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Interaction effect of temperature and thyme essential oil on vase life of cut narcissus flowers

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ABSTRACT

The effects of Temperature and Thyme Essential Oil, on cut Narcissus was studied. Temperature (4 and 16 °C) and Thyme (0, 1, 2.5, 5 and 7.5 %), their combinations were tested as preservative mixture. This study was conducted in a factorial experiment with complete randomized design on 120 Narcissus cut flowers in horticulture laboratory of agriculture faculty of Islamic Azad University, jiroft branch. The recorded traits included Vase life, relative fresh weight and Solution uptake. The results shown using Thyme as a preservative significantly increased the vase life, relative fresh weight and Solution uptake (P≤1%). The results shown using Temperature as a preservative significantly increased the vase life and relative fresh weight (P≤1%) and (P≤5%). The results shown using Interaction as a preservative significantly increased the vase life and Solution uptake (P≤1%) and (P≤5%). The results showed that Temperature and Thyme treatments increased cut flower vase life. Effect of temperature of 4ºc, compared to 16 ºc, on vase life was significant. The highest and the lowest vase life (58.75day and 34.5 day, respectively) were observed for 4ºc treatment. A direct relationship between vase life and increasing of water uptake was observed as well.

Key words: Cut flowers, relative fresh weight, Narcissus, Vase life.

INTRODUCTION

Cut flowers are precious products of horticulture. Maintaining good quality of cut flowers and extending the vase life, is considered important and practical for having acceptable products for the markets. In general, many studies have been under taken for this purpose. [24; 22, 29, 33, 34]. Vase life of cut flowers is mainly affected by two main factors, namely ethylene which accelerates the senescence of many flowers and by microorganisms which cause vascular blockage and thus reduces the vase life of cut flowers [31, 33, 34].

Narcissus is a genus of hardy, spring-blooming, bulbous plants in the family Amaryllidaceae. Earlier reports suggested that the genus Narcissus contained around 26 wild species [28]. The number has been reported to be between 50 and 100 including species variants and wild hybrids [3]. The species *Narcissus tazetta* derives its name from the word ‘‘Tazetta’’ which in Italian means ‘‘little cups’’ with reference to the centrally placed little yellow corona cups. It is the most widespread species of the genus Narcissus found in region with Mediterranean type of climate extending from Spain, Iran, Kashmir to China and Japan [5].

Monitoring of transit temperatures of commercial cut flowers has shown that flowers are often exposed to damaging high temperatures. Maxie et al. [18] and Thompson and Reid [26] recorded flower temperatures above 27 °C [81 °F] in commercial flower shipments. Poor temperature management during transport of cut flowers is largely the result of inadequate precooling and transport under nonrefrigerated conditions. Several researchers have shown the negative effects of improper storage temperatures on vase life of a range of cut flowers [4]. The poor arrival quality of transported cut flowers has spurred the development of systems like the Procona buckets [Pagter Innovations, Dinteloord, The Netherlands] in which the flowers are transported in water. Industry leaders have claimed a considerable improvement in postharvest quality for flowers transported in this way, and these claims have reduced the industry's emphasis on proper postharvest temperature management. Warm storage temperatures accelerate water loss, so it is possible that wet storage helps by replacing lost water. However, we have shown that reduction of cut flower vase life during storage is highly correlated with respiration at the storage temperature [4]. A substantial reduction in the vase life of flowers shipped at warmer temperatures would therefore be expected even if they were shipped in water.

Essential oils are natural products taken from plant materials that, due to their antibacterial, antifungal, antioxidant and anticarcinogenic properties can be used as natural additives in many crops [25]. Many authors mention usefulness or no detrimental effects on horticultural product quality parameters when essential oils are used after harvest [10, 29, 19, 27]. The major constituents of the used essential oils are phenolic compounds [2, 30].

Thyme [*Thymus vulgaris*] essential phenolic oil has been counted to have antibacterial, antimycotic and antioxidative properties [6, 7]. Its majority components were thymol, carvacrol also borneol [14], Essential oils of Black cumin [*Bunium persicum*] also have strong anti-bacterial effects. This feature could be resulted from the relatively high amount of terpinenes and cumin aldehyde in the essential oil [20]. Menthol is the main component of Peppermint [*Mentha piperita*]. The essential oils of it show strong antibacterial activity [1, 9, 13].

The aim of this work was to study the responses Narcissus to the interactive effects of Temperature and Thyme.

MATERIALS AND METHODS

Cut Narcissus flowers were obtained from a local the village nargesi, jiroft, and transported with proper covers immediately to Laboratory. Solutions were freshly prepared at the start of experiments. Stems were recut to 35 cm length. The study was arranged in a factorial test with complete randomized design with four replications. Each replication consisted of three cut flowers. Two levels of Temperature [4 and 16 °C], and five levels of Thyme [0, 1, 2.5, 5 and 7.5 %], for hours two time, were applied [total of 10 treatments]. After recording the fresh weight, each flower was placed in a bottle containing 400 ml preservative solutions.

Vase life: The average vase life of the spikes was counted from the day of transfer of spikes to the holding solution and was assessed to be terminated when 50% flowers had senesced, which was characterized by loss of turgor followed by petal wilting. Petal senescence was marked by the loss of turgor in the petal tissue followed by complete wilting.

Relative Fresh Weight: relative fresh weight [RFW] changes of the stems. Relative fresh weight was calculated as:

RFW [%] = [$Wt/Wt0$] ×100;

where, Wt is weight of stem [g] at t = day 0, 1, 2, etc., and$Wt0$ is weight of the same stem (g) at t=day 0 [11, 17].

Solution uptake*:* Solution uptake of flowers was measured using a balance by weighting each vase containing its solution without its flowers and correcting the evaporation from the 4 evapo-control vases [vases which did not contain any flowers and were located between the vases that contained flowers at different places] by subtracting the average of 4 evaporation data from solution uptake on a daily basis. Daily vase solution uptake was calculated as: vase solution uptake rate [g stem^{-1} day^{-1}] = [St-1-St]; where, St is weight of vase solution [g] at t = day 1, 2, 3, etc., and St-1 is weight of vase solution [g] on the previous day [11, 15, 17].

Experimental Design and Statistical Analysis: Experiment was arranged in a factorial test with complete randomized design with four replications. Analysis of variance was performed on the data collected using the general linear model [GLM] procedure of the SPSS software)Version 16, IBM Inc.). The mean separation was conducted by dancan analysis in the same software [*p*= 0.05].

RESULTS AND DISCUSSION

Results Mean Square for all traits are presented in Table 1. As can be seen, all the traits were influenced by treatments or their interactions.

Vase life: According to results mean square [Table 1], vase life was affected by different levels of temperature, thyme and interaction of these treatments [p<0.01]. Effect of temperature of 4ºc, compared to 16 ºc, on vase life was significant. The highest and the lowest vase life [58.75day and 34.5 day, respectively] were observed for 4ºc treatment. Treatments applied under 4ºc temperature had positive and significant effect on vase life enhancement, this is in agreement with the results reported by Mosavi Bazaz et al., [21]. Among these treatments, 5% thyme resulted in the highest vase life (11.5 days). By increasing thyme concentration in 4ºc, negative effects on post harvest longevity of the flowers was observed which accords with the results reported by [23]. compared to thyme - free treatment, different concentrations of thyme increased longevity of the flower under 16ºc, among which p<0.01 thyme had had the high impact on increased vase life [fig 1].

Results showed that 4ºc temperature postponed senescence of Narcissus cut flower, cultivar tazetta which accords with the results reported by other authors [16]. By increase in temperature, respiration rate was increased, which is used as a tool for prediction of vase life of cut flowers and narcissus in different temperatures [4].

A common way to store harvested flowers is to apply low temperature, and application of sucrose solution is a modified method [5]. Plant extracts inhibit microbial growth. Although these preservative solutions increase post harvest longevity of rose cut flowers, their application in vase solutions hasn't been reported [14]. A main cause of short longevity of rose cut flowers is botrytis which releases ethylene. Antimicrobial extracts of thyme [*Thymus capitatus*] and marjoram [Origanum marjorana] in concentrations of 85-300 mg ml have inhibited growth of botrytis [8]. Presence of s-carvone in preservative solutions [0.636 and 0.318 mM] increased post harvest longevity of cut flowers of Hakea francisiana [32]. The authors found out that s-carvone delayed the reduction of hydraulic conductance of basal 2 cm of flower stems [32].

Tab1- Mean Square for Temperature and Thyme in preservative mixture on Vase Life, Relative Fresh Weight and Solution Uptake in Narcissus Cut Flowers

Source of variation	df	Vase Life (day)	Solution Uptake (g stem^{-1} day^{-1})	RFW (% of the initial)
Thy	1	9180.9**	18.94**	1389.08**
Tem	4	226.43**	0.54^{ns}	309.7*
Thy × Tem	4	6.65**	307.78*	65.67^{ns}
Error	30	40.95	98.92	101.02

*^{ns} Non Significant at 0.05 probability level and *, ** Significant at 0.05 and 0.01 probability levels, respectively.*

Relative Fresh Weight: According to results mean square [Table 1], RFW was influenced by temperature and thyme treatments, so that temperature [p<0.01] and thyme [p<0.05] had significant effect on relative fresh weight but their interaction didn't. mean comparison [fig 3] shows that the high RFW was obtained by thyme-free treatment under temperature of 16ºc and the lowest one was observed for treatment of 4ºc and 2.5% thyme suggesting that thyme levels in 4ºc resulted in lowered relative fresh weight compared to 16ºc. thyme treatment conserved relative fresh weight in 16ºc compared to control but lowered it in 4ºc which is in agreement with the results reported by Hosseini darvishan et al, [12].

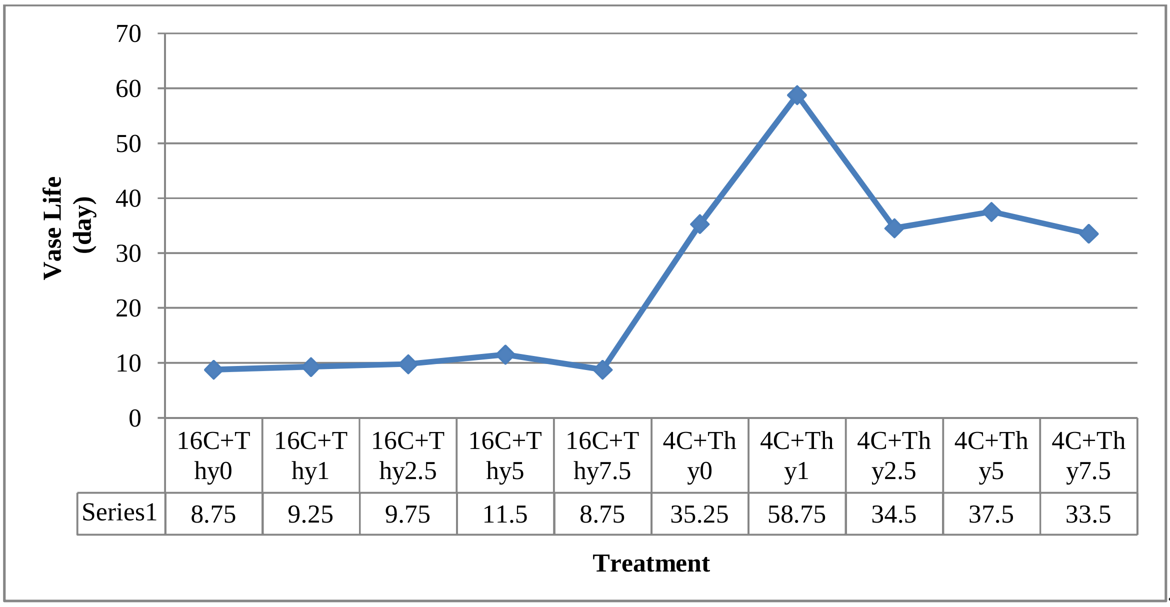

Fig 1- Values are mean of four replication ±SD. Mean separation among treatments was done by Duncan test at *p*≤0.05
Means followed by different letters are significantly different.
[C] Temperature
[Thy] Thyme

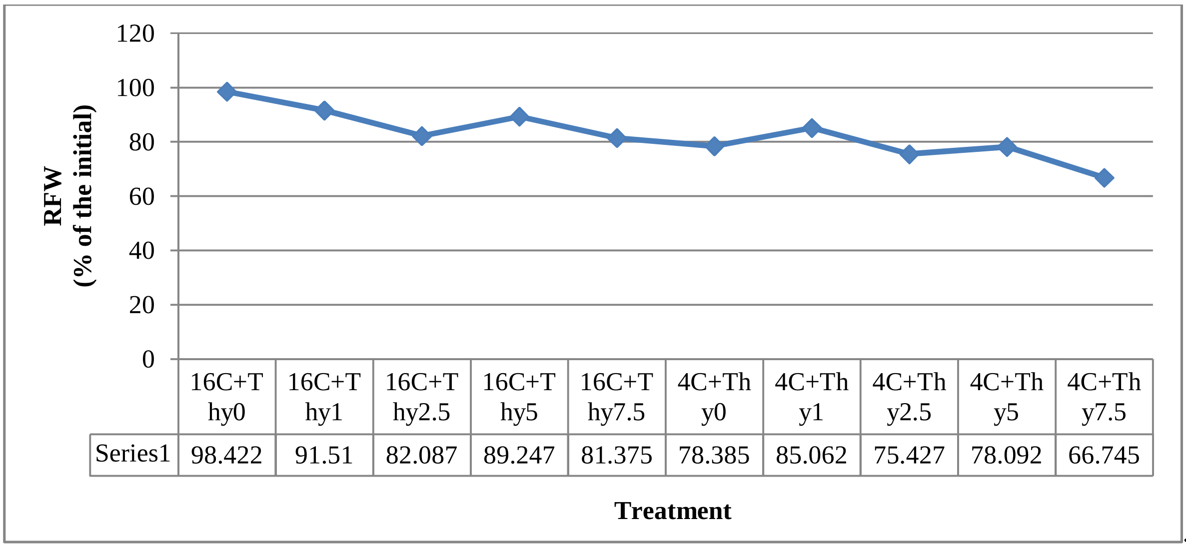

Fig 2- Values are mean of four replication ±SD. Mean separation among treatments was done by Duncan test at *p*≤0.05
Means followed by different letters are significantly different.
[C] Temperature
[Thy] Thyme

Solution Uptake: Results mean square show that water uptake was affected by temperature treatment. Temperature treatments [p<0.01] and their interaction [p<0.05] had significant effect on water uptake. Mena comparison [fig 2] indicated that water uptake was increased in temperature of 4ºc so that the highest rate of water uptake was observed in thyme -free treatment in 4ºc. Application of thyme in 16ºc reduced water uptake compared to 4ºc. the lowest rate of water uptake was observed for temperature of 4ºc and [p<0.05] thyme, suggesting negative effect of higher concentration of thyme on water uptake. Overall, it can be concluded that thyme had a negative effect on water uptake. In their investigation on lilium, Lee et al, [17] reported that low temperature decreased water loss and inhibited microbial growth, so xylem obstruction was reduced and water uptake was enhanced.

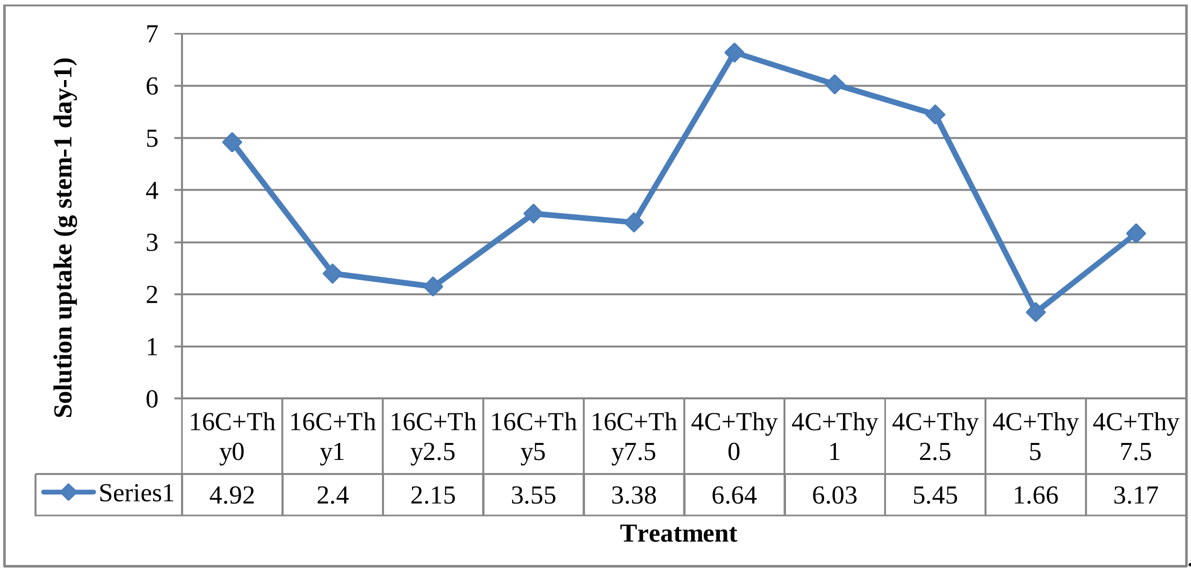

Fig 3- Values are mean of four replication ±SD. Mean separation among treatments was done by Duncan test at $p \leq 0.05$
Means followed by different letters are significantly different.
[C] Temperature
[Thy] Thyme

CONCLUSION

In present study, Temperature and thyme increased vase life of cut flowers.

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