AN APPROPRIATE PRESERVATIVE SOLUTION FOR VASE-LIFE OF '*Mokara* Madame Panne' CUT ORCHID

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ABSTRACT

Five preservative solutions were tested to identify an appropriate preservative solution for extending the vase-life and improving the flower-bud opening of Mokara Madame Panne cut orchid grown in Chiang Mai province, Thailand. The experiments were conducted at the Department of Horticulture, Maejo University during 2007-2008. The inflorescences of Mokara Madame Panne orchid bearing 7-8 (nearly 50%) opened florets were used for this experiment. The preservative solutions containing 150 ppm 8-hydroxyquinoline sulfate (8-HQS) + 2% sucrose, 50 ppm aluminum sulfate [$Al_2(SO_4)_3$] + 2% sucrose, 150 ppm 8-HQS + 50 ppm $Al_2(SO_4)_3$, 150 ppm 8-HQS + 50 ppm $Al_2(SO_4)_3$ + 2% sucrose, and only reverse osmosis (RO) water were evaluated to find-out the changes in water relation, total sugar content in florets and flower-stems and flower-bud opening. In addition, the change in floret color was also determined. Results revealed that the preservative solution containing 150 ppm 8-HQS + 50 ppm $Al_2(SO_4)_3$ can extend the vase-life of Mokara Madame Panne cut orchid significantly for 26 days as compared to the control treatment for 19 days. The other preservative solutions, 150 ppm 8-HQS + 50 ppm $Al_2(SO_4)_3$ + 2% sucrose, 150 ppm 8-HQS + 2% sucrose and 50 ppm $Al_2(SO_4)_3$ + 2% sucrose provided the vase-life for 22.5, 19 and 18 days, respectively. However, no significant difference could be detected in flower-bud opening among the treatments applied.

Keywords: *Mokara* orchid, Preservative solutions, Flower-bud opening, Vase-life

INTRODUCTION

Mokara is one of the orchid genera, considered very successful for cut flower production. It is a man-made multigeneric hybrid which was developed in Singapore by crossing *Arachnis*, *Ascocentrum* and *Vanda* genera of orchid (Yew-Hwa, 1995; Yam and Thame, 1999). Since it has monopodial growth habit, it can be planted in high density; at least 60,000 plants per hectare. Its commercial cultivars can produce 15 salable inflorescences per plant annually and it is also one of the exported cut flowers from Singapore (Yam and Thame, 1999).

Cultivar *Mokara* Madame Panne which contains peculiar red spotted yellowish florets is very popular in Thailand. Its major flowering period is May to October. In general, its inflorescences are harvested at half or more blooming stages according to market demand (personal communication with growers).

Besides temperature and humidity management suitable preservatives should also be applied throughout the handling chain in the holding solution by which the vase-life and bud-opening of cut flowers can be extended. Most preservatives used in holding solutions are- sugars (sucrose, glucose), citric acid, germicides (8-hydroxyquinoline sulfate/8-HQS, aluminum sulfate/$Al_2(SO_4)_3$) and ethylene inhibitors (amiooxyacetic acid/AOA, silver thiosulfate/STS, 1-methylcyclopropene/1-MCP).

The preservative solution containing 2 % sucrose and 200 ppm 8-HQS significantly extended the vase-life (9.5 days) of cut 'Sonia' rose flowers (Ichimura et al., 2003). The holding solution with 225 mg l^{-1} 8-HQS + 50 mg l^{-1} $Al_2(SO_4)_3$ + 4 % glucose increased vase-life (23-34 days) and bud-opening (98-100 %) significantly in different varieties of *Dendrobium* orchid. (Ketsa and Kosonmethakul, 2001). It indicated the potentiality for further improving in vase-life and flower-bud/bud-opening of *Mokara* Madame Panne cut orchid, although its average vase-life is considered to be already higher, 14 days (Yam and Thame, 1999).

On the basis of these reviews and preliminary experiment, it was decided to test only sucrose, 8-HQS and $Al_2(SO_4)_3$ in this study. Thus, the experiments were carried out to find-out an appropriate preservative solution for maximizing the vase-life and bud-opening of *Mokara* Madame Panne cut orchid.

MATERIALS AND METHODS

The following five different combinations of preservative solutions were applied as treatments based on the literatures review and the result of previous experiment:

T_1 = 150 ppm 8-HQS + 2% sucrose = HQS+Sugar
T_2 = 50 ppm $Al_2(SO_4)_3$ + 2% sucrose = AS+Sugar
T_3 = 150 ppm 8-HQS+ 50 ppm $Al_2(SO_4)_3$ = HQS+AS
T_4 = 150 ppm 8-HQS + 50 ppm $Al_2(SO_4)_3$ + 2% sucrose = (HQS+AS+Sugar)
T_5 = RO (reverse osmosis) water without any preservative = control

According to need, preservative solutions were prepared by using RO water one day before the experiment. Based on the result of the previous experiment, only the inflorescences of *Mokara* Madame Panne having 7-8 opened florets were used. The required inflorescences / cut flowers were purchased from Maejo Orchid Farm, Maejo, Chiang Mai. For uniformity, the basal parts of flower-stems were cut at 13 cm from the lowermost opened floret. Then, individual inflorescences were held in glass bottles containing 250 ml preservative solutions and 1 ml paraffin oil to reduce the evaporation loss of solutions.

The experiment was laid in completely randomized design (CRD) with 5 treatments and 10 replications (one inflorescence for each replication). Data on solution uptake and solution loss, total sugar content in florets and flower-stems, flower-bud opening, and wilting as well as abscission of florets and flower-buds were collected. The vase-life of each individual inflorescence was considered terminated when symptoms of wilting and abscission were noticed in 50 % opened florets or flower-buds or in both. The analysis of variance (ANOVA) was applied for analysing the data and mean comparisons were assessed by Duncan's Multiple Range Test (DMRT). During the experiment, there were 28°C (± 2°C) mean temperature, 66 % (± 4%) relative humidity and the condition of natural light (12 hr day).

RESULTS & DISCUSSION

Solution uptake

Inflorescences of Mokara Madame Panne held in all 5 preservative solutions showed very high amount of solution uptake (3.6 - 6.4 ml/inflorescence/day) on day-1 compared to the other days (Figure 1A). On days 4, 6 and 8, the preservative solution containing HQS+AS supported significantly higher amount of solution uptake than the control. In the most of the remaining days, inflorescences held in HQS+AS had also high amount of solution uptake, though not significantly different from the control (Figure 1A).

The combination of HQS+AS (initial pH 4.1) significantly improved the solution uptake in the inflorescences of Mokara Madame Pane during initial period of holding. It might be due to acidifying the solution as reported in cut tuberose (Halevy and Mayak, 1981 cited by Bhaskar et al., 1999).

The amount of solution loss in the inflorescences of Mokara Madame Panne held in HQS+AS had significantly higher than those of the control on days 6, 8, 12, 16 and 18 (Figure 1B). Since water loss by normal transpiration is also essential for continuous water uptake and for extending the vase-life of cut flowers (Bhaskar et al., 1999), preservative solution containing HQS+AS was found useful for maintaining water uptake and for extending the vase-life of Mokara Madame Pane cut orchid in this experiment.

Same as the solution uptake, the maximum solution balance (3.9-4.3 g/inflo./day) was occurred in the all inflorescences on day-1 except in the inflorescences held in AS+Sugar. However, the solution balance among the treatments was not significantly different during the most of the holding period (Figure 1C).

Additionally, there was unique drooping symptoms different from normal wilting of florets in the inflorescences held in sugar (2 %). It indicated that 2 % sucrose in holding solution was high for Mokara Madame Panne cut orchid which might not support for sufficient solution uptake (due to negative solute

potential in holding solution) and drooping florets were observed. In fact, there was lower solution uptake in the inflorescences held in sugar containing preservative solutions (combined with single germicide) than in those inflorescences held in RO water (control) in most of the days of holding after one week of harvest (Figure 1 A).

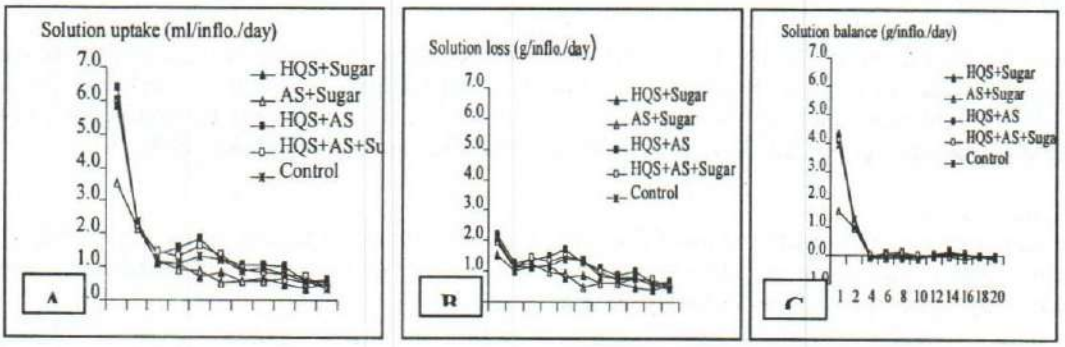

Figure-1 Solution uptake (A), solution loss (B) and solution balance (C) in the inflorescences of *Mokara* Madame Panne orchid held in different preservative solutions

Total sugar content

Initially, the total sugar content increases both in the florets and flower-stems of Mokara Madame Panne cut orchid held in the preservative solutions contained sucrose after harvest (Figure 2 A, B). From day 6, when the total sugar content decreased in florets, the content increased in flower-stems and vise versa in the treatments containing sucrose (Figure 2 A, B). On the other hand, the treatments without sucrose showed gradual decrease of the total sugar content both in florets and flower-stems over the study period (Figure 2 A, B).

The total sugar content in florets and flower-stems of Mokara Madame Panne cut orchid was higher when held in the preservative solutions containing sugar than those held in control or non-sugar containing solution. It was the similar result as reported in cut 'Sonia' rose flowers (Ichimura et al., 2003).

The preservative solution with sucrose could not extend bud-opening and vase-life of Mokara Madame Panne cut orchid compared to the control in this experiment. It suggested that the available content of total sugar within florets and flower-stems of Mokara Madame Panne cut orchid might be sufficient to maintain the physiological changes after harvest as in cut Narcissus tazetta var. chinensis (Ichimora and Goto, 2002).

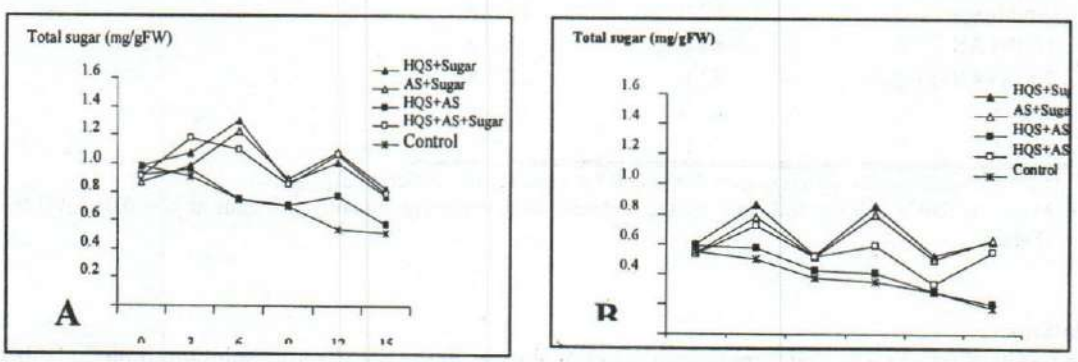

Figure 2 Total sugar content in florets (A) and flower-stems (B) of *Mokara* Madame Panne cut orchid held in indifferent preservative solutions.

Change in florets' color

No significant change of color was detected from the florets (petals + sepals) of Mokara Madame Panne cut orchid held in either sucrose containing solutions or not (Data not shown). It means exogenous sucrose and the other preservatives, 8-HQS and $Al_2(SO4)_3$ had no effect on the floret color of Mokara Madame Panne cut orchid after harvest.

The preservative solutions containing 8-HQS showed little blackening on the lower most parts of flower-stems after two weeks of holding. It indicated the toxic nature of 8-HQS. This might be one reason that all effective holding solutions applying for wet-pack of orchid cut flowers are made in the combination of 8-HQS, $AgNO_3$ and sugars (Ketsa and Boonrote, 1990 cited by Ketsa and Kosonmethakul, 2001).

Flower-bud opening

Applied preservative solutions exerted effects on the vase-life of Mokara Madame Panne cut orchid. The preservative solution containing HQS+AS could extend the vase-life up to 26 days that was 7 days longer and significantly higher than that of the control, 19 days (Table 1).

There was no significant difference in the bud-opening of Mokara Madame Panne cut orchid among the preservative solutions including control (Table 1). It indicated ineffectiveness of different preservatives applied here to improve the bud-opening of Mokara Madame Panne cut orchid. In contrast, preservative solution containing HQS+AS+glucose greatly increased the bud-opening of Dendrobium orchid (Ketsa and Kosonmethakul, 2001). It could be due to the different genetic make up of the two different orchid flowers.

The preservative solution containing HQS+AS prolonged the maximum vase life up to 26 days for Mokara Madame Panne cut orchid. It happened possibly because of the acidification of the preservative solution (initial pH 4.1) by the inclusion of $Al_2(SO4)_3$, same as in cut tuberose (Bhaskar et al., 1999). It also might be due to suppression of micro-organisms by the synergetic effect of these two preservatives as reported in Dendrobium orchid (Ketsa and Kosonmethakul, 2001). The combination of these preservatives enhanced the solution uptake in the inflorescences of Mokara Madame Panne orchid.

Table 1. Bud-opening and vase-life of *Mokara* Madame Panne cut orchid held in different **Preservative**

Treatments	Bud-opening (on day-18)	Vase-life
	(%)	(days)
HQS+Sugar	81.4	18.7 b
AS+Sugar	80.0	18.3 b
HQS+AS	84.3	25.7 a
HQS+AS+Sugar	82.8	22.5 ab
Control	83.6	19.3 b
F-test	NS	*

NS = not significantly different ($p > 0.05$) and * = significantly different at $p \leq 0.05$
Means within a column followed by the different letter were significantly different at $p = 0.05$ level by DMRT.

solutions

The results showed no further benefit from additional sugar in the preservative solution. It might be because of the sufficient availability of sugars in Mokara Madame Panne cut orchid to maintain their vase-life and other postharvest qualities as mentioned in other cut flowers. Sucrose pulsing (with 5 and 10% for 20 hr) could not extend the vase-life of cut Narcissus tazetta var. chinensis (Ichimora and Goto, 2002) and 2-3 % sucrose also did not provide any useful effects in cut tuberose (Jowkar and Saheli, 2005), probably due to high levels of sugars already presence in various floral organs and increase in microbes in holding solution, respectively.

CONCLUSION

The preservative solution containing 150 ppm 8-HQS + 50 ppm $Al_2 (SO4)_3$ provided the longest vase-life of 26 days for Mokara Madame Panne cut orchid. The combination of two preservatives, 8-HQS and $Al_2 (SO4)_3$ extended additional 7 days vase-life as compared to the control. It suggested that there no need to include sucrose or glucose in holding solution at least for this cultivar of Mokara orchid.

ACKNOWLEDGEMENT

The authors would like to offer his sincere gratitude to 'Thailand International Development Cooperation Agency (TICA), Thai government for providing financial support to accomplish this piece of research work.

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