THE ASIAN JOURNAL OF HORTICULTURE
Volume **8** | Issue 2 | December, 2013 | 547-551

Research Paper

Article history :
Received : 05.07.2013
Revised : 20.09.2013
Accepted : 04.10.2013

Influence of holding and pulsing solution on cut spikes of anthurium (*Anthurium andreanum*)

A. SANKARI, M. ANAND[1] AND R. ARULMOZHIYAN[1]

Members of the Research Forum

Associated Authors:
[1]Horticultural Research Station (T.N.A.U.), Yercaud, SALEM (T.N) INDIA

Author for correspondence :
A. SANKARI
Horticultural Research Station (T.N.A.U.), Yercaud, SALEM (T.N) INDIA
Email : sathatnau@yahoo.co.in

ABSTRACT : The present investigation was carried out to study the effect of pulsing and holding solutions on the vase life of cut spikes in anthurium cv. TEMPTATION. Pre-transit pulsing treatment with sodium hypochlororite 500 ppm took long days to develop spadix blackening (20 d), spathe blueing (21 d) and loss of glossiness of spathe (19 d) and recorded an increased vase-life period of 13 d over control. Cut spikes of Anthurium cv. Temptation kept in holding solution of sucrose 5 per cent + NaOCl, $16H_2O$ – 50 ppm + kinetin – 25 ppm took maximum days for anther bursting (18d), discolouration of the spathe (29d) and vaselife period (30d). While the untreated flowers had a reduced vase-life of 15 days only.

KEY WORDS : Anthurium, Post harvest life, Pulsing solution, Holding solution

HOW TO CITE THIS ARTICLE : Sankari, A., Anand, M. and Arulmozhiyan, R. (2013). Influence of holding and pulsing solution on cut spikes of anthurium (*Anthurium andreanum*). *Asian J. Hort.*, **8**(2) : 547-551.

Anthurium (*Anthurium andreanum* Lind) is an internationally important cut flower, which can contribute largely to the floricultural industry by virtue of its colour variation and long vase life. It is one of the most important cut flower worldwide due to its attractive form. Post harvest life of cut flowers depends on its genetic constitution and cultural practices. Vase life of cut flowers is determined by their genetic make up (Nowak and Rudinicki, 1990). Varieties as well as cultivars differ in their vase life (Nowak and Rudnicki, 1990; Bhattacharjee, 1999; Singh *et al*., 2002; Singh and Singh, 2002). In addition, some chemicals also extend their shelf life (Salvi *et al.*,1997). To improve the post harvest life of the cut flowers there are many operations carried out during export of flowers which reduce the wilt and enhance the vase life. Pulsing and placing in holding solutions are one such operations which can be helpful to hold the flowers for a longer duration. In this context, present investigation was carried out to study the effect of pulsing treatments and holding solutions on the vase life of cut spikes in Anthurium cv. TEMPTATION.

RESEARCH METHODS

The experiments were conducted at Horticultural Research Station, Tamil Nadu Agricultural University, Yercaud during 2010 and 2011.The effect of pulsing and holding solutions on the post harvest life of cut spikes was made in *Anthurium andreanum* cv. Temptation. The experiment was conducted in a Completely Randomized Design with six treatments for pulsing and eleven treatments for holding solutions, respectively and replicated thrice. The same experiment was conducted twice in two consecutive years and the data of was pooled and presented.

For the study on pulsing solutions, the cut stems were harvested when 60-75 per cent flower was open in the spadix and immediately subjected to chemical treatments mentioned below. Thereafter, the stems were precooled for 16 h at 13-15ºC. The individual spike was inserted in protected sleeve of cellophane. The base of the spike was wrapped in wet cotton during the simulated transmit to keep it moist. The stems were packed in card board boxes of 106 x 35 x 20 cm and subjected to simulated transit for 24 h at ambient conditions. Thereafter, basal 2 cm stem portions was recut under water and the vase-life was evaluated in plain water expressed at 23^0 C with 16 h illumination (1000 lux intensity) provided by 40 w fluorescent tubes under laboratory conditions. Physical observations *viz.,* spadix blackening (d), spathe blueing (d), loss of glossiness of spathe (d) and vase-life (d) were recorded in the pulsing experiment.

The treatment for pulsing solutions were as follows:

P_1 - Aluminium sulphate - 300 ppm

P_2 - Calcium hypochlorite - 500ppm
P_3 - Sodium hypochlorite - 500ppm
P_4 - Calcium hypochlorite - 1000ppm
P_5 - Sodium hypochlorite - 1000ppm
P_6 – Control

Holding solutions:

The spikes of Anthurium cv. TEMPTATION were harvested when 25-75 per cent flowers were open in the spadix and the freshly harvested stems were put into vase solutions mentioned below after recutting the basal portion of the stem (2 cm) under water and the vase life was evaluated at 23 ± 2^0C and 16 h illumination (1000 lux intensity provided by 40 W fluorescent tubes) under laboratory conditions. Observations were recorded on water uptake (ml), water loss (ml), increase in fresh weight (g), decrease in fresh weight (g), number of days taken for increase in fresh weight (d) and number of days taken for decrease in fresh weight (d) in the both the experiments. Besides, days taken for anther bursting, days taken for discolouration of spathe and phytotoxic symptoms were also observed in holding solution experiments. The data on various parameters were pooled and analysed (Panse and Sukhatme, 1989).

H_1 : NaOCl - 50 ppm
H_2 : $Al_2(SO_4)_3$. $16H_2O$ - 300 ppm
H_3 : Kinetin - 25 ppm
H_4 : $Al_2(SO_4)_3$. $16H_2O$ - 300 ppm + kinetin - 25 ppm
H_5 : NaOCl - 50 ppm + kinetin - 25 ppm
H_6 : Sucrose 5% + NaOCl-50 ppm
H_7 : Sucrose 5% + $Al_2(SO_4)_3$, $16H_2O$-300 ppm
H_8 : Sucrose 5% + kinetin-25 ppm
H_9 : Sucrose 5% + $Al_2(SO_4)_3$, $16H_2O$-300 ppm + kinetin -25 ppm
H_{10} : Sucrose 5% + NaOCl. $16H_2O$-50 ppm+ kinetin-25 ppm
H_{11} : Control (Double distilled water).

RESEARCH FINDINGS AND DISCUSSION

The experiment was carried out in *Anthurium andreanum* cv. TEMPTATION. The results on the effect of pretransit pulsing treatment in cut spike of anthurium are presented in Table 1a and b.

Effect of pulsing solution :

Significant effect of different pulsing solutions were observed on various aspects of post harvest life of cut anthruim flowers. All the pulsing treatments showed improved water uptake over the control .The cut flowers pulsed with the solutions of NaOCl 500 ppm solution for 1 min basal dip recorded the maximum amount of water uptake (25.00 ml) and water loss (28.00 ml).Whereas, flowers pulsed with distilled water showed the minimum amount of water uptake (12.00 ml) and water loss (14.00 ml). Pulsing treatment showed significant increase in the fresh weight of anthurium flowers. Among the different treatments, flowers treated with pulsing solution containing NaoCl took maximum time (4.00 d) to increase the fresh weight (10.08 g) On the other hand, flowers pulsed with distilled water showed the lowest increase in fresh weight (1.00 g) and it reached to that stage at the earliest (5.20 d).The lowest increase in fresh weight of flowers was noticed with distilled water (4.00 g). Flowers can be stored for a longer time at low temperature for use at a later date, using two methods *i.e.,* wet and dry cool storage. Dry cool storage permits a longer storage period for some flower species (Bhattacharjee, 1999). In dry storage, flowers are stored in partially permeable plastic bags to prevent the loss of moisture and to allow limited gaseous exchange during storage. Pulsing of flowers before storage helps to improve storage life of flowers (Arora and Singh, 2002).

Pulsing solution containing NaoCl at 500ppm (27 d), $Al_2(SO_4)_3$ 300ppm (22 d) and calcium hypochlorite at 500ppm (20 d) showed increased effects on post harvest life of flowers. The pulsing solutions were proved to be effective in increasing the post harvest life. However, flowers treated with distilled water showed minimum post harvest life of flowers (14 d). Pre-transit pulsing treatment with sodium hypochlororite at 500 ppm took long days to develop spadix blackening (20 d), spathe blueing (21 d) and loss of glossiness of spathe (19 d) and recorded an increased vase-

Table 1a : Effect of pulsing treatments on the water balance and biomass in Anthurium

Treatments	Water uptake (ml)	Water loss (ml)	Increase in fresh weight (g)	No of days for increased in fresh weight (d)	Decrease in fresh weight (g)	No of days for decreased in fresh weight (d)
P_1	23.00	20.00	3.06	8.00	5.03	7.00
P_2	19.00	19.00	2.00	6.60	6.67	6.00
P_3	25.00	28.00	5.00	10.08	6.00	8.00
P_4	20.00	22.00	3.00	6.60	6.00	4.45
P_5	18.00	16.00	1.08	7.52	5.25	4.25
P_6	12.00	14.00	1.00	5.20	4.00	3.00
S.E.±	1.25	5.20	3.20	6.22	8.98	1.38
C.D. (P = 0.05)	2.60	10.2	6.80	11.52	16.5	3.25

life period of 13 days over control.

Effect of holding solution:

The effect of holding solutions on the vase life of cut spikes was assessed on Anthurium cv. Temptation. The results are presented in the Table 2a and b. All the holding solutions performed better than the flowers kept in distilled water. The flowers treated with the holding solution containing sucrose 5 per cent+ $Al_2(SO_4)_3$ 300ppm + kinetin 25ppm showed the highest amount of water uptake (38.00 ml) and waterloss (42.00 ml). Significant differences had been observed between the effect of different holding solutions on the various aspects of post harvest life of cut anthurium spikes. Flowers kept in distilled water recorded the minimum amount of water uptake (10.0ml) and water loss (15.0 ml). Post harvest life or vase life of cut flower is the ultimate requirement of any flower production technology. Though the post harvest life of anthurium is genetically controlled and some times influenced by the size of flowers and harvesting stages, it can also be improved by the use of floral preservatives upto a certain limit. The most important plant physiological process related with the senescence of cut flowers is respiration. Vascular occlusion, may be due to microbial growth and gum deposition, decreases uptake of water and consequently reduces the vase life of cut flowers. Floral preservatives may work against these maladies and extend the vase life upto a certain extent. Different pulsing solution increased water uptake while water loss was found greater in case of pulsing solution.

Pulsing solutions significantly increased the fresh weight of cut flowers over control. Weight loss was also found higher with the pulsing solutions. but, the time requirement for the increase or decrease of fresh weight are responsible for enhanced vase life, was found more in case of pulsing solutions than the control .The post harvest life of cut flowers was found to be higher when pulsed with holding solutions than the distilled water pulsed flowers (15d). The holding solutions also increase the water uptake and water loss of the flowers considerably. Higher increase in fresh weight was recorded with most of the holding solutions. But all holding solutions showed lower reduced rate of fresh weight than control.

Table 1 b : Effect of pulsing treatments on vaselife of cut spikes of Anthurium cv. TEMPTATION

Treatments	Spadix blackening (d)	Spathe blueing (d)	Loss of glossiness of spathe (d)	Loss in weight (%)	Box temp ^0C	Phytotoxic symptoms	Vaselife (d)
$Al_2(SO_4)_316H_2O$ - 300 ppm	16.5	19.5	13.0	10.5	25.1	Discolouration of spathe and spadix	22.0
Calcium hypochlorite -500 ppm	17.5	18.5	16.0	10.5	25.6	Discolouration of spathe and spadix	20.0
Sodium hypochlorite -500 ppm	20.0	21.0	19.0	9.0	23.8	Discolouration of spathe and spadix	27.0
Calcium hypochlorite- 1000 ppm	15.0	17.5	15.0	10.3	25.3	Discolouration of spathe and spadix	17.0
Sodium hypochlorite - 1000 ppm	19.0	17.8	16.0	12.0	25.6	Discolouration of spathe and spadix	21.0
Control	13.0	14	10.0	15.5	25.9	Discolouration of spathe and spadix	14.0
S.E.±	0.62	0.70	0.62	0.78	0.68	-	0.85
C.D. (P = 0.05)	1.31	1.50	1.31	1.66	1.46	-	1.70

Table 2 a : Effect of different holding solutions on the water balance and biomass and post harvest vase life of cut Anthurium spikes cv.Temptation

Treatments	Water uptake (ml)	Water loss (ml)	Increase in fresh weight (g)	No of days for increase in fresh weight (d)	Decrease in fresh weight (g)	No of days for decrease in fresh weight (d)
H_1	19.00	16.00	1.21	9.00	3.71	5.00
H_2	21.00	18.00	1.02	8.00	2.80	7.67
H_3	22.00	20.00	1.16	11.00	4.50	6.50
H_4	24.00	22.00	1.50	11.50	4.80	6.00
H_5	22.00	24.00	1.00	8.00	4.90	8.00
H_6	26.00	23.00	1.66	10.20	4.75	8.83
H_7	28.00	30.00	2.18	12.20	5.15	8.85
H_8	30.00	38.00	2.80	12.00	3.60	8.50
H_9	38.00	42.00	4.08	16.00	6.04	11.00
H_{10}	32.00	40.00	3.00	10.00	4.50	10.00
H_{11}	10.00	15.00	1.35	7.04	2.60	5.00
S.E.±	2.25	11.1	1.9	0.86	0.79	2.32
C.D. (P = 0.05)	6.20	23.2	3.2	1.68	1.50	4.56

Table 2b : Effect of holding solutions on the keeping quality of cut - Anthurium

Treatments	Days taken for anther bursting	Days taken for discolouration of spathe	Total water obsorbed/ stem (ml)	Phytotoxic symptoms	Vaselife (d)
NaOCl - 50 ppm	12	22	12	Not appeared	24
$Al_2(SO_4)_3$. $16H_2O$ - 300 ppm	11	21	15	Not appeared	23
Kinetin - 25 ppm	13	24	14	Not appeared	24
$Al_2(SO_4)_3$. $16H_2O$ - 300 ppm + Kinetin - 25 ppm	14	25	18	Not appeared	26
NaOCl - 50 ppm + Kinetin - 25 ppm	15	26	25	Not appeared	27
Sucrose 5% + NaOCl – 50 ppm	15	23	24	Not appeared	24
Sucrose 5% + $Al_2(SO_4)_3$, $16H_2O$ – 300 ppm	16	26	22	Not appeared	27
Sucrose 5% + Kinetin – 25 ppm	17	26	25	Not appeared	27
Sucrose 5% + $Al_2(SO_4)_3$, $16H_2O$ – 300 ppm + Kinetin – 25 ppm		27	17	Not appeared	28
Sucrose 5% + NaOCl. $16H_2O$ – 50 ppm+ Kinetin – 25 ppm	18	29	20	Not appeared	30
NaOCl - 50 ppm	18	29	22	Not appeared	30
Control (Double distilled water)	10	14	17	-	15
S.E.±	0.80	0.83	1.48	-	0.99
C.D. (P = 0.05)	1.68	1.74	3.08	-	2.06

Number of days required for increase and decrease of the fresh weight were found higher with the holding solution. Similarly Shiva *et al. (*2002) opined that pulsing with sucrose prevents or reduces the proteolysis along with 8-HQS, there by it reduces the enzyme activity of cut roses and ultimately delays the onset of senescence in storage. Longevity of cut flowers is related to the maintenance of fresh weight (Coorts, 1973), good water uptake (Halvey and Mayak, 1979) and low transpiration loss, which can be obtained using certain preservatives. By adding sucrose and anti-ethylene agents to the holding solutions and curtailing the growth of microorganisms at the cut end of the stems could be an effective means to prolong vase-life (Marousky, 1968). In the later stages of life $Al_2(SO_4)_3$ pulsing with recorded maximum water uptake and minimum water loss thus maintaining highest fresh weight with positive water balance. $Al_2(SO_4)_3$ enhanced uptake by acting as an antimicrobial agent (Kiyoshi *et al.*, 1999) and by checking vascular occlusion induced either by bacteria or ethylene (Doorn *et al.*, 1986). The effect of chemical preservatives on water uptake was found to be significant. The maximum water uptake of 38 ml was recorded in sucrose 5 per cent + $Al_2(SO_4)_3$, $16H_2O$ – 300 ppm + kinetin – 25 ppm, which was found to be superior over the other treatmental combinations. The effect of $Al_2(SO_4)_3$ was mainly attributed to its action as bactericide that prevented the vessel blockage due to bacteria and helped to improve the uptake of water (Halvey and Kofranek, 1977). Sucrose 5 per cent + $Al_2(SO_4)_3$, $16H_2O$ – 300 ppm + kinetin – 25 ppm was found superior in recording highest vase life (30 d). Singh and Tiwari (2002) also reported a strikingly enhanced vase life and solution uptake, whereas minimum weight loss was noticed with $AgNo_3$ (300ppm) pulsing, which was due to the bactericidal properties of $AgNo_3$ (Mayak *et al.*, 1977). Treated flowers showed an increase in storage life, compared to control. Maintenance of turgidity in flowers is necessary to increase their storage life and retentive capacity of absorbed water in the flower determines the level of turgidity (Bhattacharjee, 1999).

The present study revealed that, pre-transit pulsing treatment with sodium hypochlororite 500 ppm took delayed spadix blackening (20d), spathe blueing (21d) and loss of glossiness (19d) and recorded an increased vaselife period of 16 days over control. Cut spikes of Anthurium cv. TEMPTATION placed in holding solutions of sucrose 5 per cent + NaOCl.$16H_2O$ – 50 ppm + kinetin – 25 ppm took maximum days for anther bursting (18d), discolouration of the spathe (29d) and vaselife period (30d) could be recommended for cut flower industries.

REFERENCES

Arora, J.S. and Singh, K. (2002). Pre and post harvest management of cut flowers. *Indian Hort.,* : 20-23.

Bhattacharjee, S.K.(1999). Post harvest management of cut flowers, cut foliage and post production management of potted plants. *J. Orna. Hort. New Series,* **2** (1) :32-39.

Coorts, G.D. (1973). Internal metabolic changes in cut flowers. *Hort. Sci.,* **8** : 195-198.

Doorn, V.W.G., De-Witte, Y. and Waltmann, B.C.H. (1986). Effect of exogenous bacterial concentrations on water relations of cut flowers. II. Bacteria in the vase solution. *Acta Hort.,* **181** : 463-465.

Halvey, A.H. and Kofranek, A.M. (1977). Silver treatment of carnation flowers for reducing ethylene damage and extending longevity. *J. Amer. Soc. Hort. Sci*., **102** : 76-77.

Halvey, A.H. and Mayak, S. (1979). Senescence and post harvest physiology of cut flowers.Part I. In: J. Janick (ed.), *Hort. Rev.,* **1** : 204-236.

Kiyoshi, Okhawa, Youichi Kasahara and Suh, Jung-Nam (1999). Mobility and effect on vase life of silver containing compounds in rose flowers. *Hort Sci.,* **34** (1) : 112-113.

Marousky, F.J. (1968). Influnece of 8-HQC and sucrose on vaselife and quality of cut gladiolus. *Proc. Florida State Hort. Soc.,* **81** : 415-419.

Mayak, S., Garibaldi, A.E. and Kofranek, A.M. (1977). Carnation flower longevity: Microbial populations as related to silver nitrate stem impregnation. *J. Amer. Soc. Hort. Sci*., **102** : 637-639.

Nowak, J. and Rudrick, R.M. (1990). *Post harvest handling and storage of cut flowers, Florist Greens and potted plants*. Champan and Hall, London, United Kingdom. 209 pp.

Salvi, B.R., Valsalakumari, P.K., Rajeevan, P.K. and Geetha, C.K. (1997). Effect of holding solutions on cut anthurium flower. *Hort. J.,* **10**(2):65-72.

Shiva, K.N., Chatterjee, S.R. and Bhattacharjee, S.K. (2002). Changes in protease activity of cut roses as affected by pulsing and cold storage. *Indian J. Hort.,* **59**(2) : 196-200.

Singh, K.J., Arora, S. and Bhattacharjee, S.K. (2002). Post harvest management of cut flowers.Technical Bulletin No.10, All India Coordinated Research Project on Floriculturre, IARI, New Delhi, 39 pp.

Singh, P. and Singh, K. (2002). Effect of post harvest treatments on vase life of *Asparagus* species. *J. Plant Biol.,* **29** : 83-84

Singh, A.K and Tiwari, A.K. (2002). Effect of pulsing on post harvest life of rose cv. DORIS TYSTERMANN. *South Indian J. Hort.,* **50** (1-3): 140-144.