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RESEARCH ARTICLE

The effect of herbal oil and citric acid on vase life of cut narcissus flower (*Narcissus tazetta* L.)

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ABSTRACT

The study was conducted to determine the effects of different herbal oils and citric acid on vase life of cut narcissus (*Narcissus tazetta* L.) flower. Cut narcissus flowers were placed in 100 ppm dose vase solutions containing lavender, nettle and melissa essential oil and rosin oil and citric acid. At the end of the study, the longest vase life (9, 8.5 and 8 days) was obtained from citric acid, rosin oil and melissa essential oil respectively, and other oil applications increased vase life compared to the control as well as. The highest relative fresh weight (116.1, 109.8 and 107.7%) during vase life was obtained from citric acid, melissa and nettle essential oil with respectively. All applications (except nettle essential oil) were effective in the increasing of the water uptake. As a result, it was determined that lavender, nettle and melissa essential oil and rosin oil were effective in increasing vase life of cut narcissus flower. In addition, in the study, it is necessary to determine the effects of nettle essential oil and rosin oil, which have positive effects on vase life, by applying them to vase solution of different cut flowers.

Keywords: Antimicrobial, essential oil, relative fresh weight, rosin oil, water uptake

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INTRODUCTION

Narcissus flower (*Narcissus tazetta* L.) is a cut flower that is widely consumed worldwide and appreciated by consumers due to its beautiful appearance, pleasant fragrance and flowering in winter (Ali et al., 2009; Gul and Tahir, 2013). The vase life of cut flowers is a critical factor in determining quality and plays a significant role in the maintaining of their value in the market. After the cut flowers break off the mother plant, the loss of the quality and senescence are accelerated (Solgi and Ghorbanpour, 2015). One of the reasons for the rapid loss of the quality and discoloration of the cut flowers at the postharvest is that the water lost by transpiration cannot be supplied by water uptake (Knee, 2000; Van Ieperen et al., 2002). It is thought that microorganisms that reproduce in the vase solution and the stems of the cut flowers prevent water uptake by blocking the end of the stem in the cut flowers (Ferrante et al., 2007). The fact that, the previous studies have also found that the vase life of the cut flowers is shortened by microorganisms growing on their stems (Van Meeteren, 1978, Van Doorn and De Witte 1994; Balestra et al., 2005). Many antimicrobial chemicals such as 8-hydroxyquinoline sulfate (8-HQS), silver thiosulfate (STS), aluminum sulfate, silver nitrate, sodium hypochlorite are used in vase solutions in order to increase the vase life of the cut flowers(Van Doorn, 1997; Asrar et al., 2012; He et al., 2018; Çelikel et al., 2020; Kazaz et al., 2019). However, the using of these chemicals creates a problem due to their harmful effects on human and environment (Ichimura et al., 1999; Motaghayer and Esna-Ashari, 2009). Essential oils are organic, natural, safe and environmentally friendly ingredients. They also have a

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strong anti-inflammatory, antibacterial, antifungal, antioxidant and anticarcinogenic effect. These properties are due to their high level of phenolic compounds (Solgi et al., 2009; Raut and Karuppayil, 2014). In recent years, oil acids such as carvacrol, thymol and essential oil such as lavender, cumin, thyme, dill, melissa, clove and peppermint are used in the vase solution to increase the vase life of the cut flowers (Yahyazadeh et al., 2008; Hegazi and Gan, 2009; Massoud et al., 2015; Kılıç et al., 2020; Kazaz et al., 2020; Langroudi et al., 2020). Essential oils neutralize pathogens by decomposing lipids in the cell wall, proteins of mitochondrion and membranes and by coagulating the cytoplasm (Burt, 2004). As a matter of fact, in previous studies, it has been determined that the essential oils prevent microbial growth in the vase solution, and increase vase life by increasing the water uptake of the cut flowers and reducing the loss of the fresh weight (Massoud et al., 2015; Mallahi et al., 2018; Salmi et al., 2018).

In addition, the rosin obtained from pine and spruce trees has been determined to have strong antimicrobial properties (Niu et al., 2018). Due to its properties, it is used as an agent in dressings for medical wound (Sipponen et al., 2007) and is widely added to food packaging materials (Niu et al., 2018). However, the effects of rosin oil and nettle essential oil on the vase life of the cut flowers have not been determined yet. The study was carried out to determine the effects of lavender, melissa and nettle essential, rosin oil and citric acid on the vase life, relative fresh weight and water uptake of cut narcissus flower.

Table 1: Treatments Used in This Experiment

Treatments	
Control	Distilled water
T1	100 ppm lavander essential oil
T2	100 ppm nettle essential oil
T3	100 ppm rosin oil
T4	100 ppm melissa essential oil
T5	100 ppm Citric acid

MATERIALS AND METHODS

Plant materials and treatments

The present study was carried out in the postharvest laboratory, Horticulture Department, Faculty of Agriculture, Ordu University, Ordu, Turkey. In the experiment, cut narcissus (*Narcissus tazetta*) flowers were used as plant material. The cut narcissus flower was harvested by hand at the goose-neck stage on December month in 2019 years. In the study, 90 narcissus flowers were used in total. The harvested flowers were transferred to postharvest laboratory within 1 hour in buckets containing tap water. The new cutting was made from the lower part of the stem to be approximately 30 cm length of the flower stem. Flowers were then placed in glass bottles (1000 ml) containing 300 ml of vase solutions which were distilled water, 100 ppm lavender (*Lavandula hybrida*) essential oil, 100 ppm nettle (*Urtica dioica*) essential oil, 100 ppm rosin oil, 100 ppm melissa (*Melissa officinalis*) essential oil and 100 ppm citric acid (Sigma-Aldrich, Turkey) solution (Table 1). While the vase solution was prepared, the distilled water was used in all applications. Rosin was collected from Austrian pine (*Pinus nigra*) and rosin oil was obtained by applying 280-300ºC vapor for 60 min. Constituents of rosin oil and essential oils were determined by using GC-MS analysis.

Table 2: The Most Common Compounds of Oils

Compound	Composition (%)	Compound	Composition (%)
Lavander essential oils		**Nettle essential oil**	
Linalyl acetate	26	Carvacrol	35.20
Linalool	25	Carvone	11.26
1,8- Cineole	7.51	Anethel	9.72
Rosin oil		**Melissa essential oil**	
α-pinene	38.41	1,8- Cineole	20.85
8-3- carene	27.49	p- Cymene	14.46
Limonene	5.61	α-Terpinolene	12.89

The vase life trial was conducted under conditions of 21 ± 1 ° C and 65 ± 5% relative humidity. The parameters such as vase life, relative fresh weight, water uptake and total water uptake in the flowers were investigated. The measurements were performed in 3 day intervals. The experiment was designed with 3 replications and 5 flowers were used in each repetition.

Methods

Vase life (days) = It was determined as the number of days passed from the day when the flowers are placed in the vase until the day 50% of the petals wilting (Alipur et al., 2013).

*Relative fresh weight (*RFW) (%) = (A_t / $A_{t\,=\,0)}$ x100 (He et al., 2006). A_t: weight of stem (g) at t = day (eg 1, 3, 5 etc.) $A_{t=0}$: weight of the same stem (g) at t=day 0.

Daily water uptake (DWU) = S_{t-1}-S_t (He et al., 2006). S_{t-1} = the weight of the vase solution for the previous day, S_t= the weight of the vase solution on day t (eg 1, 2, 3, etc.).

Total Water Uptake (TWU) = Refers to the total daily water uptake at the end of the vase life.

Statistical analysis

As the result of the control done, the descriptive statistics of the data, fulfilling the conditions were calculated and evaluated with variance analysis. After the data obtained were analyzed with analysis of variance (ANOVA), the level of significance between treatments was determined by Tukey's multiple comparison test. Statistical analyzes was done in MINITAB 17 package program. The significance level of statistical analyzes and interpretation of the results was taken into account as α = 5%.

RESULTS AND DISCUSSION

Vase life

The effects of the different applications on vase life of cut narcissus flower are given in figure 1. All applications had longer vase life than the control. The longest vase life (9 days) was recorded from the citric acid application. T3 and T4 applications had vase life of 8.5 and 8 days, respectively. There was no difference in vase life between T1 and T2 applications. Bacteria that grow and reproduce in vase solution of the cut flowers cause vascular occlusion thereby reduce vase life by reducing water uptake (Van Doorn, 1998). In many studies, it was determined that essential oils and citric acid, which have antimicrobial properties, were effective in extending vase life of the cut flowers(Bakkali et al., 2008; Solgi et al., 2009; Bayat et al., 2013; Rida et al., 2016; Mirjalili and Kavoosi, 2018). The fact that, in our study, 100 ppm dose citric acid, rosin and essential oils significantly increased vase life of cut narcissus flower. These results may have been obtained that because the essential oils and rosin oil prevent blockages in stalks due to their antimicrobial properties. As a matter of fact, similar findings have been obtained from other studies(Shanan, 2012; Bayat et al., 2013; Massoud et al., 2015). In addition, in previous studies, it has been reported that rosin oil has strong antibacterial properties (Niu et al., 2018).

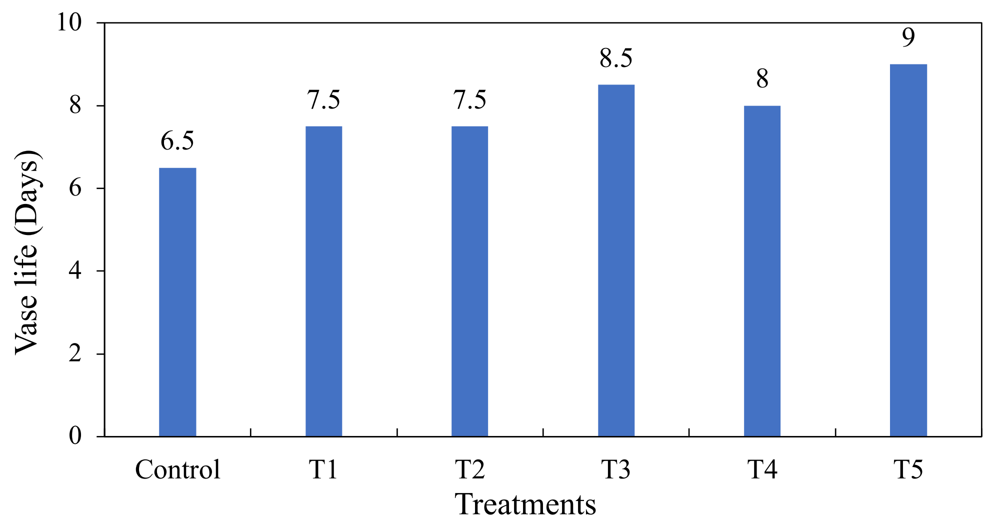

Figure 1. **Effect of different treatments on vase life of cut narcissus flower.**

Relative Fresh Weight

According to Figure 2, all applications significantly increased the fresh weight of cut narcissus flower. The fresh weights of all applications were increased up to the 3th day of vase life. Citric acid increased the relative fresh weight by up to 116.1%. Among essential oils, the highest fresh weight was found in T4, T2, T1 and T3 applications with 109.8, 107.7, 106.3 and 105.4%, respectively. While the fresh weight in citric acid applications did not decrease below the initial fresh weight during vase life, in other applications decreased on the 9th day. The fresh weight of cut flowers decreases due to a reduce in water uptake and an increase in water loss through respiration(Liao et al., 2012; Mansouri, 2012). However, all applications in our study significantly increased the fresh weight of cut narcissus flower. In addition, the highest relative fresh weight among essential oils was obtained from melissa essential oil. Researchers reported that there was a positive relationship between solution uptake and fresh weight increase (Alaey et al. 2011; Amini et al., 2016). In parallel with this finding, in our study, it was determined that in the applications with the higher fresh weight was more the water uptake. In this regard, it is thought that essential oils, rosin oil and citric acid induce the water uptake due to their antimicrobial properties. The fact that, it has been reported that with the application of essential oil, the growth of bacteria in vase solution of cut flowers was prevented and the fresh weight increased (Massoud et al., 2015).

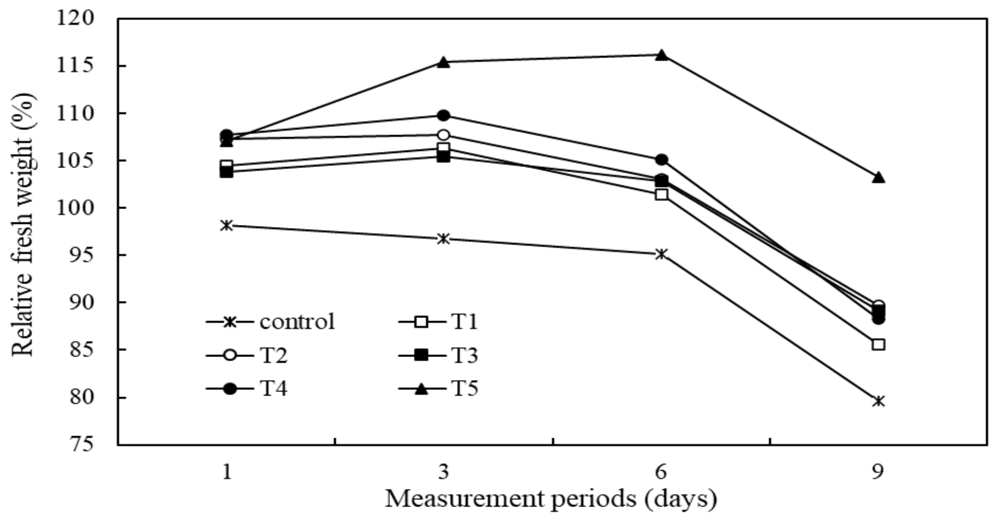

Figure 2: Effect of different treatments on relative fresh weight of cut narcissus flower during vase life.

Daily Water Uptake and *Total Water Uptake*

The effects of the different applications on the daily water uptake of cut narcissus flower are given in figure 3. The daily water uptake increased significantly in all applications until the 6th day of vase life. In the daily water uptake, there were significant differences between applications. During vase life, the citric acid application had significantly higher water uptake than other applications. But the water uptake in nettle essential oil application was lower compared to control. Except for the 1st day, the water uptake of T1, T3 and T4 applications was higher than the control.

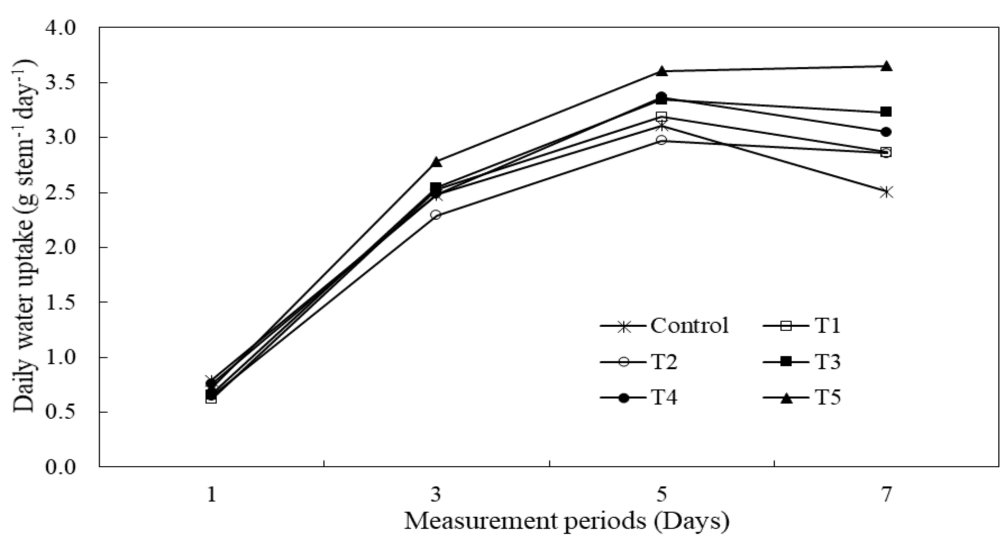

Figure 3: Effect of different treatments on daily water uptake of cut narcissus flower during vase life.

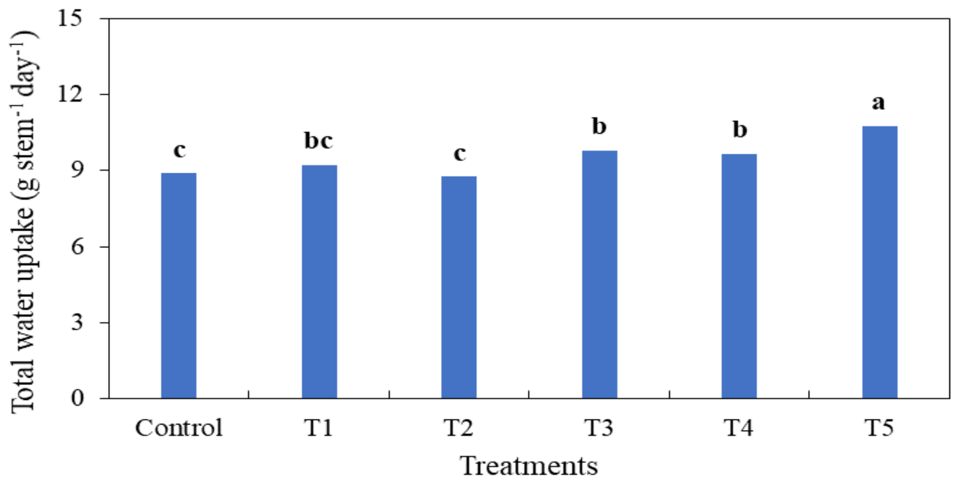

Figure 4: Effect of different treatments on total solution uptake of cut narcissus flower.

According to Figure 4, in total water uptake, there were statistically significant differences between applications. The highest total water uptake was obtained from the citric acid application. In addition, T1, T3 and T4 applications had higher water uptake than control. But there was no difference between T2 and control applications. The increased water uptake causes cut flowers to increase their fresh weight and vase life. Because water replenishment is essential for physical development like cell expansion and also supports cut flower (Da Silva, 2003). In our study, a positive relationship was found between vase life and the water uptake. Vase life of lavender and melissa essential oils, rosin oil and citric acid applications, which had higher water uptake compared to the control, was longer. In addition, in previous studies, it has been reported that essential oils and citric acid show antimicrobial properties and induce the water uptake of the cut flowers (Bayat et al., 2013; Hashemi and Mirdehghan, 2014). On the other hand, the nettle essential oil had no effect on the water uptake. In previous studies, it has been reported that the essential oils have a negative effect on water uptake of cut flowers (Baninaeim and Samsampoor, 2016; Kazaz et al., 2020). In this respect, it is very significant to determine the application doses of the essential oils (Mirdehghan and Aghamolaei, 2016).

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