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EFFECT OF NANO SILVER, SUCROSE AND CITRIC ACID ON EXTENDING THE VASE LIFE OF CUT CARNATION CV. DOMINGO

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Abstract

An experiment was carried out on the effect of nano silver, sucrose and citric acid on extending the vase life of cut carnation cv. Domingo at Floriculture Complex, Department of Horticulture, Faculty of Agriculture, Annamalai University during 2017-18. The experiment was laid out in completely Randomized Design (CRD) with 13 treatments using different combinations of three floral preservatives *viz*., Nano silver @ 10, 20, 30 and 40 ppm, sucrose @ 2, 4 and 6 per cent and citric acid @ 50, 100, 150 and 200 ppm along with control (distilled water). All the treatments with floral preservatives showed significant effect over control. Among all the treatments, T_9 (4 % sucrose + 40 ppm nano silver + 200 ppm) recorded the least optical density of vase solution(0.0173, 0.0785 and 0.0902 on 3rd, 5th and 7th day, respectively), lower pH of vase solution (3.28, 4.72 and 6.35 on 3rd, 5th and 7th day, respectively), higher TSS (11.80, 7.81 and 5.82 on 3rd, 5th and 7th day respectively), maximum vase life (7.80) and maximum water balance (3.05, 1.60 and 1.01 on 3rd, 5th and 7th day, respectively), followed by T_4 (2 % sucrose + 30 ppm nano silver + 150 ppm).

***Keywords*:** cut flower, carnation, nano silver, citric acid, sucrose, keeping quality.

Introduction

The flowers which are harvested along with long stems are termed as “cut flowers”. The demand of cut flowers in the global market is increasing at the rate of 10-15 per cent per year (Tabassum *et al.,* 2002). Wide range of flowers are sold in the market but major cut flower which dominate the global market trade are rose, chrysanthemum, orchids, tulips, gerbera, Anthurium, lilies etc., Among them carnation (*Dianthus caryophyllus* L.), belongs to the family Caryophyllaceae is one of the popular cut flower in the world. Columbia is the largest carnation producer in the world (Mohsen Kazemi, 2012). It is the national flower of Spain, Monaca and Slovenia. Carnation comes in numerous colours and each colour of carnation has a different meaning. Carnation has the highest economic importance in the floriculture industry for decorations and adornment. The vase life of carnation cut flowers is varying among various species and cultivars. Among the various practices for enhancing the vase life of cut flowers, carbohydrates, preservatives, germicides and organic acids plays a major role. Physiological and biological process of floral preservatives were well known, which enables rapid changes in the post-harvest quality and vase life of cut flowers, they are known for their influences on water relation (absorption and transpiration) and also ethylene (accelerates senescence of flowers). This was reported by Chutichuet *et al.* (2011). Silver reduces the ethylene binding capacity and stops the production of interior ethylene, therefore phenomena such as soon withering, enfolding the petals inside the flowers and blossom falling will be postponed (Bleeksma and Doorn, 2003). Sugars are the source of energy for respiration, which maintains turgidity, plays an important role in flower freshness. Sucrose treatment leads to an increase in the mechanical rigidity of the stem, which is due to cell wall thickening and lignification of vascular tissues (Steinitz, 1983). Citric acid reduces bacterial population in vase solution and increases the water conductance in xylem of cut flowers. Citric acid is one of the mobile forms of ions in plants, thus it plays an important role in ion transport (Helland Stephen, 2003).

Materials and Methods

The present investigation was carried out at the Floriculture complex in Department of Horticulture, Faculty of Agriculture, Annamalai University during 2017-18. An experiment was laid out in completely randomized design with three replications and 13 treatments. The treatments were: T_1 – Control (tap water), T_2 - Sucrose 2 % + nanosilver 10 ppm+ citric acid 50 ppm, T_3 - Sucrose 2 % + nanosilver 20 ppm+ citric acid 100 ppm, T_4 - Sucrose 2 % + nanosilver 30 ppm+ citric acid 150 ppm, T_5 -Sucrose 2 % + nanosilver 40 ppm+ citric acid 200 ppm, T_6 -Sucrose 4 % + nanosilver 10 ppm+ citric acid 50 ppm, T_7 -Sucrose 4 % + nanosilver 20 ppm+ citric acid 100 ppm, T_8 - Sucrose 4 % + nanosilver 30 ppm+ citric acid 150 ppm, T_9 - Sucrose 4 % + nanosilver 40 ppm+ citric acid 200 ppm, T_{10}- Sucrose 6 % + nanosilver 10 ppm + citric acid 50 ppm, T_{11} - Sucrose 6 % + nanosilver 20 ppm+ citric acid 100 ppm, T_{12} - Sucrose 6 % + nanosilver 30 ppm+ citric acid 150 ppm and T_{13} -Sucrose 6 % + nanosilver 40 ppm+ citric acid 200 ppm. The standard type cultivars of carnation Domingo (red) were used in this study. The stalks were cut under water to a uniform length of 30 cm and the basal two pairs of leaves were removed. Practices such as removal of lower leaves, clearing the stalks and recutting the base before placing them in the preservative solution were essential and it is generally, preferable to use distilled water as standardized water because it reduces experimental variability (Rule *et al.*, 1986). Each flower was placed in a 500 ml bottle containing 250 ml of distilled water of sucrose, nano silver and citric acid as described separately in experiment. Solutions were prepared as and when required and used in the experiment. Observations were recorded on Optical density, pH of vase solution, Total soluble solids, Vase life and Water balance.The data generated were subjected to statistical analysis. The data were tested for their level of significance at P=0.05as per method of Panse and Sukhatme (1985).

Result and Discussion

I. The effect of nano silver, sucrose and citric acid on optical density and pH of vase solution in cut carnation cv. Domingo

Optical density: Among the nano silver, sucrose and citric acid tested, optical density differed significantly among all the treatments (table 1). The least optical density of vase solution (0.0173, 0.0785 and 0.0902 on 3rd, 5th and 7th day, respectively) recorded in T_9 (4 % sucrose + 40 ppm nano silver + 200 ppm) followed by T_4 (2 % sucrose + 30 ppm nano silver + 150 ppm) which recorded optical density of 0.0182, 0.0825 and 0.1119 on 3rd, 5th and 7th day, respectively. The maximum values of optical density were observed in control (0.0360, 0.2075 and 0.2732 on 3rd, 5th and 7th day, respectively). This might be due to the interaction of nano silver with bacterial membranes and this is considered to be the main mechanism for the antimicrobial effect. Sucrose mainly acts as a food source for water balance maintenance (Khadijih Aleksair and khan, 2016). This finding was also registered by Solgi *et al.,*2009 in cut gerbera cv. Dune.

pH of vase solution: Vase solution pH showed significant differences among all the treatments (table 1). The treatment T_9 (4 % sucrose + 40 ppm nano silver + 200 ppmcitric acid)registered the lower pH of 3.28, 4.72 and 6.35 on 3rd, 5th and 7th day, respectively followed by T_4 (2 % sucrose + 30 ppmnano silver + 150 ppm citric acid) with the pH of 3.57 followed by T_6 with the pH of 3.98. Highest pH (7.02) was recorded in control at the end of vase life period. This change in pH may be due to specific interaction of vase solution with inherent transport physiology and metabolism of cut flowers (Liu*et al.,* 2009). Similar opinion was made by Nermeen Shanan (2017) in *Rosa hybrida* cv Teresa.

II. Effect of nano silver and other chemicals on total soluble solids, vase life and water balance in cut carnation cv. Domingo

Total soluble solids: Post harvest treatments exhibited significant influence on total soluble solids of cut carnation cv. Domingo (Table 2). The total soluble solids was peak on the 3rd, 5th and 7th day, respectively with the values of 11.80 ^{0}, 7.81˚and 5.82˚ Brix were noticed in the treatment T_9 (4 % sucrose + 40 ppm nano silver + 200 ppm citric acid). At the end of 7th day it was found to be decreased (5.82˚ Brix). This was followed by T_4 (2 % sucrose + 30 ppm nano silver + 150 ppm citric acid) which recorded 11.66 ^{o} on 3rd day, 7.81˚ on 5th day and 5.61^o on 7th day, respectively. The minimum TSS was recorded in control (9.93˚, 5.88˚ and 3.30˚ on the 3rd, 5th and 7th day, respectively).Similar findings were made by Marandhi *et al*. (2011) in cut carnation 'Cream Viana'.

Vase life: Vase life of cut carnation was significantly influenced among all the treatments (table 2).The maximum vase life was displayed by the treatment T_9 (40 ppm nano silver + 4 % sucrose +citric acid 200 ppm) with 7.80 days followed by the treatment T_4 (30 ppm nano silver + 2 % sucrose + 150 ppm citric acid), which recorded a vase life of 7.60 days. The lowest vase life (5.88 days) was displayed in control. This is due to the action of silver which extended the vase life and attributed to the inhibition of bacterial growth in the vase solution and at the end of cut stems during the time of the post harvest period (QaleShakhani *et al*., 2011). Similar findings were made by (Seyed Hussian, 2013) in lilium cv. Bouquet.

Water balance: The effect of nano silver with other chemicals on water balance was studied and the results are summarized in table 2.Treatment T_9 (40 ppm nano silver + 4 % sucrose +citric acid 200 ppm) recorded the maximum water balance (3.05, 1.60 and 1.01 g. flower^{-1} on 3rd, 5th and 7th day, respectively) in cut carnation cv. Domingo, followed by T_4 (30 ppm nano silver+ 2 % sucrose + 150 ppm citric acid)which recorded 2.11, 1.33 and 0.71 g.flower^{-1} on 3rd 5th and 7th day, respectively and the minimum was recorded by the control T_1 (-0.78,-1.47 and $^-$1.08 g.flower^{-1}on 3rd 5th and 7th day, respectively). These effects may be partially attributed by citric acid and sucrose ability to lower water activity (Nafiseh Darandeh and Ebrahim Hadavi, 2012). This was in accordance with the results obtained by Durkin (1979) in chrysanthemum.

It may be concluded from the results that, the holding solution with 40 ppm nano silver + 4 % sucrose +citric acid 200 ppm (T_9) recorded the least optical density of vase solution, lower pH of vase solution, higher TSS, maximum vase life and maximum water balance.

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