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Full Length Research Paper

Effect of rosemary extract on vase life and some qualitative characteristics of cut carnation flowers *(Dianthus caryophyllus cv.* 'white librity')

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The vase life of cut carnation *(Dianthus caryophyllus)* is short due to some post harvest problems leading to its low postharvest quality. Flower longevity is varied in different cultivars of cut carnation. But cause of short vase life was most reported to be loss of carbohydrate content or stem vessel blockage. Therefore in the current research effect of several antimicrobial compounds on postharvest life of carnation cut flowers (*D. caryophyllus L.*) cvs. yellow librity were investigated. Carnation's cut flowers were kept in pots containing rosemary extract (0, 5, 10, 15, 20 and 25%) and water as control. In all treatments, 6% sucrose was used. The result showed that 25% rosemary extract was the best treatment and increased vase life of cut flowers until 24.6 days in laboratory conditions. Observations indicated that rosemary treatments with its antimicrobial effect inhibited the growth of microorganisms in vase solution and with increasing water uptake considerably extended the vase-life of cut flowers of carnation.

Key words: vase life, cut flowers, dianthus, rosemary extract, silver nitrate.

INTRODUCTION

Over 300 Dianthus species have been introduced so far (Galbally and Gallbally, 1997). Various species of the genus Dianthus (family: Caryophyllaceae) (Tutin et al., 1993) are known in the horticultural literature related to carnations and pinks.

Carnation (*Dianthus caryophyllus*) is one of the mostly cultivated flowers around the world for producing of cut flowers. The senescence of carnation flowers (*D. caryophyllus* L.) is accompanied by a marked increase in the synthesis of ethylene, and a concomitant climacteric rise in respiration (Nichols, 1966). Pre-treatment of cut carnations with a silver thiosulfate complex (STS) prevents the climacteric rise in ethylene production (Veen, 1979) and delays senescence of the flowers. Vase life termination for many cut flowers is characterized by wilting (He et al., 2006). Water balance is a major factor determining quality and longevity of cut flowers. Cut flowers are sensitive to microbial contamination at the stem base or in the vase solution, shortening their vase life (Balestra et al., 2005).

Rosmarinus officiinalis L. (family: Lamiaceae), commonly referred to as rosemary, belongs to mint family. It is a popular herb in many western countries, with global cultivation and an exceptionally wide usage in the Mediterranean countries from where it originated. Rosemary has a long list of claims pertaining to its medicinal usage including antibacterial (Karamanoli et al., 2000) and antioxidant properties (Ozcan, 2003). It is known to be an effective chemo preventive agent, an antimutagenic (Minnunni et al., 1992). However, there is no available information on the use of rosemary extract for control of microbial contaminations and extending the vase life of cut flowers such as carnation.

The objective of this work was to evaluate the effect of extract of rosemary as a treatment on extending vase life and some qualitative characteristics of cut carnations (*D.*

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Table 1. Effect of different concentrations of rosemary extract on vase-life of carnation flowers.

Nano-silver concentrations (ppm)	Vase-life (Days)
NS 5	15.3^{e}
NS 10	20.6^{c}
NS 15	17.6^{d}
NS 20	23.6^{b}
NS 25	24.6^{a}
Control	9.6^{f}

Source: Mean separation among treatments was done by LSD test at p ≤ 0.05.

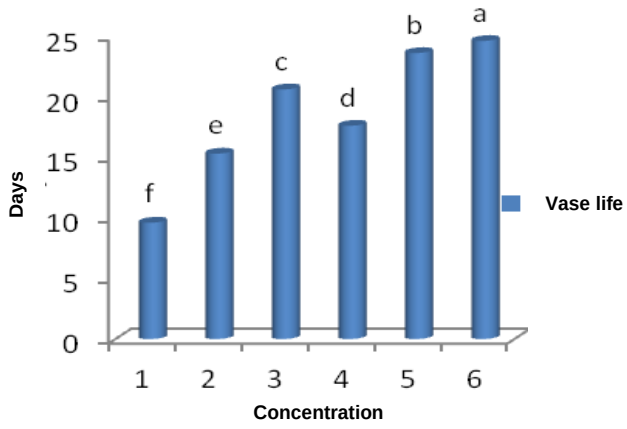

Figure 1. *D. caryophyllus* L.

caryophyllus cv. 'white librity') flowers.

MATERIALS AND METHODS

Cut carnation (*D. caryophyllus* L.) flowers were obtained from the Mahalati flower market in Tehran, Iran. Flowers were obtained in a morning of spring (April to May) in 2010. Thereafter, they were kept under shade in the flower mart until being transported within 6 h to the Gorgan University of Agricultural Sciences and Natural Resources. To minimize moisture loss, flowers were covered with plastic film during transportation. At the laboratory end of flower stalks were re-cut by ≥10 cm, and cut flowers with about 25 cm long were used in the experiments. Experiment took place in a completely randomized design base.

Vase solutions were freshly prepared at the beginning of experiments. Solutions consisted of extract of rosemary in concentration of 0, 5, 10, 15, 20 and 25% in combination with sucrose 6% and control treatment. Flowers were kept in glass vases containing 250 ml solutions. Pot mouths were then covered with a sheet of polyethylene film to minimize evaporation and to reduce further contamination. After recording the initial fresh weight, flowers were placed in glass vases filled with the preservative solutions. The flowers were then kept in a controlled room under the following conditions: 12 h photoperiod at a photo synthetically activated radiation of 850 lux, provided by fluorescent lamps, constant temperature of 20±2°C and relative humidity of 60±10%.

Main measured parameters which was supposed to be related to the effect of rosemary extract on the vase life of cut carnation during or at the end of study were quality of flower and leaves during the time, water absorption, bacteria concentration in solution, brix of petals, chlorophyll ab, chlorophyll a, chlorophyll b in leaves, carotenoids of flowers and fresh weight of carnation's cut flowers were measured. This experiment was conducted in a split plot design in 3 replications and each replication consisted of 6 cut flowers. Statistical significance between mean values were assessed using analysis of variance (glm) and conventional LSD multiple range test at p ≤ 0.05.This procedure was carried out with the aid of the SAS 9.1 software platform.

Table 2. Effect of different concentrations of rosemary extract on vase-life of cut carnation flowers.

Treatment	df	QL	QF
R	266	0.5255	0.9939
Density	5	<0.0001	<0.0001
Time	5	<0.0001	<0.0001
Density × time	25	<0.0001	<0.0001
Cv		0	0

Source: Mean separation among treatments was done by LSD test at p≤ 0.05. QL= Quality of leaves; QF= quality of flower.

RESULTS AND DISCUSSION

Significant differences (p ≤ 0.05) were found among various concentrations of rosemary in extending the vase life of carnation flowers (*D. caryophyllus* L.). The longest vase life was obtained with 25% rosemary extract (Table 1 and Figure 1). This treatment of rosemary extract was the best treatment and increased vase life of cut flowers to about 24.6 days in the mentioned conditions.

Table 2 shows the effect of different concentrations of rosemary extract on the vase life of carnation flowers. The highest quality of leaves was for 20% rosemary extract treatment and the highest quality of flower was of that 25% rosemary extract treatment. The lowest quality of flowers and leaves were obtained with control treatment (Figure 5). Interaction between time and concentration of vase solution for two mentioned factors was significant at p ≤ 0.05.

Table 3 shows considerable difference between measuring factors on different concentrations of rosemary extract at p ≤ 0.05.This table shows, significant (p ≤ 0.05) differences were found among various concentrations of rosemary extract and time on absorbed water, brix of petals (Figure 3), chlorophyll ab, chlorophyll a, chlorophyll b in leaves and carotenoid content of flowers (Figure 3). Moreover this experiment indicated that there was significant difference between bacterial concentration in vase solution and various concentrations of rosemary extract at p ≤ 0.05. The lowest bacteria concentration was obtained with 25% of rosemary's extract and the highest concentration rate was seen with control treatment.

Significant differences between means comparison

Table 3. Effect of different concentration of rosemary extract on vase life and measured factors of carnation flowers.

Treatment	df	aw	bc	B	Clab	CLb	Cla	K
R	50	0.0139	0.1594	<.0001	0.2337	0.1917	0.0848	0.0568
Density	5	0.334	<0.0004	0.2012	0.0408	0.0089	0.0867	0.0569
Time	5	<0.0001	0.0011	<0.0001	0.003	0.0006	0.0013	<0.0001
Time*density	24	<0.0001	<0.0001	<0.0001	0.4214	0.0514	0.0648	0.7362
Cv		18.5	47.3	6.71	18.55	14.02	14.64	7.86

Source: Mean separation among treatments was done by LSD test at p ≤ 0.05. aw = Absorb water, bc = bacteria concentration, b = brix (TSS), Clab = chlorophyll ab, CLa = chlorophyll a, CLb = chlorophyll b , and K = carotenoid.

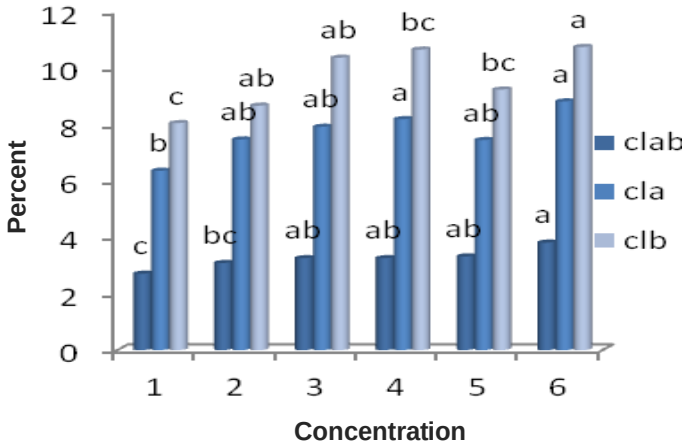

Figure 2. Chlorophyll ab, a and b.

indicates the highest total soluble solids (TSS) and cartenoid content were in the 5% concentration of rosemary extract treatment (Figure 3).The lowest TSS and carotenoid was obtained with control treatment (Figure 3). Moreover results indicated that the most content of chlorophyll ab, a and b was seen in treatment with 25% of rosemary extract and the lowest was control treatment (Figure 2).

Results also indicated that there was significant difference between fresh weight and various concentrations of rosemary extract, time and interaction between time and concentration at p ≤ 0.05.

The results for mean comparisons showed (Figure 4), the highest fresh weight was that of 25% rosemary extract treatment and the lowest was of that control treatment (Figure 4).

The beneficial effect of added sugars on the prolongation of the flower vase life in several species has been attributed to the suppression of ethylene biosynthesis or sensitivity to ethylene (Aarts, 1957). Exogenous sugars extended the vase life of several cut flowers; namely spray carnations (Borochov and Mayak, 1984), limonium, carnations (Dilley and Carpenter. 1975) and delphinium (Ishimura et al., 2000).

Results of current study indicated that, vase life of cut carnation with higher sugar content was longer. It has been approved by current and several other researches that adding sucrose to preservative solutions has positive effect on the vase life of most cut flowers, such as carnation (Halevy and Mayak, 1981). However according to the results of current research, it can be concluded that rosemary extract has antibacterial effects and can extend vase life of cut carnation. Concentration of 25 and 20% of rosemary extract in combination with sucrose 6% extended the vase life of cut flowers of white carnation by 24.3 and 23.6 days respectively (Table 1 and Figure 1).

Based on the results of current research , new antibacterial agents such as rosemary extract in combination with 6% added sucrose to vase solution had a positive effect on the vase life, relative fresh weight, lowing bacteria concentration and chlorophyll ab, a and b content of leaves (Table 3).

In other study indicated, using various concentrations of essential oils or plant extracts such as thymol, carvacrol, thyme oil and zataria oil in combination with 6% sucrose had a positive effect on the vase life of cut gerbera (*Gerbera jamesonii* cv. Dune) flowers which is close to the achieved results of current study (Solgi et al., 2009).

Moreover, several authors reported that some compounds present in rosemary extracts could have antibacterial activity (Cuvelier et al., 1996). Del Campo et

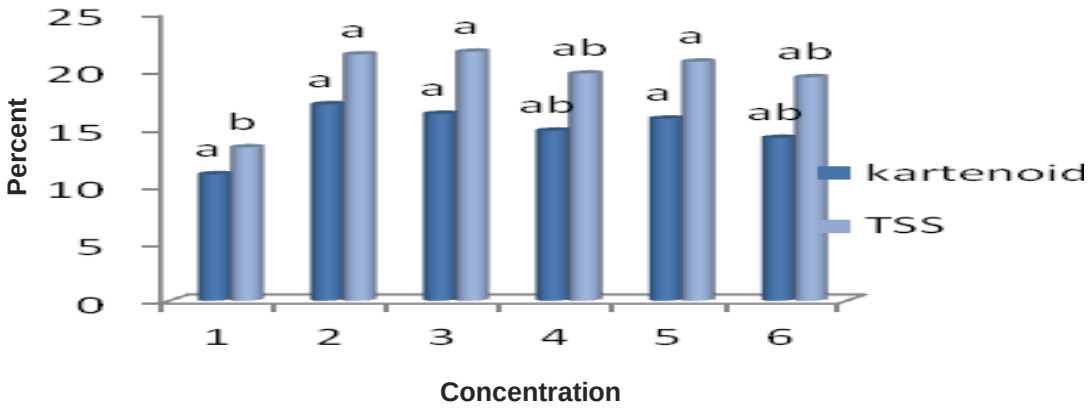

Figure 3. The lowest TSS.

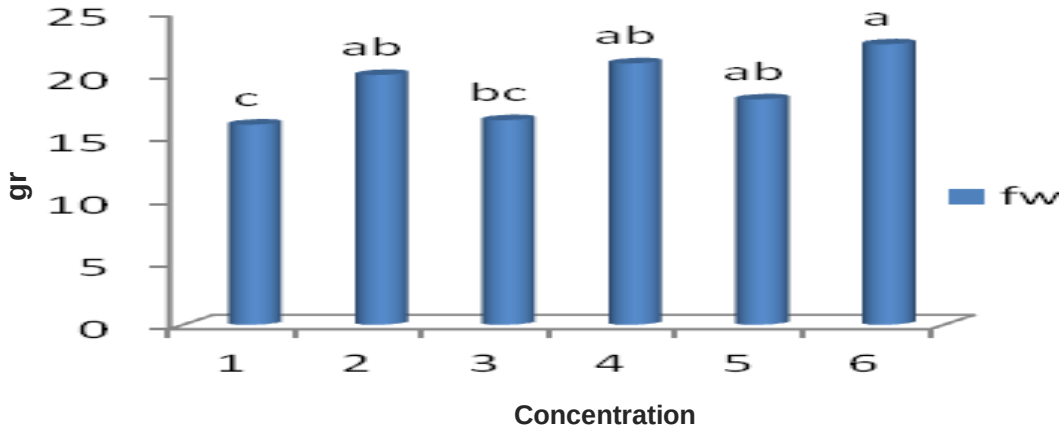

Figure 4. Highest fresh weight.

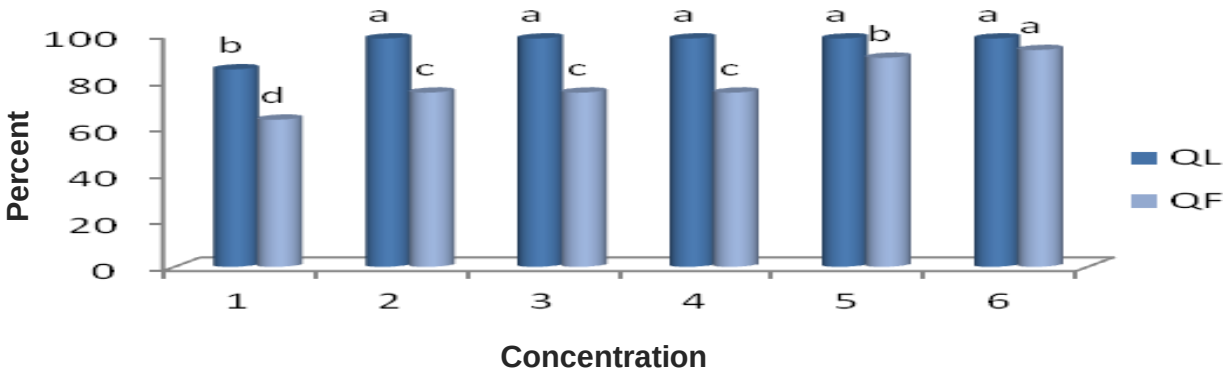

Figure 5. Concentration of vase solution.

al. (2000) reported that the compounds are responsible for the antibacterial actions seemed presumably to be the phenolic di-terpenoids, which are the main compounds of the apolar fraction of rosemary extracts.

Finally observations of current study indicated that rosemary extract treatments had no effect on colour changes of petals and leaves in carnation's cut flowers.

Conclusion

Rosemary's extract increases vase life of cut flowers of

carnation. This increase on vase life of cut flowers, petals and leaves of cut carnation is caused mainly by decreasing of bacteria concentration in vase solutions. Moreover it seems in addition to antibacterial effect of rosemary's extract, there must be other ways that rosemary's extract postpones flower deterioration and provide positive effect on increasing quality and vase life of cut flowers of carnation (*D. caryophyllus L.)* which needs more researches taking place in future.

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