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Effect of Antibiotics and Essential Oils on Postharvest Life and Quality Characteristics of *Chrysanthemum* Cut Flower

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Abstract

Chrysanthemum cut flower is not sensitive to ethylene and its vase life depends on vascular blockage. In order to evaluating of effect of antibiotics and essential oils on the vase life and quality characteristics of chrysanthemum cut flower an experiment carried out based on a RCD with 10 treatments: *Artemisia* at 3 levels (10, 30 and 50 %), amoxicillin at 3 levels (100, 200 and 300 mg l^{-1}), Rifampin at 3 levels (100, 200 and 300 mg l^{-1}) and the control plants in 3 replications. Analysis of variance showed that effect of treatments on measured traits was significant at $p\leq0.05$ or $p\leq0.01$. Mean comparisons also revealed that 30% of *Artemisia* oil, 200 mg l^{-1} amoxicillin and 200 mg l^{-1} rifampin caused the longest vase life, the highest preservative solution uptake. petal's soluble protein contents, leaf chlorophyll and maximum fresh weight.

Keywords: Chrysanthemum, *Artemisia* essential oil, Antibiotic, Vase life, Preservative solution uptake, Petals soluble protein content.

INTRODUCTION

Chrysanthemum (*Denderanthema grandiflorum* L.) belongs to Asteraceae family which has been planted since thousands years ago, and now is the most important cut flower in the world (Khoshkhui, 2010; Shiravand and Rostami, 2009). Chrysanthemum belongs to non-climactric flowers and its senescence is in response to changes that occur in the carbohydrate content, and water relations. Moreover, the quality of cut chrysanthemum reduced due to the formation of air embolism inside the vessels, this can be occurred both in the stems kept in vases (directly in water) and in stems stored in wet storages (Bartoli *et al.,* 1996; Adachi *et al*., 1999). Another reason for the decline in the cut flowers quality is leaves yellowing, it occurs due to the chlorophyll degradation during senescence, so using disinfectant compounds can be overcome this occasion (Edrisi, 2009; Halevy and Mayak, 1981). Di (2008) in his study on cut gerbera flowers found that use of tetracycline and penicillin caused delay in protein degradation and also increased POD and SOD activity. Oraee *et al*. (2011) studied on *Gerbera jamesonii* and found that thymus oil improved vase life and reduced microbial contamination in stem end and vase solution.

The aim of this study is investigation on effect of antibiotics and essential oils on vase life and postharvest quality of cut chrysanthemum cv. White.

MATERIALS AND METHODS

Cut chrysanthemum flowers cv. 'White' was purchased from a commercial producer in Tehran province and immediately were transferred into the postharvest laboratory under standard conditions. All cut flowers were cut in the height (60 cm) and recutted and placed into vases containing determined concentrations of Artemisia essential oil and antibiotics for 24 hour pulse treatment.

Fig. 1. Chrysanthemum cut flowers in the vase solution.

This study carried out based on randomized complete design with 3 levels of Artemisia essential oil (10, 30 and 50 mg l^{-1}), rifampin and amoxicillin in 3 concentrations (100, 200 and 300 mg l^{-1}), and the control flowers, at 3 replications and 30 plots. After 24h pulse treatment, cut flowers were transferred to 500 ml preservative solution containing 8- hydroxyquinoline sulphate (250 mg l^{-1}) and sucrose 3% (Fig. 1).

Vase life, preservative solution uptake, petal's protein content, leaves chlorophyll content and fresh weight loss were measured. Petal's protein content was measured according to Bradford (1976) method and chlorophyll was measured based on Mazumdar and Majumdar (2003) method. Fresh weight was measured by digital scale (0.01g) and fresh weight loss and water uptake calculated by followed formula :

Fresh weight loss = fresh weight in 1st day - (Fresh weight in final day + recuts weight)

Solution uptake (ml g^{-1} F.W.) = 500 - (Amount of vase solution in final day +Amount of room evaporation)/Fresh weight in first day.

For determination of vase life, leaf yellowing and petal wilting were evaluated in the end of flower longevity (Nabigol *et al.*, 2005).

Data analysis was performed using SPSS and MSTATC soft ware and mean comparisons was done by LSD test.

RESULTS AND DISCUSSION

Vase life

Effect of different treatments on vase life was statistically significant at 5% probability level. Mean comparisons also revealed that 200 mg l^{-1} rifampin had the highest vase life (11.33 days) as compared to the control (6 days) (Fig. 2).

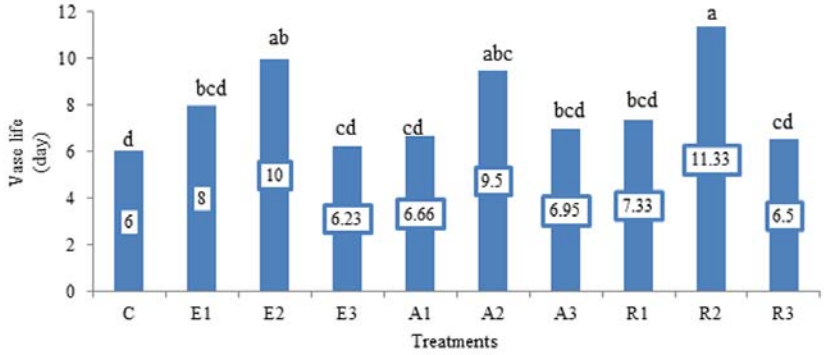

Fig. 2. Effect of different treatments on vase life of cut chrysanthemum cv. 'White'.
A1: 100 mg l^{-1}, A2: 200 mg l^{-1}, A3: 300 mg l^{-1} amoxicillin
E1: 10 %, E2: 30 %, E3: 50 % *Artemisia* oil
R1: 100 mg l^{-1}, R2: 200 mg l^{-1}, R3: 300 mg l^{-1} rifampin
C: Control (Distilled water)

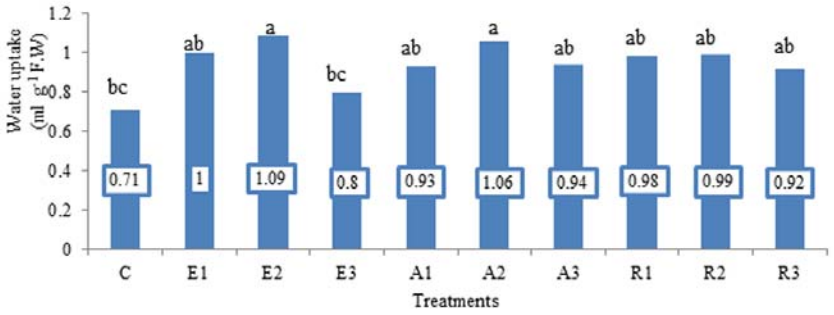

Fig. 3. Effect of different treatments on water absorption of cut chrysanthemum cv. White.
A1: 100 mg l^{-1}, A2: 200 mg l^{-1}, A3: 300 mg l^{-1} amoxicillin
E1: 10 %, E2: 30 %, E3: 50 % Artemisia oil
R1: 100 mg l^{-1}, R2: 200 mg l^{-1}, R3: 300 mg l^{-1} rifampin
C: Control (Distilled water)

Increasing of vase life with these treatments may be due to the antimicrobial properties that could prevent vascular blockage and improvement of water uptake, which causes water relations enhancement, so it prevents water stress and wilting of petals (Jalili Marandi *et al.*, 2011, Di, 2008). Our results were agreement by Figueroa *et al*. (2005), Kiamohammadi *et al*. (2011), and Mohmmadi Ostad Kalayeh *et al.* (2011) on other cut flowers. Oraee *et al.* (2011) studied on *Gerbera jamesonii* and found that thymus oil improved vase life and reduced microbial contamination in stem end and vase solution. Al-Humaid (2008) in his study on penicillin and streptomycin showed that these antibiotics could enhance postharvest quality of *Gladiolus hybridus.*

Water uptake

Effect of different treatments on water uptake was significant at the 5% probability level. Mean comparisons also revealed that among all treatments, 30% Artemisia essential oil by 1.09 ml g^{-1} F.W. water uptake had the most absorbtion as compared to other treatments. Effect of amoxicillin (200 mg l^{-1}) on water absorbtion was significant (1.06 ml g^{-1} F.W). Effect of rifampcin on water uptake showed that 200 mg l^{-1} antibiotic had greater uptake as compared to the control (0.99 and 0.71 ml g^{-1} F.W, respectively) (Fig. 3). This superiority may be due to improved water relations and hydraulic conductivity in cut flower which prevents vascular blockage in addition to water

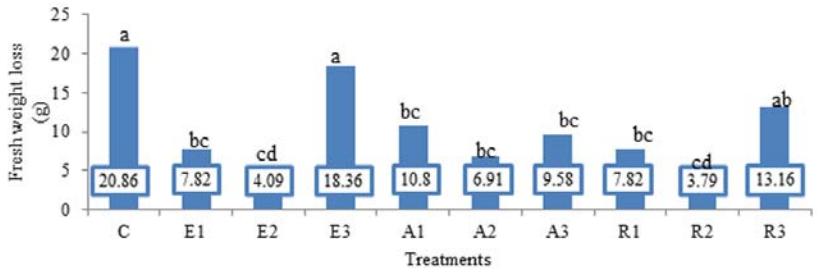

Fig. 4. Effect of different treatments on fresh weight loss of cut chrysanthemum cv. White.
A1: 100 mg l^{-1}, A2: 200 mg l^{-1}, A3: 300 mg l^{-1} amoxicillin
E1: 10 %, E2: 30 %, E3: 50 % Artemisia oil

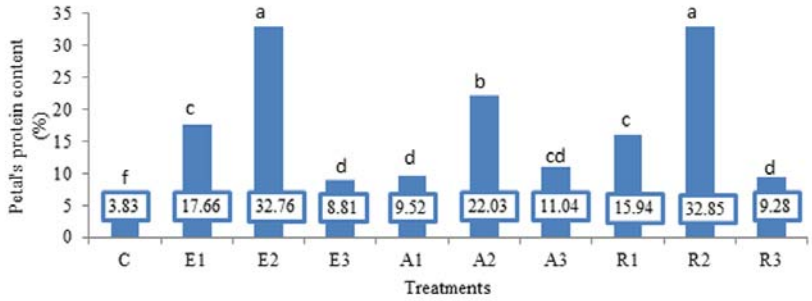

Fig. 5. Effect of different treatments on petal's protein content of cut chrysanthemum cv. White.
A1: 100 mg l^{-1}, A2: 200 mg l^{-1}, A3: 300 mg l^{-1} amoxicillin
E1: 10 %, E2: 30 %, E3: 50 % Artemisia oil
R1: 100 mg l^{-1}, R2: 200 mg l^{-1}, R3: 300 mg l^{-1} rifampin
C: Control (Distilled water)

uptake in the vessels that ultimately increases water absorption (Monshizadeh *et al.*, 2011; Figueroa *et al.,* 2005). Another reason for these results could be defined as control the activity of microorganisms (such as bacteria and fungi) which prevents vascular blockage, these results are in consistent with Jalili Marandi *et al*. (2011) and Burt (2004).

Fresh Weight Loss

Fresh weight loss affected by different treatments ($p \leq 0.05$). Mean comparisons also revealed that 30% Artemisia essential oil with 4.09 g and 200 mg l^{-1} rifampin with 3.79 g in fresh weight loss were the best treatment compared to other treatments (Fig. 4).

Petridou *et al.* (2001) evaluated the effect of antimicrobial and anti-ethylene compounds on quantitative and qualitative properties of cut chrysanthemum and found that using these compounds prevents vascular blockage and fresh weight loss which finally increased vase life, our findings also confirms these results. Al-Humaid (2008) in his study on penicillin and streptomycin showed that these antibiotics could enhance postharvest quality of Gladiolus hybridus. These results also confirms by Mohammadi Ostad Kalayeh *et al.* (2011).

Petal's Protein Content

Effect of different treatments on petal's protein content was statistically significant at 1% probability level. Mean comparisons indicated that 30% Artemisia essential oil with 32.76% and 200 mg l^{-1} rifampin with 32.85% protein content were the best treatments (Fig. 5).

Increasing of petals protein may be due to reduction of proteolytic enzymes activity. Improvement of water uptake ultimately leads to membrane stability and prevents protein degredation

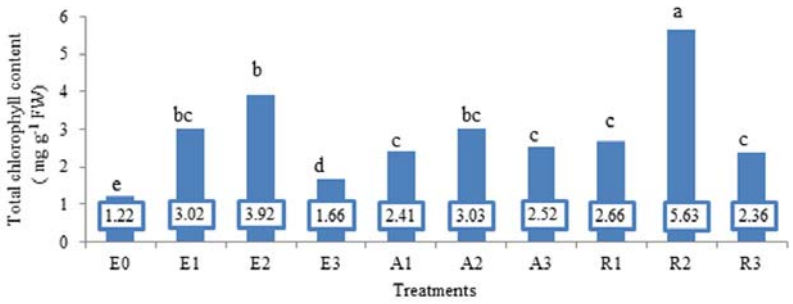

Fig. 6. Effect of different treatments on total chlorophyll content of cut chrysanthemum cv. 'White.

A1: 100 mg l^{-1}, A2: 200 mg l^{-1}, A3: 300 mg l^{-1} amoxicillin
E1: 10 %, E2: 30 %, E3: 50 % Artemisia oil
R1: 100 mg l^{-1}, R2: 200 mg l^{-1}, R3: 300 mg l^{-1} rifampin
C: Control (Distilled water)

(Sood and Nagar, 2003; Lerslerwonga *et al.*, 2009). Kazemi *et al*. (2011) showed that vase life extending compounds by maintenance membrane stability caused protein content enhancement and prevent protein degradation. Also, it is observed that cell membrane stability is reduced with senescence progressed (Ezhilmathi *et al.*, 2007). Hashemabadi (2011) found that the use of antimicrobial agents is effective to maintain of cell membrane in cut carnation cv 'Tempo'. Zamani *et al.* (2011) studied on the impact of vase life extending compounds on MDA activity and cell membrane stability of cut chrysanthemum and stated that these compounds increased membrane stability about 25 to 40% more than the control which is in consistent with present results. Di (2008) in his study on cut gerbera found that use of tetracycline and penicillin caused a delay in protein degradation and also increased POD and SOD activity.

Total Chlorophyll Content

Results showed that 200 mg l^{-1} rifampcin with 5.63 mg g^{-1} F.W had highest chlorophyll among all applied concentrations (Fig. 6).

The superiority of all treatment compored to control may be due to antimicrobial properties of essential oils and antibiotics as vase life extending compounds which prevents senescence with controlling vascular blockage and water absorption enhancement (Elgimabi and Ahmed, 2009; Edrisi, 2009). Also, controlling the activity of chlorophyll degradation enzymes is another reasons for chlorophyll content enhancement with these treatments that is in accordance with Ferrante *et al.* (2002). Mousavi Bazzaz and Tehranifar (2011) evaluated the effects of herbal essential oils on *Alstroemeria* cut flower and found that the use of these compounds is effective to increase chlorophyll content. As well, similar results has been reported by Hashemabadi (2011) and Basiri and Zarei (2011) which confirm our findings.

CONCLUSION

According to all findings, it could be resulted that 30% *Artemisia* essential oil and 200 mg l^{-1} rifampin had the most efficiency and enhancing impact on postharvest quality of cut chrysanthemum cv. 'White', so using these compounds with determined concentrations are recommended.

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