ORCHIDS' RESPONSE TO 1-METHYLCYCLOPROPENE (1-MCP) AS CUT FLOWER

Tanveer Fatima Miano* and Mohammad Golam Rabbani**
*****Department of Horticulture, Sindh Agriculture University Tandojam, Pakistan,
**Department of Horticulture, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh, Bangladesh
Corresponding Author's email: drtanveerfmiano@yahoo.in
Email: drmgrabbani@yahoo.com Cell# 008801711885790

ABSTRACT: *With the advancement of cut flower demand orchids have become the most popular cut flower throughout the world. Present research has been carried out during 2013-2014 to evaluate orchids' response to various concentrations of 1-MCP as cut flower. 1-MCP powder was weighed (0.25mg, 0.5mg, 0.75mg and 1mg) and placed in a sterilized 50 ml beakers then with syringe 1 ml of distilled water was poured for individual spike to provide a total concentration of T_1= Control, T_2 = 0.25 mM, T_3= 0.5 mM, T_4= 0.75 mM, T_5=1.00 mM for Dendrobium Sonia and Vanda coerulea (G.) under laboratory conditions. Treatment of 0.75 mM of 1-Methylcyclopropene (1-MCP) for 2 hour significantly improved postharvest characteristics of Dendrobium Sonia, while Vanda coerulea (G.) performed well in 0.5 mM 1-MCP at 25°C±2°C. However, for using these treatments to other orchids; their responses should be studied properly before application.*

Keywords: 1-Methylcyclopropene, Dendrobium Sonia, Vanda, flower quality, vase life.

INTRODUCTION

1-Methylcyclopropene (1-MCP) has a great influence on a wide range of horticultural crops. It is applied in a low quantity that might range from 2.5 nl L^{-1} to 1 ml L^{-1}. Its low quantities largely depend upon temperature and duration, from studies it has been proved that low concentrations for long duration has a positive effect on flowers and fruits [1]. 1-MCP is usually applied at 20−25°C while, some crops can be treated at lower temperatures under certain conditions [2]. Generally, horticultural crops treated within 12-24 hours will achieve full response of MCP. For fully positive response other conditions like stage of harvesting, variety, time of application might be judged [1]. I-MCP within particular plant may also influence other physiological functions like chlorophyll formation and degradation, protein synthesis, resistance power, ethylene and volatiles changes etc [3]. Application of 1-MCP to various crops for enhancing shelf life is quite safe and favorable in regard to living beings and environment [2]. Both Ethyl Bloc and Smart Fresh are approved for use the effectiveness of 1-MCP on extending display life of various cut flowers has been reported [4]. However, the effects of 1-MCP depend on concentration, duration time of fumigation and temperature [4]. *Phalaenopsis* flowers that were treated with 0.1 to 0.4 µl l^{-1} of 1-MCP were less prone to ethylene as high as 10 µl l^{-1}. However, the protective effect of 1-MCP lasts for no longer than 7 days at room temperature in case of orchids.

Cut flowers life is much shorter due to the formation of ethylene within petals [1, 5], as flower abscission become rapid under its influence [6]. [7] found that various cut rose cultivars showed a range of responses to ethylene treatment, such as inhibition of opening, acceleration of opening, abnormal opening, petal and leaf abscission, and loss of petal gloss. Treatments with anti-ethylene compounds, such as 1-MCP (1-methylcyclopropene), can effectively protect flowers against exogenous ethylene [8, 9, 10].

MATERIALS AND METHODS

Experiment has been done with the objective to investigate the response of the most popular and demanded cut flower Dendrobium Sonia and *Vanda coerulea* (G.) under different concentrations of 1-MCP under laboratory conditions. The flower spike with half opened buds were obtained from commercial grower (Dipta Orchids) and transported to Horticulture Department BAU, Mymensingh used in experiment immediately after transport. The two factor experiment was set in the completely randomized design having three replications containing 10 spikes. The laboratory conditions were maintained at 25ºC with 15 µmol m^{-2} s^{-1} irradiance using fluorescence tubes at 16-h photoperiod.

1-MCP treatment application:

Experimental materials (flower spikes with their bases in water containing 4 % glucose) were placed in two liter plastic bottle of which bottom end was cut and removed, opened mouth of bottle was covered with polyethylene and fastened with tape solution around the mouth, then 1-MCP powder was weighed (0.25mg, 0.5mg, 0.75mg and 1mg) and placed in a sterilized 50 ml beakers then with syringe 1 ml of distilled water was poured for individual spike that contained of T_1= Control, T_2 = 0.25 mM, T_3= 0.5 mM, T_4= 0.75 mM, T_5=1.00 mM. 10 flowering spikes per treatment were used. The bottles were closed for 2 hours. Control flowers were subjected in the same bottles without 1-MCP application. Spikes were then set out in the lab conditions to record various observations. 1-MCP is a stable, water-soluble powder when the powder is dissolved in water, 1-MCP is released as a vapor that travels through the air, making its way eventually to plants' ethylene receptors within 30 minutes.

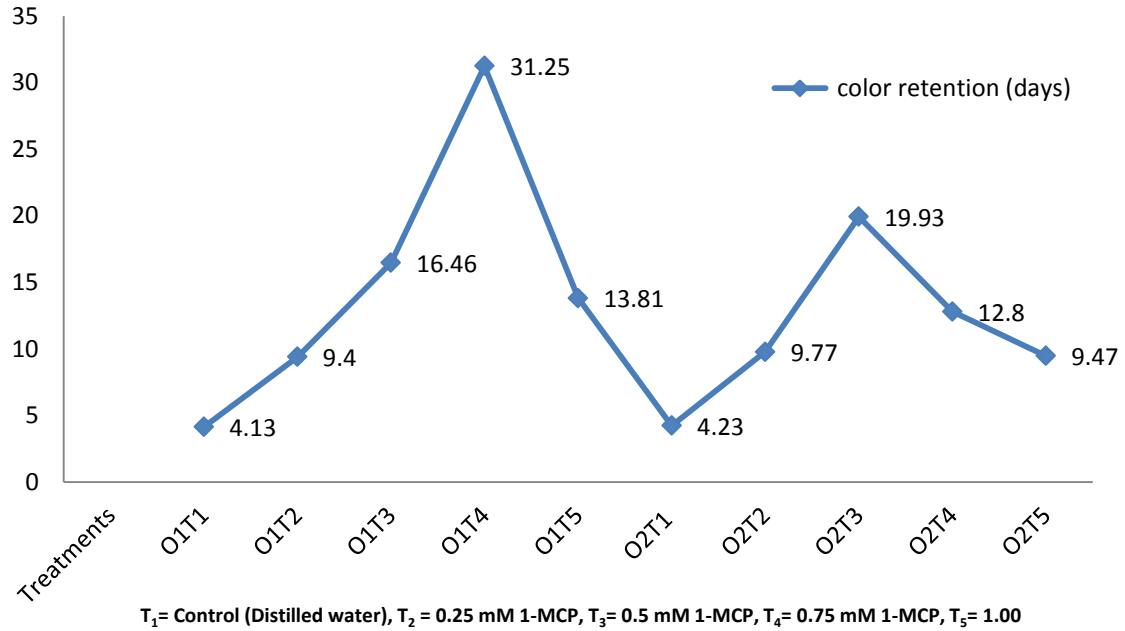
RESULTS

Flower color retention (days):

Results pertaining to flower color retention have been presented in Figure 1. The combined effect showed that Dendrobium Sonia had maximum days to flower color

retention (31.25 days) in 0.75 mM 1-MCP for 2 hour which was highly significant than control and other treatments. However non-significant results were observed under application of 0.5 mM and 1.00 mM (16.46 and 13.81) but these reults were significant with control (4.13 days). Vanda coerulea (G.) had maximum days to color retention (19.93 days) in 0.5 mM 1-MCP for 2 hour which was highly significant than control. Moreover, non-significant results were determined with the application of 0.25mM and 1.00mM (9.77 and 9.47 days).

Fig 1. Orchids' Response to 1-Methylcyclopropene (1-MCP) for color retention (days)



T_1= Control (Distilled water), T_2 = 0.25 mM 1-MCP, T_3= 0.5 mM 1-MCP, T_4= 0.75 mM 1-MCP, T_5= 1.00 mM 1-MCP

O_1= Dendrobium Sonia, O_2= *Vanda coerulea* (G.)

Flower diameter (cm):

Result on combined effect of orchids and 1-MCP treatments were highly significant Figure 2. Maximum flower diameter (30.60 cm) was observed in Dendrobium Sonia under the application of 0.75 mM 1-MCP for 2 hour. While, non-significant values; 11.52, 15.54 and 12.16 were obtained with 0.25 mM, 0.5mM and 1.00 mM but these results were significant with treatments 1 and 2. Whereas, Vanda coerulea (G.) recorded maximum flower diameter (22.71 cm) in treatment application of 0.5 mM for 2 hour followed by 0.75 mM 1-MCP for 2 hour (20.23 cm), these results were significant with the control.

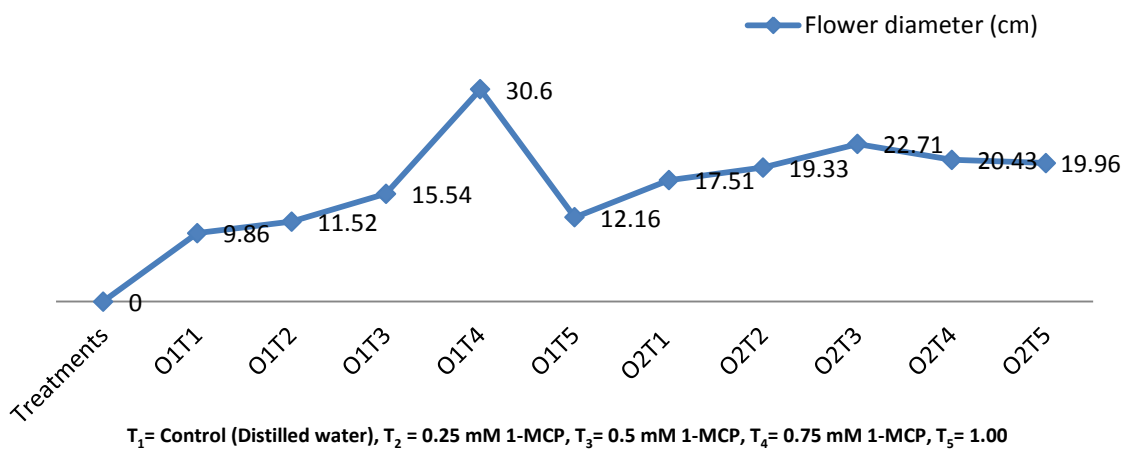
Water uptake:

Statistically highly significant variation was observed between two orchids in respect of water uptake (Figure 3). Combined effect revealed that Dendrobium Sonia utilized more water under the application of 0.75 mM 1-MCP (18.00 ml) followed by 0.5 mM 1-MCP for 2 hour and 1.00 mM 1-MCP for 2 hour (12.07 and 12.00 ml) where the values obtained were non-significant but significant with the results of control and 0.25 mM treatment (7.33 ml). Vanda coerulea (G.) utilized more water (17.00 ml) in treatment containing 0.5 mM 1-MCP for 2 hour followed by 0.75 mM (14.0 ml) as compared to control (7.70 ml) and other treatments. Where as under treatment 0.25 mM and 1.00 mM the results obtained were non-significant (12.33 and 13.0 ml).

Flower drop:

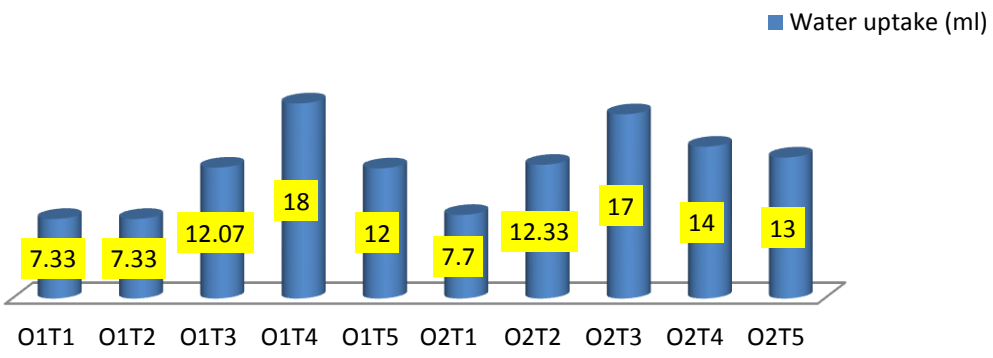
Result on flower drop has been presented in Figure 4 which shows highly significant values obtained with the application of 1-MCP. Combined effects of orchids and treatments indicated that flower drop was found lowest in Dendrobium Sonia (0.04 %) with treatment 0.75 mM 1-MCP for 2 hour followed by 0.5 mM for 2 hour (0.09 %). While maximum flower drop was recoded under control where no 1-MCP treatment was applied (45.19 %) followed by treatment 0.25 mM. Whereas, Vanda coerulea (G.) had lowest flower drop (0.06 %) in 0.5 mM for 2 hour followed by 0.75 mM for 2 hour (0.09 %) as compared to control and other treatments. From the results it is clear that 1-MCP reduced the flower drop drastically as compared to control.

Fig 2. Orchids' Response to 1-Methylcyclopropene (1-MCP) for flower diameter (cm)



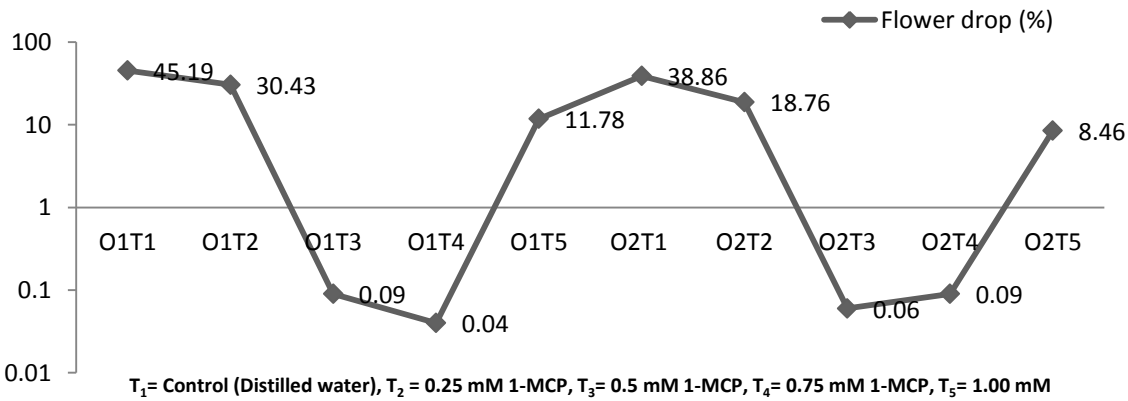
T_1= Control (Distilled water), T_2 = 0.25 mM 1-MCP, T_3= 0.5 mM 1-MCP, T_4= 0.75 mM 1-MCP, T_5= 1.00 mM 1-MCP
O_1= Dendrobium Sonia, O_2= *Vanda coerulea* (G.)

Fig 3. Orchids' Response to 1-Methylcyclopropene (1-MCP) for water uptake (ml)



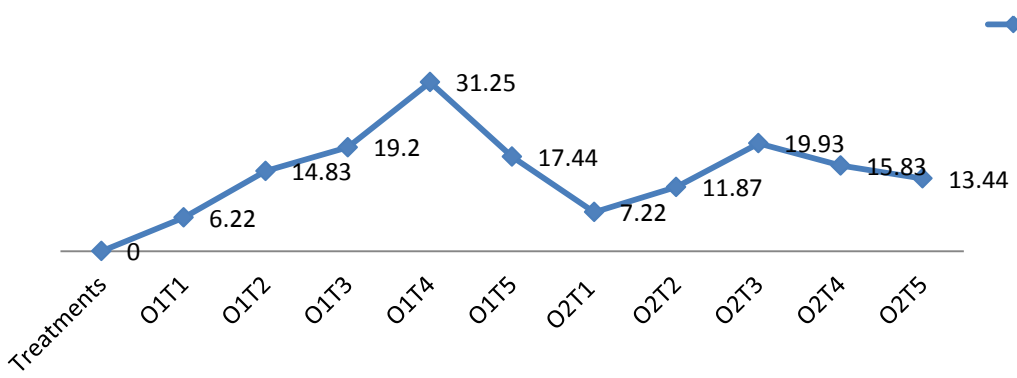
T_1= Control (Distilled water), T_2 = 0.25 mM 1-MCP, T_3= 0.5 mM 1-MCP, T_4= 0.75 mM 1-MCP, T_5= 1.00 mM 1-MCP
O_1= Dendrobium Sonia, O_2= *Vanda coerulea* (G.)

Fig 4. Orchids' Response to 1-Methylcyclopropene (1-MCP) for flower drop (%)



T_1= Control (Distilled water), T_2 = 0.25 mM 1-MCP, T_3= 0.5 mM 1-MCP, T_4= 0.75 mM 1-MCP, T_5= 1.00 mM 1-MCP
O_1= Dendrobium Sonia, O_2= *Vanda coerulea* (G.)

Fig 5. Orchids' Response to 1-Methylcyclopropene (1-MCP) for vase life (days)



T_1= Control (Distilled water), T_2 = 0.25 mM 1-MCP, T_3= 0.5 mM 1-MCP, T_4= 0.75 mM 1-MCP, T_5= 1.00 mM 1-MCP

O_1= Dendrobium Sonia, O_2= *Vanda coerulea* (G.)

Vase life:

Combined effect of orchids and 1-MCP treatments had significant effect on vase life of two orchids. maximum vase life (31.25 days) in Dendrobium Sonia were observed under application of 0.75 mM 1-MCP for 2 hour as compared to control (6.22 days). Whereas, non-significant results were determined by 0.5 mM and 1.00 mM (19.2 and 17.44 days, Figure 5. Vanda coerulea (G.) had maximum vase life (19.93 days) in 0.5 mM for 2 hour and minimum in control (7.22 days), non-significant results were observed between 0.75 mm and 1.00 mM 915.83 and 13.44 ml).

DISCUSSION

Response of both the orchids was significantly influenced by 1-methylcyclopropene (l-MCP) concentrations (Figure 1-5). Dendrobium Sonia had minimum flower drop %, flower diameter, color, vase life and water uptake at 0.75 mM concentration followed by 0.5 mM concentration. However, Vanda produced maximum response at 0.5 mM 1-MCP concentration, under these concentrations orchids utilized more water which maximized flower diameter, color retention and vase life but at very low concentration 0.25 mM response was not effective between two orchids, as it could not reduce ethylene level up to 1ppm. 1-MCP (1-methylcyclopropene) inhibited bud drop through eliminating ethylene passage in the Dendrobium cultivars at 0.5 ppm 1-MCP. l-MCP has been a very effective especially for cut flowers. At very minute quantities (0.5 to 0.75) it worked effectively not only in preventing the effects of exogenous ethylene but also in delaying senescence of flowers whose natural senescence was mediated by a rise in endogenous ethylene production. Response of 1-MCP was orchid specific.

The same conclusions were reported by [11] who concluded that orchids responded differently for their ethylene sensitivity and vase life (11.10 days) with Pre-treatment with 1-MCP 300 nl L^{-1} resulted in maximum quality and vase life in orchids. Application of 1-MCP 1000 ppb, on Mokara orchid, yielded a higher longevity of 25 days, significantly longer than the control that lasted 19.33 days as reported by [12] further, they concluded that the vase life of cut inflorescences of Mokara 'Jairak Gold' and Dendrobium 'Aaron White' orchids after application of different concentrations of 1-MCP, could have been most affected by genetic factors. The interrelationship of time application and amount clearly indicated that appropriate treatment conditions could be developed for a range of possible treatment regimes. The 1-MCP treatment largely inhabited the bud and flower shedding in Dendrobium orchid's where inflorescences were treated for 4h at 25°C with 100-500nl L^{-1} [13].These and other strategies warrant investigations as the licensing and registration of this promising new postharvest tool. Similar work was done by [14,15, 11, 16, 17] who reported best orchids qualities and vase life at 0.5- 100 nl L^{-1} concentrations. 1-MCP treatment contains no any heavy metal implications due to which there will not be any waste disposal problem. Since the material is gas, its use would obviate the need for placing flowers in additional treatment solutions which is labor intensive, because the concentration required is so small, commercial application might be in the greenhouse prior to packing, in the transportation vehicles or in a storage area reported by [15]. If l-MCP can be registered for use with cut flowers, it will have exciting commercial possibilities. Development of particular system for its application in terms of cut flowers with l-MCP will depend on research problem. However, other concentrations with different orchids should be evaluated for enhancing vase life and flower quality.

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