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Investigation of Low Cost Materials to Improve Shelf Life of Cut Orchids

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ABSTRACT. Distilled water (control), Benzyl Amino Purine (BAP), Silver Nitrate ($AgNO_3$), Silver Thio Sulphate (STS), Glycerine, Potassium Permanganate ($KMnO_4$) and hot water treatments were used as preservatives to observe the shelf life of cut orchids. Flowers were first inserted into fresh water and then transferred to the preservative solutions in specific time. After that flowers were continuously dipped in distilled water and the water was changed during a period of 2 days interval. Quality of flowers were assessed by evaluating the colour, wilting, freshness and abscission of flowers.

Of the preservative techniques 5 mg l^{-1} BAP is the best method to extend the shelf life of cut orchids. It showed highest performances, having average of 28 days of shelf life. Potassium Permanganate could prolong the longevity of cut orchids up to 20 days. As BAP is more expensive when compared to $KMnO_4$, 2 mg l^{-1} $KMnO_4$ can be recommended as preservative chemical in extending the shelf life of cut orchids.

INTRODUCTION

Flowers symbolize beauty, love and tranquillity. People in Sri Lanka have been associated with flowers since ancient times because they are sanctified and are commonly used for worshipping in Buddhist and Hindu temples. Orchidaceae, one of the largest and most diverse family of flowering plants, consists of over 20,000 species.

Only a small group of people in Sri Lanka was engaged in growing orchids and these few enthusiasts regarded orchid growing as a hobby rather than an industry. To the credit of them and breeders, Sri Lanka produced some outstanding hybrids particularly of Vanda Dendrobiums and other Vandaceous orchids but they directed their efforts largely to the production of unusual or exhibition type of flowers.

Exotic tropical flowers have a very good demand in the world market as they are decorative, colourful and could produce all around the year. In the case of tropical orchids, handling make them more suitable for dispatch by air to markets far away from the producing countries. The present study was conducted to find out locally available low cost preservative solutions to extend the shelf life of cut flower orchids.

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MATERIALS AND METHODS

Dendrobium intermediate (Phalanopsis X cane) a white flowered orchid variety grown in the nurseries of Supreme Foliage Company, Kaduwela, Hibutana was collected for this study. They were harvested in the afternoon and transported to the Crop Science Department Laboratory, Faculty of Agriculture, within 3 hours. The experiment was carried out for a period of 30 days.

During the experiment period the temperature of the laboratory was about 28°C and the relative humidity was about 90–95%. Immediately after the flowers were harvested, they were dipped in water, stem was re-cut under water and dipped in the specific chemical solutions (Table 1). They were then kept in individual glass bottles with 200 ml distilled water according to the treatments. Distilled water was changed at 2 day intervals. Observations were taken on sepal colour, appearance at wilting signs on sepal, freshness at sepals and flower abscission. Grades were given depending on observations.

Table 1. Chemical used and duration of dipping in the twelve treatments.

Treatment	Chemical Compound	Dipping time
T1 - distilled water	Control	-
T2 - 5 ppm	BAP	10 minutes
T3 - 10 ppm	BAP	10 minutes
T4 - 15 ppm	BAP	10 minutes
T5 - 1000 ppm	Silver Nitrate ($AgNO_3$)	10 minutes
T6 - Na_2SO_3 0.79 g $AgNO_3$ 0.46 g 500 ml solution	Silver Thio-Sulphate (STS)	20 minutes
T7 - 25%	Glycerine	dipped continuously
T8 - 50%	Glycerine	dipped continuously
T9 - 75%	Glycerine	dipped continuously
T10 - 100%	Glycerine	dipped continuously
T11 - 2 ppm	$KMnO_4$	dipped continuously
T12 - 80°C water	Hot water	Covered from paper bag and cut surface of the stem dipped in the hot water solution for few minutes

Visual quality

Visual quality was assessed using an objective method, based on visual characters of the flowers, described as follows. According to visual qualities, the best orchid branch gets the maximum 13 marks.

Characteristics	Marks
Colours of the sepals	
Colourful sepals, no fading	3
Slightly fading	2
Moderate fading	1
Severe fading	0
Wilting of sepals in orchid	
No wilting, fresh appearance	3
Slightly wilting/wrinkling	2
Moderately wilting/wrinkling	1
Severe wilting/wrinkling	0
Scale for sepal freshness	
Highly fresh	3
Slight loss of freshness	2
Moderate loss of freshness	1
Severe loss of freshness	0
Petiole conditions	
Good stability and strength of petiole	4
Slightly bending	3
Moderately bending	2
Severely bending	1
Abscission of flowers	0

Treatments were arranged in a Completely Randomized Design (CRD) with 4 replicates. The data were analysed by analysis of variance (ANOVA) followed by Least Square Means Procedure for mean separation at 0.05 probability level.

RESULTS AND DISCUSSION

Generally the shelf life is expressed in days and there are no well defined criteria and conditions to evaluate the lasting qualities of cut flowers. According to the results the effect of treatments on visual quality of flowers was significant at the 0.01 probability level (Table 2). There was a significant difference in T2 (BAP 5 ppm) compared to all other treatments. It increases shelf life of cut orchids up to 28 days (Fig. 1a). There was also significant difference in T11 compared with T5, T6 and T12. Although there was no significant difference between T3 and T11, potassium permanganate (T11) was the cheapest treatment compared with BAP. It prolonged the shelf life of cut orchids up to 20 days without visual change in colour (Fig. 1b), wilting of sepals (Fig. 1c), freshness of flowers (Fig. 1d) and abscission of flowers (Fig. 2a).

Potassium permanganate which inactivates liberated ethylene, has been successfully used to prevent or delay fading of orchid blossoms. Similar results were reported by Salunkhe *et al.* (1990).

Table 2. Effects of different preservative chemicals on the shelf life of cut orchids.

Concentration	Treatment	Shelf Life (days)	Mean Separation *
Control	Distilled water (T1)	5	gf
5 ppm	BAP (T2)	28	a
10 ppm	BAP (T3)	17	bc
15 ppm	BAP (T4)	16	c
100 ppm	$AgNO_3$ (T5)	9	de
$AgNO_3$ 0.462 g $Na_2S_2O_3$ 0.079 g in 500 ml water	STS (T6)	8	def
25%	Glycerine (T7)	7	ef
50%	Glycerine (T8)	4	g
75%	Glycerine (T9)	4	g
100%	Glycerine (T10)	3	g
2 ppm	$KMnO_4$ (T11)	20	b
80°C	Hot water (T12)	11	d

* Means with same letters are not significantly different; CV = 14.18%
(Values followed by the same letters are not significant at P = 0.01 level determine by the Duncan's Multiple Range Test)

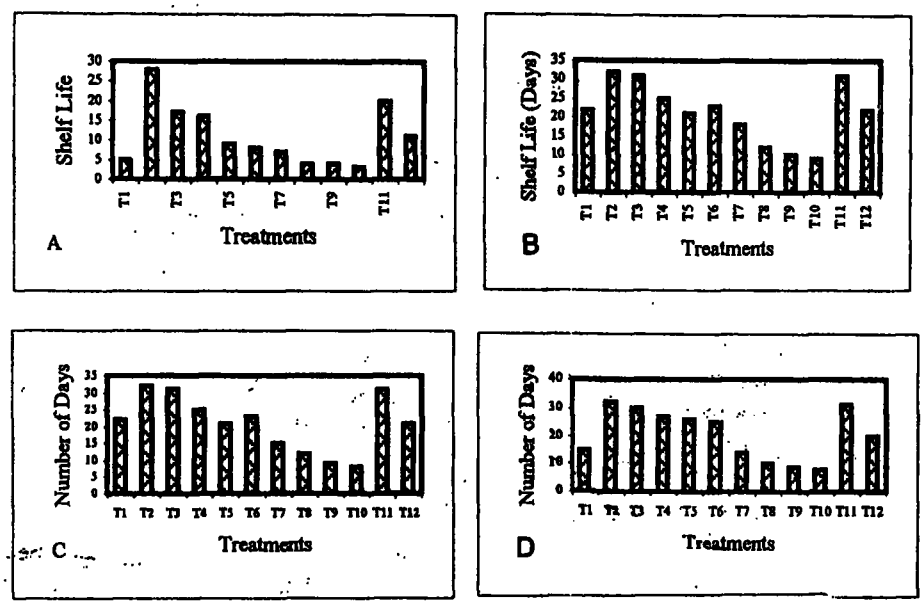

Fig. 1. Effect of treatments on a) shelf life of cut flowers, b) number of days to change the colour, c) wilting with time and d) flower freshness with time.
[Note: T1 - Control, T2 - 5 ppm BAP, T3 - 10 ppm BAP, T4 - 15 ppm BAP, T5 - $AgNO_3$, T6 - STS, T7 - 25% Glycerine, T8 - 50% Glycerine, T9 -75% Glycerine, T10 - 100% Glycerine, T11 - $KMnO_4$, T12 - Hot water].

The least performances were shown by the 'Glycerine' which began to dry the flowers and break the stalk within 3–7 days. Hence the performances of the control was better than that in the glycerine solution. Silver thio sulphate (STS) and $AgNO_3$ inhibit the ethylene action. Silver plug block the cut surface of the stalk of the stem, and prevent entering of micro-organisms. Paull and Goo (1982) reported that, silver ion in the form of thio-sulphate complex moves readily through the stems and into the flowers, thus minimising the postharvest losses of cut flowers.

By evaluating the impact of preservative solutions it is seen that there is a significant effect of preservatives on lengthening of the shelf life of cut orchids. When we consider the visual quality values of orchids, the highest value was obtained by the flowers dipped in 5 ppm BAP (Figs. 2b and 2c). According to the results, it is clear that performances of BAP is the best compared to other solutions used in this study. It improved shelf life of cut orchids up to 28 days. A reason behind this could be the antagonistic effect.

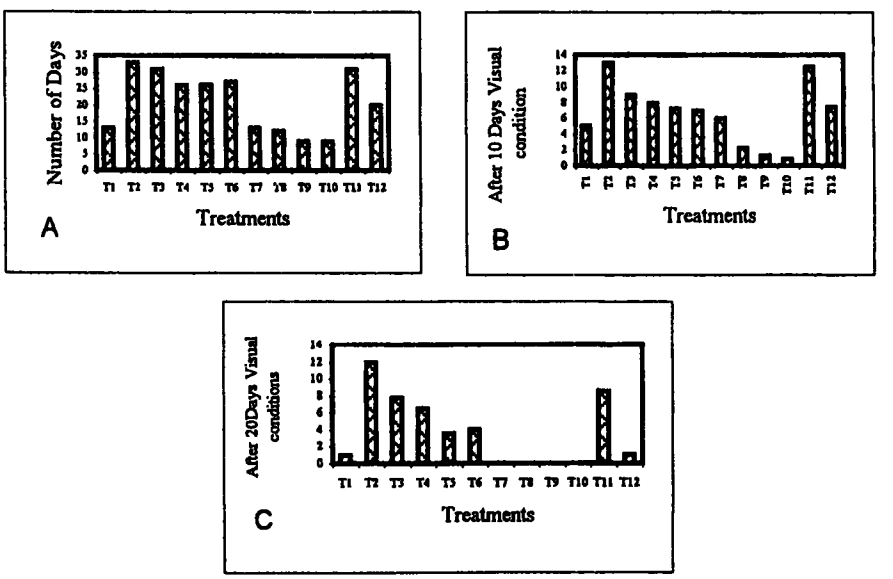

Fig. 2. Treatment effects on a) abscission of orchid flowers, b) visual quality of orchid flowers after 10 days and c) visual quality of orchid flowers after 20 days.

[Note: T1 - Control, T2 - 5 ppm BAP, T3 - 10 ppm BAP, T4 - 15 ppm BAP, T5 - $AgNO_3$, T6 - STS, T7 - 25% Glycerine, T8 - 50% Glycerine, T9 -75% Glycerine, T10 - 100% Glycerine, T11 - $KMnO_4$, T12 - Hot water].

CONCLUSIONS

The results of the study indicate that preservative chemicals used in the experiment can be used to improve the shelf life of cut orchids. It is evident that treatments with 5 ppm BAP and 2 ppm $KMnO_4$ are the best to be used as preservative solutions in extending the shelf life of cut orchids. BAP is an expensive hormone but $KMnO_4$ is readily available and inexpensive. Therefore, the best chemical treatment for small scale orchid growing farmers to improve of shelf life appeared to be $KMnO_4$.

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