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ORIGINAL ARTICLES

Extending Postharvest Life And Keeping Quality Of Gerbera Cut-Flowers Using Some Chemical Preservatives

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ABSTRACT

A laboratory trails were carried out to investigate the effect of some chemical preservatives such as 8-hydroxyquinoline sulphate (8-H QS at 100 or 200 ppm) and Calcium chloride ($CaCl_2$ at 1000 or 2000 ppm) alone or in combination with 4% sucrose, in addition control (distilled water) on keeping quality and vase life of *Gerbera jamesonii* (Dark Pink Gerbera) cut flowers. Using solution of 8-HQS (at 200ppm) or $CaCl_2$ (at 1000 or 2000ppm) + 4% sucrose significantly increased both water uptake and water loss during all shelf life periods (3^{rd}, 6^{th}, 9^{th} and 12^{th}) as compared to other treatments. Most of chemical preservative solutions supplemented with 4% sucrose increased the fresh weight percentage of cut flowers up to 6^{th} day as compared to distilled water, 8-HQS (100, 200 ppm) or $CaCl_2$ (1000, 2000 ppm) without sucrose. The chemical solutions of 8-HQS at 100 or 200 ppm or $CaCl_2$ at 1000 or 2000 ppm each supplemented with 4% sucrose lowered the flower weight loss and increased dry weight percentage and longevity of cut flowers to highest values and also resulted in the highest soluble sugars and anthocyanin pigment in petals of flowers.

Key words: 8-HQS, $CaCl_2$, Vase life, *Gerbera jamesonii*.

Introduction

Gerbera *(Gerbera jamesonii)* belong to Asteraceae family, the largest family of flowering plants, and is one of ten popular cut flowers in the world and according to global trends in floriculture, it occupies the fourth place among cut flowers (Choudhary and Prasad, 2000). It is in considerable demand in both domestic and export market. The blooms are attractive, suitable for any type of floral arrangements and are available in different shades and hues. Besides floral arrangements, gerbera is widely used in bouquets and in dry flower crafts. The cut flowers have a long vase life, which fetches premium market prices.

Keeping quality is an important parameter for evaluation of cut flower quality for both domestic and export markets. Addition of chemical preservatives to the holding solution is recommended to prolong the vase- life of cut flowers. Several preservatives are available to increase the longevity. Most of them do an excellent job of extending vase life (Sacalis and John, 1993). Most floral preservatives contain carbohydrates, germicides, ethylene inhibitors, growth regulators and some mineral compounds (Nowak and Rudnicki, 1990). Chemical preservatives, i.e. citric acid, boric acid, ascorbic acid, aluminum sulphate, cobalt sulphate, calcium chloride 8-HQS, etc. have been used in different formulations and combinations to enhance the vase life of flowers (Muhammed *et al.*, 2001).

Dineshbabu *et al.*, (2002) reported that holding solutions containing 8-HQS + Sucrose extended the vase life of dendrobium flowers and improved flower quality, as suggested by improved water consumption, fresh weight and flower freshness. This treatment also reduced the respiration rate and physiological loss in weight. Hassan *et al.* (2003) found that 8-HQS without sucrose resulted in the longest vase life of leaves and inflorescences, and the lowest loss of initial fresh weight of *Solidogo canadensis*. Skutnik *et al.*, (2006) reported that 8-HQS and sucrose solution shortened vase life in *Asparagus setaceus.*

Torre *et al.*, (2002) showed that $CaCl_2$ treatment promoted bud opening and delayed the decrease in both membrane proteins and phospholipids and increased ATPase activity in the aging petals of rose. Chen *et al.* (2004) pointed out that cut flowers of *Gerbera hybrida* were steeped in $CaCl_2$ solution and their flowering period had been prolonged.

Sucrose is widely used in floral preservatives, which acts as a food source of respiratory substrate and delays the degradation of proteins improves the water balance of cut flower. Treatment of flowers with solutions containing sucrose (5-15%) improves the vase life of carnation and *Gladiolas sp.* (Mor

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et al., 1981). The vase life of gerbera (*Gerbera jamesanii* cv. Dune) flowers were significantly increased by addition of 6% sucrose in preservative solution (Mousa *et al.,* 2009). The main postharvest disorder of cut gerbera flowers in addition to flower wilting is stem break that occurs 10 cm below the capitalism (Wilberg, 1973). Stem break, a sudden bending of the stem, occurs in many gerbera-cultivars and is a practical problem affecting the sale of the flowers (Meetern, 1978). The important factors that affect this postharvest disorder are genetic factors; other factors include some phytohormones, mineral elements, water imbalance caused by bacteria activity in xylem vessels of cut flowers, postharvest condition and storage temperature after harvest and during handling (Ferrante *et al.,* 2007). So, the objective of this study was to investigate the effect preservative chemicals 8-HQS and $CaCl_2$ alone or combined with sucrose at different concentrations on keeping quality and vase- life of *Gerbera jamesonii* cut flowers to keep it for a longer period for interior decoration.

Materials And Methods

The present study was conducted at Department of Ornamental Plants and Woody Trees, National Research Centre during years 2009 and 2010. The cut flowers were harvested from Floramax farm in El-Mansuria district at 60 cm length and were used about 2h after harvesting. The study was carried out on March to evaluate the effect of some holding solutions containing 100 or 200 ppm of 8- HQS or 1000 or 2000 ppm of CaCl2 each alone or combined with sucrose (4%) on quality and longevity of *Gerbera jamesonii* (Dark Pink Gerbera) cut flowers.

The flowers were cut in the early morning, wrapped in Kraft paper in groups and translocated vertically under dry conditions to the laboratory within two hours. Then the flowers were rapidly precooled by placing them in cool water for 3 hours. The experiment design was a completely randomized with three replications with nine flowers per treatment.

The flowers were placed in glass bottles containing 250 ml of previous mentioned chemical preservative solutions as well as distilled water as control treatment and kept in the laboratory at room temperature (25 ± 2°C) for 12 days; 30 – 35 % RH and continuous lighting with fluorescent lamps 1000 lux.

Data recorded:

The following data were recorded: water uptake (g), water loss (g/flower), the changing of flower fresh weight (%) every 3, 6, 9 and 12 days during the shelf life period, flowers weight loss (%) at the end of the shelf life period, flower longevity which was determined when the petals showed symptoms of wilting and change of color edge of petals. The dry weight of flowers (%) was determined by drying it in an electrical oven at 70°C for 72 hours, till constant as well as total soluble sugar content in flowers which were determined calorimetrically according to the method described by Dubois *et al.* (1956) and anthocyonin according to Husia *et al.,* (1965).

The data collected were analyzed statistically using the combined analysis of variance by LSD test according to method of Steel and Torrie (1980).

Results and Discussion

Water uptake (g/flower):

Data presented in Table 1 indicated that treatment with solution of 8- HQS at 200ppm or $CaCl_2$ at 1000 or 2000ppm supplemented with sucrose (4%) significantly increased water uptake in most cases up to 12^{th} day as compared to flowers placing in other solutions or distilled water (control). Also, it is clear from data that with the extension of shelf life period after 9^{th} day, a gradually decrease in the amount of water uptake was observed after that day in most treatments. The results in agreement with those of Farahat and Gaber (2009) on *Monestera deliciosa* who indicated that using $CaCl_2$ at 1000 ppm recorded the highest water uptake (%) after 12 days. Sucrose helps in maintaining the water balance and turgidity. Hence, addition of sucrose to holding solution might have lead to increased uptake of the holding solution (Rogers, 1973). In our study, the declining of water uptake by flowers when they placed in water may be due to vascular blockage particularly at the stem base and using 8-HQS or $CaCl_2$ at various concentrations acted as a biocide inhibiting microbial population that might have resulted in blockage of the vascular tissues, and subsequently caused stem break.

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Table 1: Effect of different preservative solutions on water uptake (g/flower) of *Gerbera jamesonii* (Combined analysis of two seasons).

Day / Treatments	3rd	6th	9th	12th
Control	6.71	18.53	0.0	0.0
8- HQS 100 ppm	7.23	25.62	34.54	0.0
8 -HQS 200 ppm	8.59	27.27	37.58	0.0
8- HQS 100 ppm+ sucrose 4%	7.31	26.47	36.66	0.0
8- HQS 200 ppm + sucrose 4%	9.13	28.47	38.54	52.40
$CaCl_2$ 1000 ppm	8.40	27.50	37.23	0.0
$CaCl_2$ 2000 ppm	9.67	30.36	40.55	0.0
$CaCl_2$1000 ppm + sucrose 4%	11.26	31.01	40.57	56.46
$CaCl_2$2000 ppm + sucrose 4%	9.89	28.77	38.90	51.40
LSD 5%	1.38	1.58	1.36	0.99

Water loss (g/flower):

As shown in Table 2, water loss of *Gerbera jamesonini* cut flowers treated with chemical preservative solutions of 8-HQS at 200 ppm or $CaCl_2$ at 1000 or 2000 ppm+ sucrose 4% had increased as compared with other all treatments or distilled water in all shelf life periods (3^{rd}, 6^{th}, 9^{th}, and 12th). In this respect, Khenizy(2000) pointed out that carnation cut flowers treated with vase solution containing sucrose + 8- HQC + Citrice acid + Tween – 20 increased water loss with increasing shelf life periods.

Table 2: Effect of different preservative solutions on water loss (g/flower) of *Gerbera jamesonii* (Combined analysis of two seasons).

Day / Treatments	3rd	6th	9th	12th
Control	3.91	17.41	0.0	0.0
8 -HQS 100 ppm	4.95	19.42	36.63	0.0
8 -HQS 200 ppm	5.68	22.40	39.36	0.0
8 -HQS 100 ppm+ sucrose 4%	5.42	20.60	38.39	0.0
8 -HQS 200 ppm + sucrose 4%	6.06	23.38	40.32	64.57
$CaCl_2$ 1000 ppm	6.30	22.47	39.40	0.0
$CaCl_2$ 2000 ppm	7.57	25.47	40.67	0.0
$CaCl_2$1000 ppm + sucrose 4%	8.28	26.37	42.43	68.24
$CaCl_2$2000 ppm + sucrose 4%	6.96	23.48	40.70	63.54
LSD 5%	0.51	1.23	1.61	1.07

The change of flower fresh weight (%):

Data in Fig. 1 revealed that the fresh weight percentage of *Gerbera jamesonii* flowers mostly increased up to 6^{th} day when flowers were treated with chemical preservative solution of 8-HQS at concentration of 100 ppm or 200ppm + sucrose 4% or $CaCl_2$ at 1000 or 2000 ppm + sucrose 4%

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compared to flowers placing in those materials solutions without sucrose or distilled water (control). The results were in agreement with those of Ichimura *et al.* (1999) on *Rosa hybrida* cv. "Sonia", El-Saka (2002) on gerbera flowers cv. "North star" and Lobna and Soad (2010) on *Sterelitzia reginae* who mentioned that preservative vase solutions recorded higher rate daily fresh weight which increased as percentage. The flower weight expressed the flower freshness, flower longevity and flower senescence. Steinitz (1982) opined that addition of sucrose to the solution increased the mechanical rigidity of the stem by inducing cell wall thickening and lignifications of vascular tissues. Sucrose antagonizes the effect of ABA which promotes senescence (Halevy and Mayak, 1979). Under study, the decrease of increasing flower fresh weight after 6th day from the beginning of the experiment may be due to increase of transpiration about of water uptake during the shelf life period.

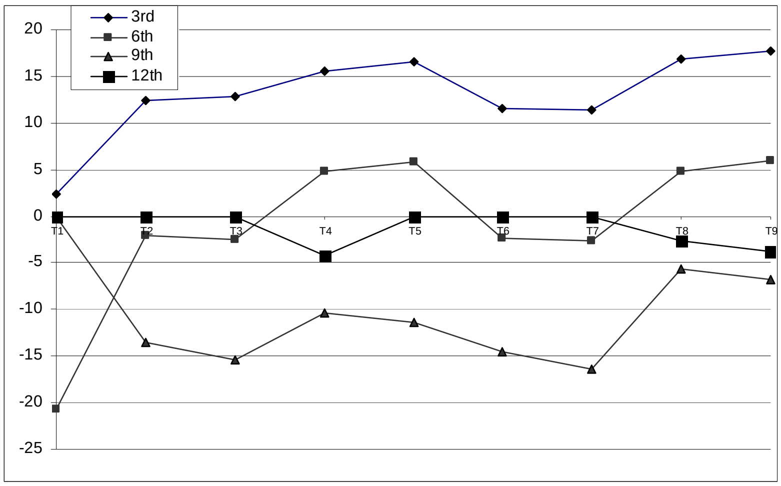

Fig. 1: Effect of different preservative solutions on changing percentage of fresh weight during shelf life (days) of *Gerbera jamesonii.*

Treatments:

T1: distilled water (control), T2: 8-HQS 100ppm, T3: 8-HQS 200ppm

T4:8-HQS 100 ppm + 4% sucrose, T5: 8-HQS200ppm + 4% sucrose

T6: $CaCl_2$ 1000ppm, T7: $CaCl_2$ 2000ppm, T8: $CaCl_2$ 1000ppm +4% sucrose, T9: $CaCl_2$ 2000ppm + 4% sucrose.

Flower weight loss (%):

Data in Table 3 indicated that maximum of flower weight loss percentage was observed in control treatment (distilled water), 8-HQS at 100 or 200ppm or $CaCl_2$ at 1000 or 2000 ppm(21.55, 19.52, 18.27, 19.43 and 18.45, respectively). Normally the treatment resulting in less weight loss percentage of flowers are considered good because these may results in longer vase life compared to those showing more ones. It is clear, also from data in Table 3 that adding sucrose 4% to preservative solutions contained 8-HQS or $CaCl_2$ decreased flower weight loss percentage. This may attributed to the effect of sucrose in delaying petal senescence and flower wilting (Halevy and Mayok, 1979). Holding solution containing 8-HQS + sucrose reduced the respiration rate and physiological loss in weight of spikes of dendrobium hybrid sonia-17 (Dineshbobu *et al.,* 2002). Singh and Tiwari (2003) found that pulsing stem of rose in $CaCl_2$ gave a minimum weight loss.

Dry weight and longevity:

It is clear evident from the data in Table 3 that the highest dry weight percentages and the maximum longevity of gerbera flowers were recorded by using 8-HQS (100 or 200 ppm) or $CaCl_2$ (1000 or 1000 ppm) each supplemented with sucrose 4% as compared with all preservative solutions or control treatment (distilled water). Similar results were obtained by Amariutei *et al.,* (1986) on gerbera who demonstrated that the flower characters as dry weight of inflorescence, relative vase life were greater in pulsed inflorescences than those in water only. Dineshbabu *et al.* (2002) revealed that holding solutions containing 8-HQS + sucrose extended the vase life of dendrobium flowers and improved flower quality. Farahat and Gaber (2009) mentioned that $CaCl_2$ treatment (500 or 1000 ppm) extended vase life of cut leaves of window leaf. The inclusion of 1% sucrose in the vase solution also extended longevity in *Alstroemeria* (cv. Rebecca) flowers (Chanasut *et al.*, 2003).

Table 3: Effect of different preservative solutions on flower weight loss percentage, dry weight percentage and longevity at the end of shelf life period of *Gerbera jamesonii*(Combined analysis of two seasons).

Treatments	Flower weight loss (%)	Dry weight (%)	Longevity (Days)
Control	21.55	12.70	7.30
8 -HQS 100 ppm	19.52	13.65	8.33
8 -HQS 200 ppm	18.27	14.37	9.37
8 -HQS 100 ppm+ sucrose 4%	14.46	15.61	10.43
8 -HQS 200 ppm + sucrose 4%	13.58	16.66	11.23
$CaCl_2$ 1000 ppm	19.43	13.60	8.37
$CaCl_2$ 2000 ppm	18.45	14.67	9.43
$CaCl_2$1000 ppm + sucrose 4%	13.65	17.34	11.43
$CaCl_2$2000 ppm + sucrose 4%	12.82	16.29	11.27
LSD 5%	1.66	0.36	0.40

Total Soluble Sugars And Anthocyanin:

From recorded data in Fig. 2; we can notice that gerbera cut flowers when holding in different preservative solutions were recorded the highest content of both total soluble sugars and anthocyanin pigment as compared to distilled water. It also clear that adding sucrose 4% to preservative solution increased that content to highest values. The results are in agreement with those reported by Farahat and Gaber (2009). They mentioned that window leaf cut foliage when holding in different preservative solutions were recorded the highest content of total soluble sugars with $CaCl_2$ at the rate of 1000 ppm. However, 8-HQS 200 or 400 ppm + 30 g/ litre sucrose recorded the lowest values. The results by Ichimura *et al.* (2003) showed that the decrease in the soluble carbohydrate concentration in petals of "sonia" roses (*Rosa hybrida*) cut flowers which were treated with various preservative solutions, was more important than vascular occlusion in determining the vase life. Khenizy (2000) found that carnation cut flowers treated with sucrose + 8-HQC +citric acid was most effective on maintaining level of pigment in petals. Han (2003) reported that addition of 2% sugar into the vase solution of individual *Lilium sp.* "stargazer" flowers significantly enhanced anthocyanin content and, thus the intensity of petal color.

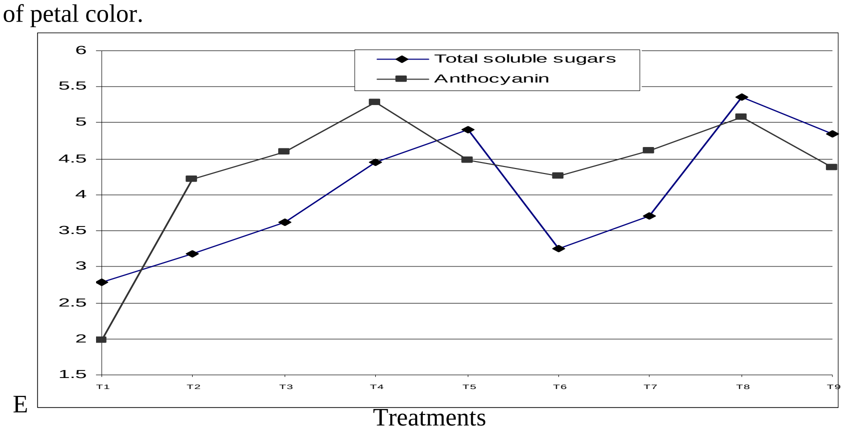

Fig. 2: Effect of different chemical preservative solutions on total soluble sugars in petals of *Gerbera jamesonii* (g/100g F.W). $LSD_{0.05}$ for both total soluble sugars and anthocyanin= 0.105.

Treatments:
T1: distilled water (control), T2: 8-HQS 100ppm, T3: 8-HQS 200ppm
T4:8-HQS 100 ppm + 4% sucrose, T5: 8-HQS200ppm + 4% sucrose
T6: $CaCl_2$ 1000ppm, T7: $CaCl_2$ 2000ppm, T8: $CaCl_2$ 1000ppm +4% sucrose, T9: $CaCl_2$ 2000ppm + 4% sucrose.

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