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Effect of chemical preservative on water relation and vase-life of *Tithonia rotundifolia* Blake Cut flower

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ABSTRACT

The vase life of cut flowers and foliage is often shortened by vascular occlusions that constrict vase solution supply. Reduction in stem conductivity is typically caused by blockage of cut stem ends and xylem conduits by microbes, physiological plugging, and disruption of water columns in xylem vessels by cavitation and air emboli. Cut flower and foliage longevity can be greatly affected by the chemical composition of the vase solution. In present study Citric acid-100ppm, Aluminium Sulphate-100ppm and 1% Sucrose were used in different combination to enhance the longevity of Tithonia rotundifolia Blake cut flower.

Key words: *Tithonia rotundifolia* Blake, Vase life, Sucrose, Citric acid, Aluminium Sulphate.

INTRODUCTION

Cut flowers refer to flowers *i.e.* blossom of flower buds those are cut with branches, stems and leaves to be used for bouquets or decoration. Keeping quality is an important parameter for evaluation of cut flower quality, for both domestic and export markets. Various factors influence the postharvest performance and the vase life of cut flowers [1, 2]. Several factors induced senescence in cut flowers *e.g.*, water stress [3] carbohydrate depletion [4], microorganism [5] and ethylene effect [6]. In majority cases, cause of deterioration of cut flowers is blockage of xylem vessels by microorganisms which accumulation in the vase solution or in the vessels themselves. Addition of chemical preservatives to the holding solution is recommended to prolong the vase-life of cut flowers. For many years, floral preservatives have been acidified and have usually included biocides to inhibit bacterial proliferation [7]. Sucrose has been used with germicides, because sugar treatment without germicides promotes bacterial proliferation, leading to shortening of the vase life. Large amount of soluble carbohydrates is required for flower opening as the substrate for respiration and synthetic materials as well as osmolytes. Some vase solutions including sucrose extend vase life of cut flower [8, 9].

MATERIALS AND METHODS

Experimental site: The experiment was conducted in Department of Botany, University School of Sciences, Gujarat University, Ahmedabad, Gujarat.

Plant Material: Tithonia rotundifolia Blake was selected as plant material for the present study. Seeds were obtained from Anand Agricultural University, Anand.

Experimental Design: fresh flowers of *Tithonia rotundifolia* Blake grown in the botanical garden of the Department of Botany were used for the experimental work. The flowers that had just opened were cut diagonally from the plant in the morning. They were immediately placed in the beaker containing water and were brought to the laboratory. Leaves, if any, were removed from the flowering twig, were re-cut again diagonally and were immediately placed in a definite volume of different preservative solution [10]. The length of the twig was kept 10 cm to overcome the influence of flower stalk length on vase life [11]. The twigs were placed in a cool placed in the laboratory at room temperature. The tubes containing solution were covered with transparent polythene pieces to prevent water loss by evaporation. The treatments were laid out in a randomized complete block design (RCBD). Each treatment was replicated four times. Cut flowers were pulsed with the different solution till the senescence of flower. The control stems were treated with DW. The treated cut flowers were placed in holding solution containing different chemical preservatives in different combination *i.e.* 1% sucrose, 100 ppm citric acid + 1% sucrose, 100 ppm citric acid + 100 ppm Aluminium sulphate + 1% sucrose.

Data Collection: Data was recorded regularly at interval of 24 hours. Water uptake, transpiration loss, water balance and shelf life in term of gm/flower/day were calculated.

RESULTS AND DISCUSSION

Vase life of flower was determined as the number of days to wilting of flowers. The flowers were checked once a day for sign of deterioration. As shown in table, flower exposed to holding solution containing chemical preservative regardless of exposure duration increased in *Tithonia rotundifolia* Blake vase life as compared to control. It was observed that shelf life of flower was increased by 1 day *i.e.* 5 day in holding solution containing chemical preservatives as compared to the DW infused flower. In term of water balance combination of citric acid 100 ppm, Aluminium Sulphate 100 ppm, 1 % sucrose was effective for *Tithonia rotundifolia* Blake flower. These preservative help to control ethylene synthesis, pathogen development, maintenance of hydric and respiration balance, to contribute to colour conservation and delay over all senescence of flower [11, 12]. Kuiper *et al.*, [8] conclude that sugar plays important roles as substrates for respiration and cell wall synthesis as in plants. Steinitz [14] opined that addition of sucrose to the solution increased the mechanical rigidity of the stem by inducing cell wall thickening and lignification of vascular tissues.

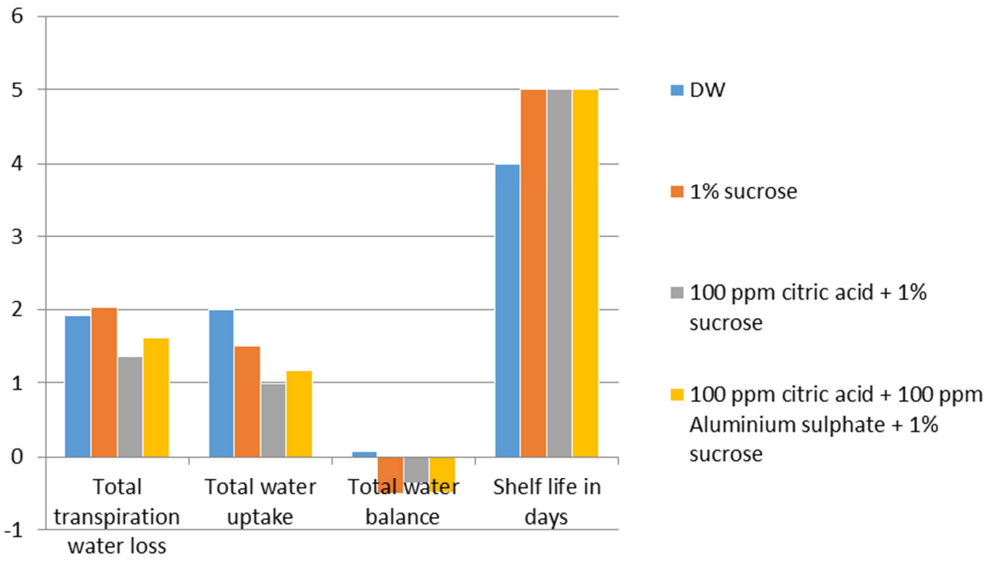

Figure-1: Effect of different chemical preservatives on *Tithonia rotundifolia* Blake

Sucrose antagonized the effect of ABA, which promotessenescence [15]. Sugars alone, however, tends to promote microbial growth. Hence, the combination of sugars and biocides might have extended the vase life of cut flower. $AgNO_3$ or sucrose alone was less effective as compared to their combination with regard to vase-life. Similar results were also reported by Steinitz [14] andAwad*et al.* [16] in *Gerbera* and *Zinnia*, respectively. A pre-shipment

treatment with citric acid (150 ppm) added to the pulse solution was found to be effective in *Carnation*. Citric acid prevent the plugging of vascular bundles improved the water balance and enhanced the intensity of petal colour probable by changing pH of cell sap. Use of citric acid at 0.5-0.7% in holding solution promoted the floral development and keeping quality of cut spikes of tuberose [17]. In roses, the loss of petal turgidity and fresh weight was preceded by a decreased rate of water uptake, indicating that reduced rather than excessive water loss is responsible [18].

Sucrose helps in maintain the water balance and turgidity. Hence, addition of sucrose to the holding solution might have lead to increased uptake of the holding solution [19]. This was in conformity with the finding of Rogers [20]. Floral preservative solution containing aluminium sulphate at 150 mg/L under 25 °C extended cut eustoma (*Eustoma grandiflorum* Shinn. cv. HeiHou) vase life [21]. The effect of other chemical treatment in increasing vase life of some cut flowers has been suggested by many authors [22, 23]. Therefore, the vase life varied among various cultivars in *Carnation*[6, 24] and *Gerbera*[25].

Most floral preservatives contain carbohydrates, germicides, ethylene inhibitors, growth regulators and some mineral compounds [7]. The preservative materials used as pulsing of holding solutions seemed to prolong longevity. In this study, some chemical preservatives *i.e.* citric acid or aluminium sulphate as a biocide alone on with sucrose were used to prolong vase life [26]. Sucrose was the kind of sugar mostly used in floral preservatives. Merwe *et al*. [27] found that vase life, general appearance fresh mass, and medium uptake of the commercially mature gladiolus inflorescence were improved with sucrose treatment. Sucrose uptake from the vase solution replenished intercellular respirable carbohydrates, allowing a sustained high respiration rate and prolonged vase life. The increase of vase life due to sucrose may result from decreased moisture stress and improved water balance.

The importance of improving water relation as a means for prolonging the vase life of cut flower has been long been recognized and there have been substantial studied of cut flower. In general, the water relations of cut flowers are determined by the difference between the amount of water loss by transpiration and the water uptake [28, 29]. Murali*et al*., [30] showed that vase solutions containing sucrose 4 % increased water uptake and transpirational loss, and increased fresh weight of spikes of *Gladiolus* compared with control. Halevy *et al.*, [31] found that citric acid was widely used to decrease the pH of water balance and reduce stem plugging citric acid showed positive effect in increasing the longevity of cut flowers. Durkin [32] noticed that acidification of water may increase vessel wall porosity, perhaps by breaking the calcium pectate bonds. Aluminium sulphate has been reported to increase the vase life of *Gladiolus* cut flowers [33]. The influence of mineral salts such as $Al_2(SO_4)_2$ on the physiological changes of cut roses (*Rosa hybrida*) in relation to extension of vase life, was attributed to their effective in increasing the permeability of the cell membrane and keeping the peroxidative changes at a minimum rate [34]. Combinations of sucrose with $Al_2(SO_4)_2$ 300 ppm, increased vase life and quality of *Gladiolus* flowers over control [35].

CONCLUSION

Flowers are extremely perishable, maintaining their physiological functions vary actively even after harvest. Flowers remain fresh longer if they are placed in a suitable floral preservative. Sucrose supply increase flower vase life by approaching carbohydrate starvation. 1 % sucrose solution increase the capacity of water uptake while combination of citric acid 100 ppm, aluminium sulphate 100 ppm and 1 % sucrose was proved best to maintain water balance in flower. It is also an osmotically active molecule leading to the promotion of subsequent water relation. So by application of these chemicals, blockage of vessels is prevented and ethylene levels retain resulting in prolonged fresh vase life, thus decreasing floral fading percentage.

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