the other reasons for improvement of total chlorophyll by the above mentioned compounds. These results are consistent with the results of the studies by Ferrante *et al.* (2002).

CONCLUSION

The 20% tea extract with 18.86 days increased the vase life of cut chrysanthemum compared to controls (9.64 days) by 9.2 days.

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