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EFFECT OF SOME CHEMICALS ON KEEPING QUALITY AND VASE LIFE OF SNAPDRAGON (*Antirrhinum majus* L.) CUT FLOWERS.

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ABSTRACT

This investigation was carried out during 2007-2008 to determine whether the selected chemical agents can be used to improve the post-harvest quality of snapdragon (*Antirrhinum majus*, L. cv. Riesen Vorbote) spikes, freshly cut flowering spikes were placed in glass bottles containing 100 ml of preservative solutions [distilled water or 8-hydroxyquinoline sulfate (8-HQS) at 200ppm or silver thiosulfate (STS) at 0.2mM] with or without sucrose at 20 g/L. Compared to the control, all treatments improved the quality and vase life of the flowers. Vase solutions containing 8-HQS plus sucrose was the most effective in promoting water uptake, percentage of maximum increase of spikes fresh weight so that the vase life of cut spikes extended to 18 and 16 days during the first and second seasons, respectively. The results indicated that using 200ppm 8-HQS combined with 20 g/L sucrose has the potential to be used as a commercial cut flower preservative solution for delaying flower senescence, prolonging the vase life and enhancing post- harvest quality of snapdragon cut flowers.
Keywords: Cut flowers, snapdragon, preservative solution, vase life.

INTRODUCTION

Antirrhinum majus (Common Snapdragon; often – especially in horticulture – simply "snapdragon") is a species of Antirrhinum native to the Mediterranean region, from Morocco and Portugal north to southern France, and east to Turkey and Syria. It is belonged to Family Scrophulariaceae.

It is a herbaceous perennial plant growing to 0.5-1 m tall, rarely up to 2 m. The leaves are spirally arranged, broadly lanceolate, 1-7 cm long and 2-2.5 cm broad. The flowers are produced on a tall spike, each flower is 3.5-4.5 cm long, zygomorphic, with two 'lips' closing the corolla tube; wild plants have pink to purple flowers, often with yellow lips. The fruit is an ovoid capsule 10-14 mm diameter, containing numerous small seeds. (Blamey, M. and Grey-wilson, C. 1989).

Fresh flowers deteriorate for one or more reasons. One of the most common reasons for early senescence is inability to absorb water. The water conducting tubes in the stem become plugged. Bacteria, yeast, and fungi living in the vase water or within the flower stem. These microorganisms and their chemical products plug the stem ends, restricting water absorption. They continue to multiply inside and eventually block the xylem tubes and prevent the water flow.

It was pointed out by Scholes and Boodley (1964) that many chemicals have been used experimentally or commericially to improve cut flower vase life because of there inhibitory property against microbial organisms.

Bactericidal substances that have been evaluated include amphyl, sodium hypochlorite, 8-hydroxyquinoline sulfate (8-HQS), copper sulfate, silver nitrate, zinc acetate and aluminum nitrate. Among these chemicals, 8-HQS was found to have the widest spectrum of effectiveness and the widest margin of safety for use in cut flower holding solutions.

Low carbohydrates are another reason for flower deterioration. A low carbohydrate supply can occur as a result of improper storage temperature and handling.

Sugars are able to cover the energetic needs of cut flowers. (Paulin, 1986). However, adding a carbohydrates source such as sucrose to the holding solution resulted in an extension of vase-life, if growth of micro-organisms was controlled (Marousky, 1969&1972).

Moreover, sucrose is the best form of carbohydrates which could be introduced after harvest as a component of the flower preservative solution. The form of carbohydrate for post-harvest use should be a metabolic sugar since the non-metabolic sugars were found to have no effect on prolonging the vase life of cut flowers when the cut flowers of carnation were fed with solutions of labled sucrose, they revolved $C^{14}O_2$ indicating the sucrose was being metabolized (Nichols, 1973).

Another reason for early senescence is the harmful effect of ethylene. Ethylene is evolved from plant tissue, particularly injured and old plant tissue. Ethylene gas has many deleterious effects. Generally it causes premature deterioration of flowers. Ethylene can cause flower wilting and is generally not reversible.

$AgNO_3$ applied through the stem base is relatively immobile and moves only for a short distance in the stem, but silver thiosulfate (STS) is very mobile and travels readily from the base of cut stem to the flower (Kofranek and paul, 1972&1974).

Also, STS acts as an ethylene antagonist, reduced ethylene production (Veen, 1979 a) and respiration (Veen, 1979 b) of standard carnations, and extended flower longevity (Staby *et al.* 1979).

The aim of this work was to determine the effect of using of 8-HQS and STS in combination with sucrose on the keeping quality of snapdragons cut flowers.

MATERIALS AND METHODS

The present research was conducted in the Laboratory of Vegetable and Floriculture Department, Faculty of Agriculture, Mansoura University during the two seasons of 2007 and 2008 to study the effect of using some chemicals in the preservative solution on some post harvest characters of cut flowers of *Antirrhinum majus cv. Riesen Vorbote*.

Plant material:

Antirrhinum majus seeds were obtained from Benary Company in Germany and sown on 1st of September in both seasons (2007&2008).The spikes were harvested at half opening stage (3-4 opened flowers). Uniform spikes were immediately transported to the laboratory of Horticulture

Department. The lower leaves were removed and flowering stems were re-cut for about 2 cm from the bases.

After recording all the fresh weight of snapdragon flower spikes, each flower was placed in glass cylinder (100 ml) containing the specific preservative solution. The glass containers were kept under laboratory conditions, i.e. 24 hrs fluorescent light, temperature at 24 ºC ± 2 and relative humidity between 60 – 70%. In addition, three jars filled with similar preservative solution without flower stem were added to each treatment and placed in the laboratory under the same conditions in order to measure the average daily evaporation value.

Treatments:

Snapdragon flower spikes were hold till the end of the experiment in the preservative solutions as follows:

1- Distilled water (Control).
2- Sucrose solution at 20 g/l.
3- 8-HQS solution at 200 ppm.
4- 8-HQS at 200 ppm + sucrose at 20 g/l.
5- STS solution at 0.2 mM concentration was used in this experiment according to Gorin *et al*. (1985).
6- STS at 0.2 mM + sucrose at 20 g/l.

Experimental design:

The experimental design was arranged in complete randomized blocks and design with three replicates and each replicate consisted of three glass cylinders (100 ml capacity). Each cylinder contained one cut flower stem.

Collected data:

1- The longevity (Vase life) in days was determined from starting time of the experiment till 50% of snapdragon flowers fall.
2- Absorbed solution (ml/flower/day) was measured every two days during the vase life periods by putting the flowers in a graduated cylinder and recorded the decrease in the solution level.
3- The change in fresh weight of flowers (%) was measured every two days during the vase life periods. Change in fresh weight calculated by subtracting the measured weight from the weight determined in the previous day.
4- Maximum increase of fresh weight of flower stems (%) was determined by weighting the spikes every two days until the end of the vase life.

Statistical analysis

Data collected from the current research were statistically analyzed and comparison between means was done according to Duncan Multiple Range Test (Little and Hills, 1978).

RESULTS AND DISCUSSION

Vase life (days):

Data presented in Table (1) showed that using of 8-HQS at 200 ppm plus sucrose at 20 g/l as a holding solution significantly increased the longevity period of snapdragons cut spikes when compared with all other treatments in the two seasons except the treatment of distilled water plus 20 g/L sucrose in the second season. Cut spikes that were held in preservative solution contained 200 ppm 8- HQS and 20 g/l sucrose gave the maximum longevity period compared with the other treatments.

The minimum values of longevity period (8 and 10 days in the first and second season, respectively) were recorded when STS +20 g/L sucrose was added to the holding solution.

The results show the importance of 8-HQS in increasing the vase life. Applying 8-HQS prevented the accumulation of microorganisms in xylem vessels and suppressed the xylem occlusion. These results may be due to the role of 8-HQS as antimicrobial agent and hence, it might reduce stem plugging. This explains the short vase life of untreated control and long vase life when 8-HQS was applied. The present results agreed with those reported by Patil *et al.* (1997) and Hassan *et al.* (2003) on solidago, El-saka (2002) on gerbera and Snider *et al.* (2004) on rose's flowers.

Adding sucrose to 8-HQS solution in vase extended vase life and make the cut spikes of *Antirrhinum majus, L* cv. Riesen Vorbote had better quality as compared with holding solution containing 8-HQS alone. This might be due to the importance of sucrose as a food supply necessary for improving flowering period.

Table (1): Effect of adding some chemicals to the preservative solution on averages vase life (days) of *Antirrhinum majus* L. cv. Riesen Vorbote cut spikes in 2007 and 2008 seasons.

Preservative solutions	Season	
	2007	2008
Distilled water (Control)	13.00 c	13.33 **cd**
8-HQS at 200 ppm	15.00 b	14.00 **bc**
STS	13.00 c	12.00 **d**
Distilled water +20 g/l sucrose	15.00 b	15.33 **ab**
8-HQS at 200 ppm +20 g/l sucrose	18.00 a	16.00 **a**
STS +20 g/l sucrose	8.00 d	10.00 **e**

***Means with the same letter are not significantly different at 0.05 probability.**
***The first season with normal letters and the second one with bold letters.**

Absorbed solution (ml/ 100 gm fresh weight):

Data in Tables (2) showed that the treatment of 8-HQS at 200 ppm plus 20 g/l sucrose was the only treatment which keeps the average of absorption during and up to 14th day of longevity period, and then a gradual decline in the amount of absorbed solution was occurring in the two seasons.

Comparing the absorbed amount in relation to preservative solutions, it is clear that during the two seasons the least average of absorbed solution along longevity period was belonged to the preservative solution treatment of distilled water plus 20 g/l sucrose.

Supplying the cut flowers with exogenous sugar preserved the dry mater and respiration substance.

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Adding sucrose to vase solution reduced the hydrolysis of starch naturally, the degradation of lipids and increase in the osmotic concentration, thereby decreasing the absorption of water and maintaining turgidity Elshawa (2008).

Maximum increase of fresh weight of the cut spikes (%):

Data presented in Table (3) indicated that the treatment of 8-HQS at 200 ppm plus 20 g/l sucrose significantly gave the maximum increases of fresh weight of snapdragons cut spikes when compared with other treatments (34.88 and 55.27% in the first and second season, respectively).

The lowest values of maximum increase of fresh weight (18.67 and 29.73% in the first and second season, respectively) were obtained when distilled water plus 20 g/l sucrose was used. These results were in agreement with the results obtained by Amariutei *et al*. (1995) on gerbera.

Table (3): Effect of the preservative solution treatments on the averages maximum increase of fresh weight (%) of cut spikes of *Antirrhinum majus* L. cv. Riesen Vorbote during 2007 and 2008 seasons

Preservative solutions	2007	2008
Distilled water (Control)	29.18 ab	33.17 **b**
8-HQS at 200 ppm	33.64 a	34.34 **b**
STS	29.91 ab	31.39 **b**
Distilled water +20 g/l sucrose	18.67 b	29.73 **b**
8-HQS at 200 ppm +20 g/l sucrose	34.88 a	55.27 **a**
STS +20 g/l sucrose	29.27 ab	33.56 **a**

***Means with the same letter are not significantly different at 0.05 probability.**
***The first season with normal letters and the second one with bold letters.**

The change in spikes fresh weight (%):

Data illustrated in Table (4) indicated that in the first season all preservative solution treatments induced the highest increases in fresh weight percentage of cut spikes at the second day of the experiment. This increment extended up to the 4^{th} day for the treatment of 8-HQS at 200 ppm and until 6^{th} day for the treatment of 8-HQS plus 20 g/l sucrose.Afterwards, all treatments showed a loss in fresh weight until the end of longevity period.

The same trend was observed in the second season (Table, 4) with the exception of the treatment of 200 ppm 8-HQS plus 20 g/l sucrose as it kept the increasing in fresh weight until 8^{th} day.

Supplying sucrose with 8-HQS solution increased fresh weight. This might be due to the increase absorbed solution. Elshawa (2008).

These results are in agreement with those found by Anju *et al.* (1999) on chrysanthemum and Knee (2000) on carnation, Dineshbabu *et al*. (2002) on dendrobium and Maitra *et al*. (2001) on roses.

Conclusion

From the previous results, it can be generally, concluded that adding 8-HQS at 200ppm combined with 20g/l to the vase solution led to give the maximum improvements of the keeping quality value of the cut spikes of snapdragon cv. Riesen Vorbote, compared with the other treatments.

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تأثير بعض الكيماويات على القدرة الحفظية لأزهار حنك السبع المقطوفة

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تضمنت هذه الدراسة تأثير استخدام بعض الكيماويات المختلفة على حياة وجودة أزهار حنك السبع المقطوفة. وقد اشتملت هذه المواد على المعاملات التالية: السكروز (٢٠جم/لتر)، ٨-هيدروكسى كينولين سلفيت (٢٠٠جزء في المليون)، غمس السيقان الزهرية المقطوفة في خليط من السكروز+٨-هيدروكسى كينولين سلفيت (٢٠٠جزء في المليون)، غمس السيقان الزهرية المقطوفة في محلول ثيو سلفات الفضة (٠.٢ ملليمول)، غمس السيقان الزهرية المقطوفة في محلول ثيو سلفات الفضة (٠.٢ ملليمول +محلول السكروز حتى نهاية التجربة أو وضع السيقان الزهرية في ماء مقطر (كنترول). وبالمقارنة مع معاملة الكنترول لوحظ أن جميع المواد المستخدمة أدت إلى تحسين وإطالة عمر الأزهار المقطوفة، إلا أن استخدام السكروز+٨-هيدروكسى كينولين سلفيت معاً سجلت أفضل المعاملات من بين المعاملات الأخرى في الموسم الأول والثاني من حيث كمية الامتصاص للمحلول والنسبة المئوية لأقصى وزن للأزهار المقطوفة وكذلك في إطالة عمر هذه الأزهار والتي امتدت إلى ١٨،١٦ يوماً في الموسم الأول والثاني من الدراسة على التوالي.
مما سبق يتضح أنه يمكن التوصية بمعاملة أزهار حنك السبع المقطوفة بمحلول حفظ يحتوي على ٢٠جم/لتر سكروز وفي وجود ٢٠٠ جزء في المليون من ٨- هيدروكسي كينولين سلفيت للحصول على أعلى قيمة للقدرة الحفظية لأزهار الصنف "ريسين فوربوت".

قام بتحكيم البحث

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Table (2): Effect of adding some chemicals to the preservative solutions on the average ampunt of absorbed solution (ml/ 100 gm fresh weight) of *Antirrhinum majus* L. cv. Riesen Vorbote cut spikes during 2007& 2008 seasons.

Preservative solutions	Life (days)																	
	2		4		6		8		10		12		14		16		18	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Distilled water (Control)	128.61 a	127.43 ab	73.90 a	72.34 a	42.32 ab	61.20 a	34.51 bc	59.15 bc	22.87 a	41.40 bc	29.18 ab	31.66 b	–	21.1 b	–	–	–	–
8-HQS at 200 ppm	123.53 a	169.13 a	86.86 a	137.52 a	71.72 ab	138.66 a	58.00 ab	124.6 ab	48.14 ab	105.57 ab	35.85 ab	58.18 b	67.34 b	17.8 c	–	12.42 b	–	–
STS	108.80 a	128.45 ab	80.67 a	112.22 a	56.17 ab	91.34 a	25.61 bc	64.29 bc	17.49 b	42.43 ab	10.81 b	19.65 b	–	–	–	–	–	–
Distilled water +20 g/L sucrose	91.54 a	91.77 b	41.70 a	70.45 a	31.64 b	60.66 a	37.60 bc	45.10 c	33.97 b	28.26 c	29.54 ab	14.81 b	17.99 c	12.6 d	15.46 b	–	–	–
8-HQS at 200 ppm +20 g/l sucrose	90.13 a	111.02 ab	85.15 a	118.63 a	85.81 a	104.42 a	87.93 a	147.64 a	91.98 a	142.57 a	94.28 a	125.01 a	83.21 a	121.3 a	75.82 a	59.35 a	32.84 a	–
STS +20 g/l sucrose	77.30 a	127.13 ab	74.35 a	85.91 a	34.11 b	73.78 a	14.08 c	50.76 bc	–	10.39 c	–	–	–	–	–	–	–	–

***Means with the same letter are not significantly different at 0.05 probability.**
***The first season with normal letters and the second one with bold letters.**

Table (4): Effect of the preservative solution treatments on the averages Change of fresh weight (%) ofcut spikes of *Antirrhinum majus* L. cv. Riesen Vorbote during 2007&2008 seasons.

Preservative solutions	Life (days)																	
	2		4		6		8		10		12		14		16		18	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Distilled water (Control)	23.89 a	28.50 a	-11.52 b	-2.17 b	-12.30 b	-1.49 a	-12.88 a	-13.84 ab	-12.57 a	-12.89 c	-14.75 a	-12.89 c	-7.35 b	-3.99 b	–	–	–	–
8-HQS at 200 ppm	25.36 a	31.39 a	1.28 ab	6.39 a	-5.14 ab	-0.76 a	-10.49 a	-14.62 ab	-14.32 a	-13.49 b	-13.67 a	-6.25 ab	-11.35 a	-3.22 a	–	-2.00 a	–	–
STS	24.05 a	25.67 a	-2.42 ab	1.21 ab	-1.62 ab	-16.45 a	-13.17 a	-8.50 ab	-19.51 a	-21.25 c	-26.23 a	-12.66 b	–	–	–	–	–	–
Distilled water +20 g/L sucrose	11.21 a	18.60 a	-9.45 ab	-0.67 ab	-8.92 ab	-1.82 a	-4.63 a	-3.76 ab	-8.12 a	-18.05 c	-12.78 a	-20.96 c	-16.69 a	-12.37 d	-23.53 a	–	–	–
8-HQS at 200 ppm +20 g/l sucrose	13.31 a	34.02 a	3.34 a	13.70 a	3.72 a	10.69 a	-7.21 a	5.84 a	-13.14 a	-0.83 b	-1.87 a	-1.51 a	-10.38 a	-4.25 c	-14.01 a	-3.57 b	-3.81 a	–
STS +20 g/l sucrose	23.09 a	21.30 a	-9.49 ab	1.48 ab	-12.82 b	-14.68 a	-6.36 a	-41.24 b	–	-10.76 c	–	–	–	–	–		–	–

***Means with the same letter are not significantly different at 0.05 probability.**
***The first season with normal letters and the second one with bold letters.**