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VASE LIFE AND KEEPING QUALITY OF DENDROBIUM ORCHID (*Dendrobium* sp.) ON PRESERVATIVE SOLUTIONS

P. KHAN[1], H. MEHRAJ[2], T. TAUFIQUE[3], N. AHSAN[3] AND A.F.M. JAMAL UDDIN[3]*

[1]Kodaikanal International School, Kodaikanal 624 101, Tamil Nadu, India; [2]The United Graduate School of Agricultural Sciences, Ehime University, Ehime 790-8556, Japan; [3]Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

*Corresponding author & address: AFM Jamal Uddin, E-mail: jamal4@yahoo.com
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ABSTRACT

Khan P, Mehraj H, Taufique T, Ahsan N, Jamal Uddin AFM (2015) Vase life and keeping quality of Dendrobium orchid (*Dendrobium* sp.) on preservative solutions. *Int. J. Expt. Agric.* 5(3), 22-27.

The experiment was conducted in order to improve the vase life of Dendrobium orchid (Cultivar: Sonia 17) by using some chemical preservative solutions *viz.* T_0: Tap water (Control); T_1: Sugar (50-ppm); T_2: Citric Acid (50-ppm); T_3: Salicylic Acid (50-ppm); T_4: Chitosan (50-ppm); T_5: Silvar Thiosulphate (50-ppm); T_6: Sugar + Citric Acid (50-ppm); T_7: Sugar + Salicylic Acid (50-ppm); T_8: Sugar + Chitosan (50-ppm) and T_9: Sugar + Silvar Thiosulphate (50-ppm) were used as vase solution. Results demonstrated that maximum floret opening (78.3%), first floret wilting (8.3 days), first petal dropping (10.1 days), solution uptake (52.3 ml), petal water content (52.9%) and vase life (29.3 days) were found from treatment T_9 which was followed by T_7. It was observed that 50-ppm of Sugar and Silvar Thiosulphate mixture has a great potentiality to prolonging the vase life and increasing the keeping quality of dendrobium Sonia 17.

Key words: *Sonia 17, chemical preservatives, vase life and keeping quality*

INTRODUCTION

Dendrobium belonging to Orchidaceae family, is the second largest genus in this family (Puchooa 2004) having unique characteristics among the cut orchids like varieties of color, larger number of florets in the inflorescence and recurrent flowering (Mehraj *et al.* 2014; Fadelah *et al.* 2001). Among the all orchids Dendrobium is very common in Bangladesh. Flowers of most *Dendrobium* cultivars last for several weeks if they remain attached to the mother plant, and are not pollinated. In contrast, floral life after harvest is short, depending on conditions during holding (Nair 1984). A small rise in ambient ethylene levels results in early senescence and abscission of both floral buds and open flowers although *Dendrobium* flowers produce only little ethylene (Ketsa and Thampitakorn, 1995; Reid and Wu, 1992). Another greatest problem in postharvest flower physiology is the blockage of the vascular system due to air or bacterial and micro-organism growth. This results in reduced water uptake, and combined with the blockages in the xylem vessels, results in water stress (Van Meetern *et al*. 2001). This has been observed as early wilting flowers (Henriette and Clerkx, 2001). All holding solutions must contain two components; sugar and germicides. Various preservative chemicals like citric acid, salicylic acid, silvar thiosulphate, HQS (8-hydroxyquinoline sulphate) acted as germicides also as the ethylene production inhibitor (Shirin and Mohsen, 2011; Prashanth *et al.* 2010; Ezhilmathi *et al.* 2007; Ketsa *et al*. 1995; Leslie and Romani, 1988; Reid *et al*. 1980) and increases water uptake by reducing physiological stem blockage in sterile tissues (Reddy *et al*. 1996). Sucrose is the most commonly used sugar or chitosan for prolonging the vase life of cut flowers. The exogenous supply of sucrose provides the cut flowers with much needed substrates for respiration. Slightly acidic sucrose solution plays an important role to extend the vase life providing the food for cut flowers and by stopping the growing of microorganisms on solution (Mehraj *et al.* 2013a; Mehraj *et al.* 2013b; Mehraj *et al.* 2013c). In order to reduce postharvest problems, we investigated the effects of some chemicals preservative solutions for vase life and keeping quality of dendrobium.

MATERIALS AND METHODS

Experiment was conducted at 2abiotech laboratory, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh from October 2012 to March 2013 to find out the appropriate chemical preservative solution for extending the vase life of Dendrobium. Equally maintained Dendrobium orchid (Cultivar: Sonia 17) were collected from rooftop garden, Sher-e-Bangla Agricultural University. Ten chemical preservative solutions were used for vase life analysis and these were T_0: Tap water (Control); T_1: Sugar (50-ppm); T_2: Citric Acid (50-ppm); T_3: Salicylic Acid (50-ppm); T_4: Chitosan (50-ppm); T_5: Silvar Thiosulphate (50-ppm); T_6: Sugar + Citric Acid (50-ppm); T_7: Sugar + Salicylic Acid (50-ppm); T_8: Sugar + Chitosan (50-ppm) and T_9: Sugar + Silvar Thiosulphate (50-ppm) using Completely Randomized Design (CRD) with three replications. Data were collected on floret opening, floret wilting, days to floret wilting, days to first petal dropping, solution uptake, petal water content, vase life and fungal infection. Solution uptake was measured by subtracting the solution at the last days in flower vase from the initial solution of the flower vase. Petals water content (% WP) was determined with the below equation (Kalate Jari *et al.* 2008):

$$\%WP = \{(FW\text{-}DW) \div DW\} \times 100$$

Collected data were analyzed statistically using MSTAT-C computer package program and significance of the difference among the treatment means was estimated by the Least Significant Difference (LSD) test at 5% level of significance (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

***Floret opening**:* Floret opening of Dendrobium orchid (Cultivar: Sonia 17) showed significant variation among different vase solutions at different days after treating. Maximum floret opening was found from T_9 (78.3%) followed by T_7 (71.7%) whereas minimum from T_0 (26.7%) at 13th days after placement in the vase solution (Fig. 1a).

***Floret wilting**:* Floret wilting varied significantly due to the variation of vase solution. However, minimum floret wilting was found from T_9 (10.0%) followed T_6 and T_7 (15.0%) while maximum from T_0 (75.0%) at 13th days after placement in the vase solution (Fig. 1b). Floret wilting is mainly plant food depletion and inability to draw up water which leads to subsequent color change and flaccidity of cell (Ichimura *et al.* 2002) caused flower wilting. Effective bactericide in pulsing solution may improve floret wilting by eliminating bacterial accumulation along vascular bundle blocking the water path way to the petal. Silver reduces ethylene-binding capacity and suppresses endogenous ethylene production (Van Doorn and Wolthering, 1991) thereby delaying appearance of characteristics such as wilting, petal in-rolling and abscission of flowers and buds (Nichols 1966).

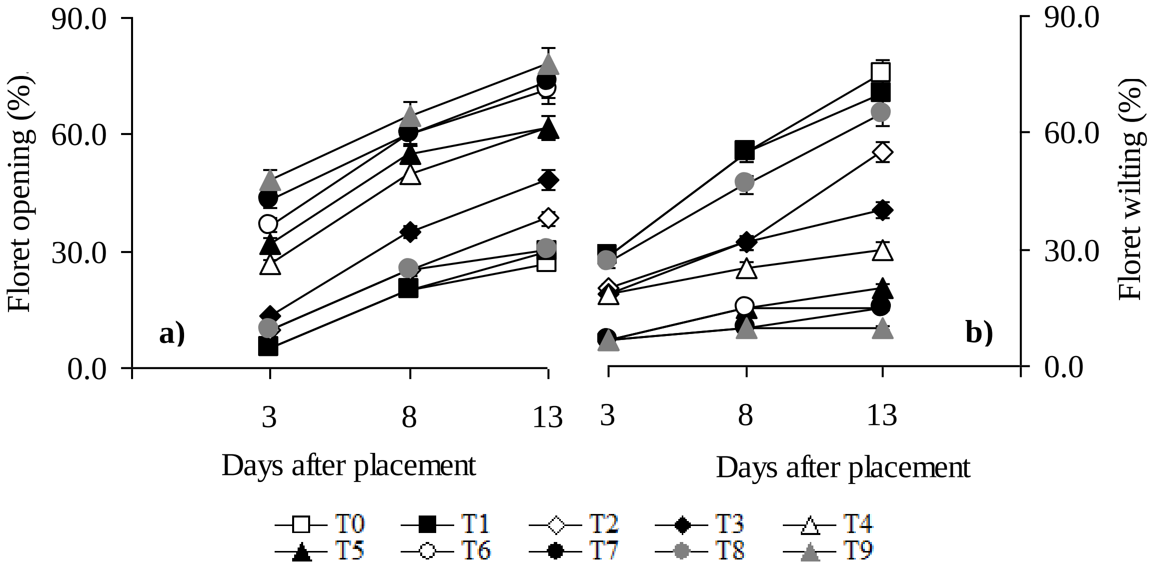

Fig. 1. Response of Dendrobium Sonia 17 to different vase solution on a) floret opening and b) floret wilting

Note: The difference among each treatment mean was presented with error bars at 5% level of significance. Here, no overlapping among the treatments error bars denoted that these were really had different effects (on average) while overlapping denoted that had not have different effects (on average).

***Days to first floret wilting**:* Days to first floret wilting was varied significantly among the vase solution. Late floret wilting was found from T_9 (8.3 days) followed by T_7 (7.3 days) while early floret wilting was found from T_0 (3.3 days) (Table 1). Time to wilting of Dendrobium orchids flowers was probably regulated by ethylene that can be drastically reduced by the application of sugar (Ketsa *et al.* 2001). Deterioration and discoloration are due to an increase of vacuole's pH or enzyme effects on senescing flowers (Almasi *et al*. 2012; Aran *et al.* 2011).

Days to first petal dropping: Days to first petal dropping varied significantly among the vase solutions. Late petal dropping was found in T_9 (10.1 days) followed by T_7 (9.1 days) whereas early from T_0 and T_1 (3.1 days) (Table 1). Yellowing, drooping and venation of florets in Dendrobium orchids are major signs of senescence (Almasi *et al*. 2012). Senescence is possible to delay by Silvar Thiosulphate in cut sweet pea, carnations and Delphinium (Ichimura *et al.* 2002).

Solution uptake: Solution uptake by flower varied significantly among the vase solutions. Maximum vase solution was up taken by T_9 (52.3 ml) followed by T_7 (45.3 ml) whereas minimum from T_1 (24.3 ml) (Table 1). Adding a suitable germicide in vase water can prevent the growth of microbes and increased water uptake (Anjum *et al*. 2001). Silver thiosulphate or salicylic acid with sucrose increased water uptake (Hajireza *et al.* 2013; Shirin and Mohsen, 2011). In this experiment, Silvar Thiosulphate, Salicylic Acid and Citric Acid were seemed to act by germicide the decrease of microbial population and increased the solution uptake but Silvar Thiosulphate was found as the best for solution uptake.

Petal water content: Petal water content of Dendrobium orchid (Cultivar: Sonia 17) varied significantly among the vase solutions. Maximum petal water content was found from T_9 (52.9%) which was statistically identical with T_6 (51.9%) and T_7 (52.2%) whereas minimum from T_1 (40.2%) which was statistically identical with T_0

(40.7%) (Table 1). Salicylic Acid treatments increased petal water content (%) by 73% compared to the controls in chrysanthemum (Vahdati Mashhadian *et al.* 2012). Post-harvest application of Salicylic Acid (150 mg/L) maintain higher antioxidant enzyme, stability of membrane and leading to delay in petal senescence (Hatamzadeh *et al.* 2012).

Vase life: Vase life of Dendrobium orchid (Cultivar: Sonia 17) varied significantly among the vase solutions. Maximum vase life was found from T_9 (29.3 days) followed by T_7 (26.0 days) while minimum from T_0, T_2 and T_3 (15.3 days) (Table 1). Treatment with Silvar Thiosulphate extended vase life of Dendrobium (orchid) inflorescences (Uthaichay *et al.* 2007). It was found that Silvar Thiosulphate (ethylene production inhibitor) mixed with sucrose improved the vase life of dendrobium orchid. Similar result was found in gladiolus (Beura *et al.* 2001), gentian flowers (Zemin *et al.* 2001), snap-dragon (Mor *et al.* 1984; Ishihara *et al.* 1991; Sexton *et al.* 1995) and cut carnation (Burzo and Dobrescu, 1995) and they suggest that sucrose and Silvar Thiosulphate act similarly at least on soluble sugar changes and ethylene production that are associated with inhibiting flower senescence. Pulsing with sucrose resulted in increased glucose and fructose concentration and improved the maintenance of high starch concentration in floret during flower opening. Silvar Thiosulphate may improve sucrose uptake and its subsequent hydrolysis (Meir *et al.* 1995). Combined treatment of Silvar Thiosulphate/Salicylic Acid/Citric Acid with sucrose may be preferable for improving the vase life of cut flowers (Khan *et al.* 2015a; Khan *et al.* 2015b; Asrar 2012). Beneficial effect of Silvar Thiosulphate was in the vase-water to the production of Ag^+ ions, which might inhibit the rise of ethylene precursor, thereby enhancing the longevity of cut flowers (Knee 1992; Awad *et al.* 1986). Results of present study showed that adding Salicylic Acid in holding solution had positive effect on keeping quality and vase life of Dendrobium flowers. Salicylic Acid required for basal resistance against pathogens as well as for the inducible defense mechanism which confers resistance against a broad-spectrum of pathogens (Chaturvedi and Shah, 2007). Also, Salicylic Acid inhibited the ethylene biosynthesis and delayed senescence progress in plant tissues (Leslie and Romani, 1986). Sucrose or its combinations with biocides or antioxidants, improved postharvest performance in *Tuberose*, *Phalaenopsis*, *Leptospermum*, *Amaryllis nerine*, *Lathyrus*, *Antirrhinum* (Huang *et al*. 1995; Burge *et al*. 1996; Gul *et al*. 2007; Gul and Tahir, 2009; Elhindi 2012; Asrar 2012).

Fungal infection: From the experiment T_0, T_1, T_4 and T_8 solutions were infected by fungus and rest of the solutions were not to be found by fungal infection (Table 1). Pathogens also affect vase life due to vascular blockage (Van Doorn *et al.* 1994). Citric Acid and Salicylic Acid is an acidifier and acidic solution; inhibits bacteria growth and proliferation (Raskin 1992); inhibits the growth of microorganisms (Dole *et al.* 1999) while these can alleviate water uptake and extend vase life due to its antiembolism trait (Bhattacharjee *et al*. 1993). Silvar Thiosulphate reduced the severity of gray mold on rose and carnation by inhibiting the ethylene action (Elad 1988). This inhibition reduced the senescence of the flowers, and consequently, the advance in pathogen colonization. Silvar Thiosulphate decreased the bacterial population in cut flowers (Torre and Fjeld, 2001).

Table 1. Response of Dendrobium Sonia-17 flower to different vase solution on different attributes[X]

Treatmetns[Y]	Days to first floret wilting	Days to first petal dropping	Solution uptake (ml)	Petal water content (%)	Vase life (days)	Fungal infection
T_0	3.3 f	3.1 g	29.3 h	40.7 e	15.3 f	+
T_1	3.3 f	3.1 g	24.3 j	40.2 e	17.3 e	+
T_2	4.3 e	4.1 f	32.3 g	46.4 d	15.3 f	-
T_3	4.3 e	4.1 f	33.3 f	47.1 d	15.3 f	-
T_4	4.3 e	5.1 e	35.3 e	49.1 c	23.0 d	+
T_5	5.3 d	6.1 d	39.3 d	51.2 b	25.0 c	-
T_6	6.3 c	8.1 c	43.3 c	51.9 ab	25.0 c	-
T_7	7.3 b	9.1 b	45.3 b	52.2 ab	26.0 b	-
T_8	3.3 f	3.1 g	26.3 i	39.4 e	16.7 e	+
T_9	8.3 a	10.1 a	52.3 a	52.9 a	29.3 a	-
LSD0.05	0.9	0.6	0.4	1.4	0.7	
CV%	2.7	3.2	6.8	1.8	1.9	

[X]In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability
[Y]Different vase solutions

CONCLUSION

From the current study it was found that Sugar + Silvar Thiosulphate (50-ppm) was the best chemical treatments for orchid Dendrobium Sonia-17 which was statistically identical with Sugar + Salicylic Acid (50-ppm). Both can be used to increase the vase life of Dendrobium Sonia-17 for commercial purpose.

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