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Improving the Vase Life of Cut Gerbera (*Gerbera jamesonii* L. cv. 'Balance') Flower with Silver Nano-particles

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ABSTRACT

Gerbera is one of the ten most popular cut flowers in the world and according to global trends in floriculture, it occupies the forth place in cut flowers. In order to evaluate the effect of silver nano-particles on vase life and postharvest quality of cut gerbera cv. 'Balance', an experiment based on the completely randomized design with one factor; silver nano-particles in 4 levels (0, 5, 10 and 20 mg l^{-1}) in three replications and 12 plots with 4 flowers per plot was done. Analysis of variance revealed that the effect of silver nano-particles on vase life, flower diameter decreasing index and loss of fresh weight was significant at 5% probability level. According to the mean comparisons, the maximum vase life and flower diameter decreasing index was obtained in 10 mg l^{-1} silver nano-particles treatment and the minimum loss of fresh weight belonged to the 20 mg l^{-1} silver nano-particles treatment.

Keywords: Silver nano-particles, Gerbera, Vase life, Flower diameter decreasing index.

INTRODUCTION

Gerbera (*Gerbera jamesonii*) belongs to the Asteraceae family, which is a perennial Mediterranean plant [14]. Cut flowers have short vase life and mostly are used freshly, so their vase life improvement is one the first floriculture's purposes [2, 4]. The major reasons for shorten vase life of cut flowers are; nutrient deficiency, bacterial and fungal contaminations, water stress-induced wilting and vascular blockage [1, 3]. So, the use of proper preservative solutions is recommended to extend the cut flower's vase life [8]. Silver ions are used as an antiseptic compound to inhibit microorganism's growth which ultimately increases vase life [5, 9]. But, taking into consideration the danger of silver heavy metal for human health and natural environment, the use of safe (environment friendly) compounds is recommended. Nowadays, silver nano-particles application is increasingly widespread [12]. Silver nano-particles have high surface area which causes better contact into microorganisms, so they have higher efficiency rather than other silver compounds [11]. Also, silver nano-particles act as antibacterial compound which interfere with bacterial cell membrane permeability and inhibit DNA multiplication that ultimately removes these microorganisms [10]. Positive impact of pulse treatment with silver nano-particles on cut rose cv. 'Movie Star' in 3 concentrations (50, 100 and 250 mg l^{-1}) is reported and they stated that 50 and 100 mg l^{-1} treatment had the maximum vase life and minimum fresh weight loss [7]. The aim of this study was to determine the most effective silver nano-particles concentration to extend vase life and to keep postharvest quality of cut gerbera cv. 'Balance'.

MATERIALS AND METHODS

In March 2011, cut gerbera (*Gerbera jamesonii* L. cv. 'Balance') flowers was obtained from a commercial producer located in 'Mahallat' city and immediately were transferred into the postharvest laboratory of Islamic Azad University, Rasht, Iran. Flowers were harvested at their commercial stage which had two rows of outer florets open

on the central disk. The 4 cut flowers were placed in 2 litter volume plastic vases containing 250 ml preservative solution (0, 5, 10 and 20 mg l^{-1}) silver nano-particles. In order to avoid the damaging effects of light on silver nano-particles, vases outer surface was covered. After a 24 h pulse treatment, flowers were transferred into the other vases containing 500 mg l^{-1} 8-hydroxyquinoline sulfate and 3% sucrose, and remained until the end of vase life. Postharvest laboratory conditions was 12 h light (white fluorescent lights), also light intensity was 12 µmol m^{-2} s^{-1} and room temperature was 20±2°C, relative humidity was fixed between 60 to 70%. The end of vase life was determined with visible wilting of petals and their rolling to the outer part. Flower diameter was measured every other day with a digital caliper; flower diameter index was calculated as following expressions:

$D_3/D_1+D_5/D_3+\ldots+D_{f-2}/D_f$

Where; D is flower diameter, and D_f is last day flower diameter. The number of this formula was divided to the number of ratios and the final number represents the flower diameter decreasing index. Fresh weight was measured at the first day and also at the last day of vase life with the digital scale, with the difference between the two numbers and the weight of re-cut pieces were isolated every other day, fresh weight loss was calculated. Data were subjected to analysis of variance using MSTATC software and mean comparisons were performed according to LSD test.

RESULTS AND DISCUSSION

Analysis of variance indicated that the effect of silver nano-particles on the vase life, flower diameter decreasing index and loss of fresh weight was statistically significant at 5% probability level. Mean comparison showed that the 10 mg l^{-1} had the maximum vase life as compared to the control (14.22 and 10.83 days, respectively) (Table 1). The reason for this can be attributed to potent antimicrobial silver nano-particles by reducing stem end the bacteria population will significantly help to increase vase life. Liu et al. [6] investigated the effect of silver nano-particles on the vase life of cut acacia and found that due to the antibacterial activity of this compound, it increased vase life as compared to the control which is in consistent to present results. Significant impact of silver nano-particles on flower diameter decreasing index showed the most significant decrease in diameter (0.99) rather than the control (0.96) is devoted to the treatment with 10 mg l^{-1}, this can explained with the inhibitory effects of silver nano-particles on the transpiration rate. Flower opening process requires ATP consumption from sugar breakdown, so, anything that reduces transpiration rate, delays flower opening. Rostami and Rahemi [12] studied the effect of pulse treatment with different concentrations of silver nano-particles and benzyladenine on cut rose cv. 'Sweet Water' and concluded that treatment of 150 mg l^{-1} silver nano-particles could inhibit flower diameter decreasing significantly. Current study confirms this finding. The least loss of fresh weight (6.95 g) rather than the control (12.44 g) is devoted to the treatment with 20 mg l^{-1}. Reasons for the introduction of silver nano-particles as a senescence delaying compound and effective on the loss of fresh weight can be its positive impact on water uptake enhancement which ultimately keeps fresh weight. Solgi et al. [13] also investigated the effects of silver nano-particles and some herbal essential oils on cut gerbera flowers cv. 'Dune' and concluded that the use of these compounds increased fresh weight as compared to the control. These results are in agreement with the present study.

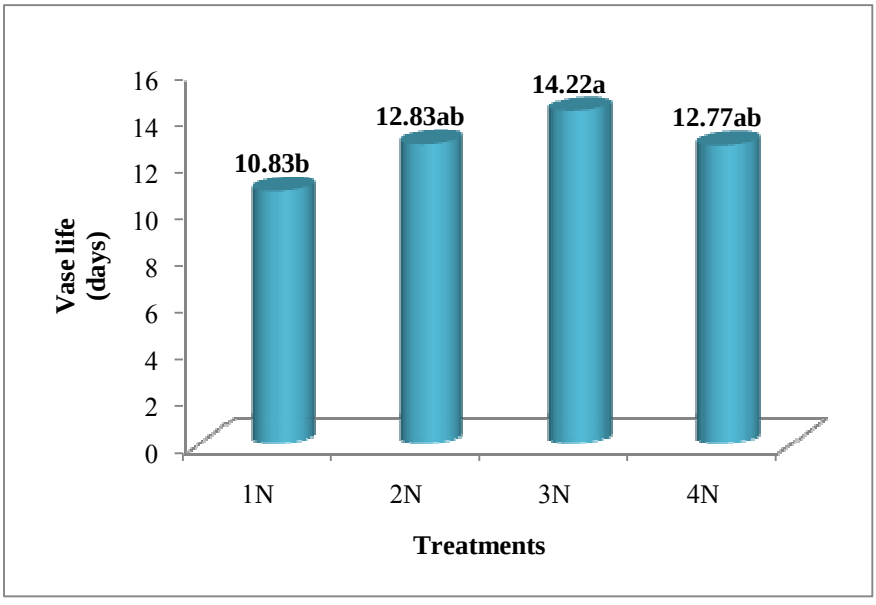

Fig. 1: Effect of silver nano-particles on vase life of cut gerbera cv. 'Balance' (N: different concentrations of nano-particles).

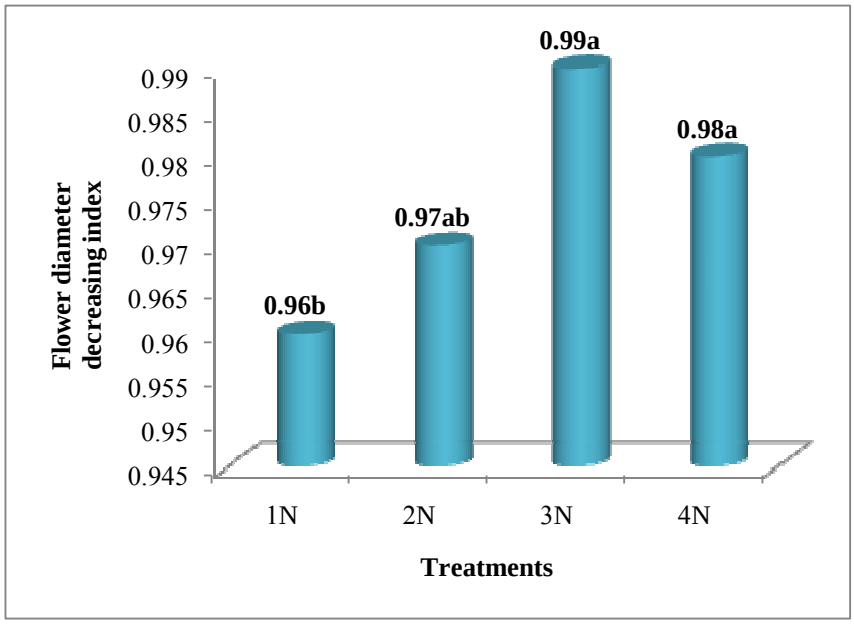

Fig. 2: Effect of silver nanoparticles on flower diameter index of cut gerbera cv. 'Balance' (N: different concentrations of nano-particles).

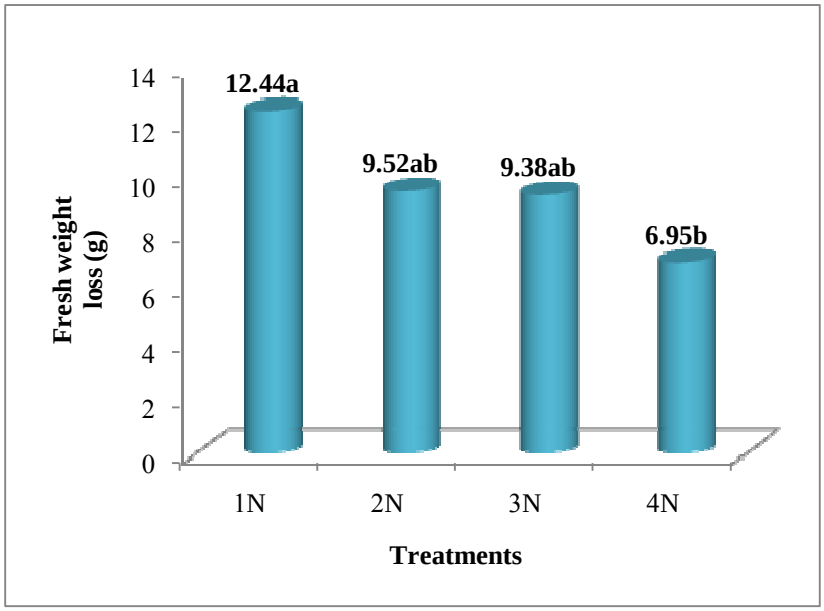

Fig. 3: Effect of silver nanoparticles on fresh weight loss of cut gerbera cv. 'Balance' (N: different concentrations of nano-particles).

Table 1: Effect of silver nano-particles on vase life of cut gerbera cv. 'Balance'.

Silver nano-particles treatments (mg l^{-1})	Vase life (days)	Flower diameter decreasing index	Fresh weight loss (g)
Control	10.83b	0.96b	12.44a
5	12.83ab	0.97ab	9.52ab
10	14.22a	0.99a	9.38ab
20	12.77ab	0.98a	6.95b

According to LSD test, in each column, means with the same letters are not significantly different.

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