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Effect of Plant Extract on Vase Life in Gerbera var. Pre Intenzz

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Abstract

The present study was carried out during *rabi*, 2020–21 (February–June 2021) on "Effect of plant extract on vase life in gerbera" at the Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi, Bagalkot, Karnataka (591218), India. The experiments were laid out in Completely Randomized Design. Among the effect of plant extract on gerbera flowers held in vase solution containing 8-HQS @ 0.8% (Standard check) recorded the longest vase life (11.54 days), cumulative uptake of vase solution (CUV) of 31.72 g $days^{-1}$, cumulative transpiration loss of vase solution (CTL) of 40.86 g $days^{-1}$, minimum microbial load 2.92 cfu×10^{-5} which was on par with *Ocimum sanctum* @ 5.0% recorded the longest vase life (11.00 days), CUV of 30.82 g $days^{-1}$, CTL of 39.66 g $days^{-1}$, minimum microbial load 3.15 cfu×10^{-5}. In different combinations of plant extracts the gerbera flowers held in vase solution containing T_3 (*Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%) had recorded a longest vase life of 9.35 days, CUV of 28.96 g $days^{-1}$, CTL of 29.19 g $days^{-1}$, fresh weight of 21.58 g $days^{-1}$, minimum microbial load 4.04 cfu×10^{-5}. Among the effect of plant extract on the vase life of gerbera flowers T_2 (*Ocimum sanctum* @ 5.0%) was found to be best in maintaining vase life and its parameters and which is on par with T_{16} (8 HQS @ 0.8%). T_3 (*Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%) was found effective among the combination of plant extract.

Keywords: Gerbera, CUV, CTL, 8-HQS, CFU

1. Introduction

Gerbera (*Gerbera jamesonii* Hook.) having its origin in South Africa which belonging to the family Asteraceae is one of the most important commercial cut flowers among the top ten cut flowers in the world. It is well known for its attractive colourand arrangment. The first official description of *Gerbera jamesonii* was done by J.D. Hooker in 1889 in Curtis Botanical Magazine (Codd, 1979). It was used for decorative purposes and used during social functions, weddings, funerals, gifts on various occasions, in times of illness, to beautify homes and public places (Tsegaw et al., 2011). With the increase in the standard of living, the demand for gerbera flower also increased and meeting these demands which depends largely on an increase in production and most importantly proper postharvest handling should be done at all levels. Postharvest losses in floriculture industries are the major issue and a worldwide problem.Flower vase life depends upon many factors such as causing depletion of carbohydrates, rise in temperature, respiration rates, rapid attack by microorganisms, water stress and increased accumulation of ethylene. All these activities lead to deterioration of the harvested flowers which in turn decreases the longevity of the fresh produce (Nowak and Rudnicki, 1990). The cut stem is a living entity, when detached from the plant, the cut stem is deprived of its natural sources of food, water, minerals and hormones carries out its life processes at the expense of reserved food material it contains. It is estimated that nearly 30% of flowers have perished during postharvest handling (Singh et al., 2018). Gerbera flowers frequently have a short vase life owing to stem bending. This bending has been linked to bacteria in vase water, which prevents water from entering the xylem conduits at the cut surface of the stem. Another element contributing to an imbalance in water uptake and loss from cut flowers is stem end obstruction. Microbes can be the most common cause of stem obstruction (Sathish et al., 2019).

Many chemicals have been used in cut flowers vase solutions for inhibiting microorganism's growth, which extends the vase life by improving water uptake. These chemicals include silver nitrate, aluminium sulphate, 8- hydroxyquinoline sulphate and 8-hydroxyquinoline citrate. Because most of the chemicals are toxic in nature and also causes environmental pollution so, alternatively using of the natural compounds can reduce the environmental pollution and also have no side effects on human health as they don't possess toxicity (Okigbo, 2005). A suitable method for extended vase life, which are easy to use, natural, safe and inexpensive compounds is always crucial in this respect for large-scale applications. Natural plant extracts have come into prominence nowadays, some natural plant extracts have strong antimicrobial properties against some pathogens. As we have a variety of aromatic crops, trees and weeds which are the source of natural plant extracts, which can substitute their action instead of synthetics. Plant extracts as natural, safe and biodegradable compounds which are suitable alternatives to conventional chemical treatments to prolong vase life.Plant extracts are organic, harmless, and environmentally friendly, and they have excellent antimicrobial effects against certain diseases. The primary ingredients of essential oils are phenolic and monoterpenic chemicals. The antimicrobial process is based on synthetic suppression of DNA, RNA, proteins, and polysaccharides. Plant extracts and essential oils have a high quantity of phenolic chemicals such as carvacrol, thymol, and eugenol (Sathish et al., 2019). Such ingredients include some of the herbal plant extracts that are safe ingredients and their antimicrobial properties and their effect on increasing life after the harvest of horticulture products have been proven.

2. Materials and Methods

The present investigation entitled "Effect of plant extract on vase life in gerbera" was carried out during *rabi*, 2020–21 (February–June, 2021) in the Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi (University of Horticultural Sciences, Bagalkot), Karnataka (591218), India. Gerbera var. Pre Intenzz was collected from Horticulture Research and Extension Center, Kanabargi (UHS, Bagalkot) which were grown under naturally ventilated poly house to carry out the experiment.The Treatments for effect of plant extract on vase life of gerbera flower T_1: *Ocimum sanctum* @ 2.5%, T_2: *Ocimum sanctum* @ 5.0%, T_3: *Ocimum sanctum* @ 7.5%, T_4: *Mentha viridis* @ 2.5%, T_5: *Mentha viridis* @ 5.0%, T_6: *Mentha viridis* @ 7.5%, T_7: *Azadirachta indica* @ 2.5%, T_8: *Azadirachta indica*@ 5.0%, T_9: *Azadirachta indica*@ 7.5%, T_{10}: *Vitex negundo* @ 2.5%, T_{11}: *Vitex negundo* @ 5.0%, T_{12}: *Vitex negundo* @ 7.5%, T_{13}: *Cymbopogon winterianus* @ 2.5%, T_{14}: *Cymbopogon winterianus* @ 5.0%, T_{15}: *Cymbopogon winterianus* @ 7.5%, T_{16}: 8-HQS @ 0.8% (Standard check) and the treatments for effect of combination of different plant extracts on vase life of gerbera flower. T_1:*Ocimum sanctum* @ 5.0%+*Ocimum sanctum* @ 2.5%, T_2: *Cymbopogon winterianus* @5.0%+*Ocimum sanctum* @5.0%, T_3: *Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%, T_4: *Ocimum sanctum* @ 2.5%+*Cymbopogon winterianus* @5.0%, T_5: *Ocimum sanctum* @ 2.5%+*Mentha viridis* @ 5.0%, T_6: *Cymbopogon winterianu* @ 5.0%+*Mentha viridis* @ 5.0%, T_7: 8–HQS @ 0.8% (Standard check). The flowers having straight stalks were selected and the basal portion of the stalk was given a cut to about 2.5 cm to remove any blockages due to air bubbles. Gerbera stalks were then cut to a uniform length of 40 cm. Initial weight of the flowers was taken by using weighing balance for the different combination experiment. Each cut flower was placed in a 250 ml conical flask containing desired quantity of extract as per the treatments and sucrose four percent with the volume to 150 ml by adding distilled water. Parameters like cumulative uptake of vase solution (g days^{-1}), cumulative transpiration loss of vase solution (g days^{-1}), fresh weight (g days^{-1}), microbial load (cfu ml^{-1}) and Vase life (Days) were taken into consideration and accordingly the results were obtained. The treatment means were compared by the Completely Randomized Design (CRD) test at CD (p=0.01) level (Gomez and Gomez, 1984).

3. Results and Discussion

3.1. Cumulative uptake of vase solution (CUV) (g days^{-1})

The effect of plant extract oncumulative uptake of vase solution in gerbera flowers during the vase period is presented in Figure 1. CUV differed significantly in each treatment. The treatment T_{16} (8 HQS @ 0.8%) showed maximum CUV of 31.72 g days^{-1} followed by T_2 (*Ocimum sanctum* @ 5.0%) (30.82 g days^{-1}). In case of effect of combination of plant extracts (Table 1), treatment T_3 (*Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%) showed maximum CUV (28.96 g days^{-1}) followed by T_6 (*Cymbopogon winterianus* @ 5.0%+*Mentha viridis* @ 5.0%) with CUV of 26.75 g days^{-1}

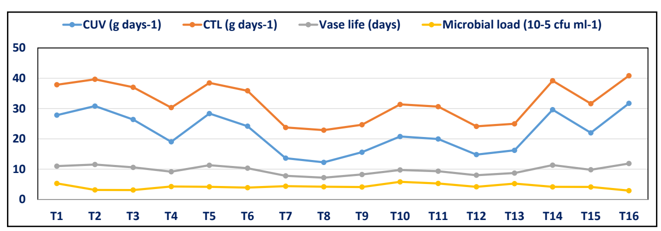

Figure 1: Effect of plant extract on Cumulative uptake of vase solution (CUV), Cumulative Transpiration Loss (CTL), Vase life (days) and microbial load (cfu ml^{-1}) of gerbera flowers; T_1: *Ocimum sanctum* @ 2.5%; T_2: *Ocimum sanctum* @ 5.0%; T_3: *Ocimum sanctum* @ 7.5%; T_4: *Mentha viridis* @ 2.5%; T_5: *Mentha viridis* @ 5.0%; T_6: *Mentha viridis* @ 7.5%; T_7: *Azadirachta indica* @ 2.5%; T_8: *Azadirachta indica* @ 5.0%; T_9: *Azadirachta indica* @ 7.5%; T_{10}: *Vitex negundo* @ 2.5%; T_{11}: *Vitex negundo* @ 5.0%; T_{12}: *Vitex negundo* @ 7.5%; T_{13}: *Cymbopogon winterianus* @ 2.5%; T_{14}: *Cymbopogon winterianus* @ 5.0%; T_{15}: *Cymbopogon winterianus* @ 7.5%; T_{16}: 8-HQS (Standard check) @ 0.8%

Table 1: Effect of combination of plant extract on Cumulative uptake of vase solution (CUV), Cumulative Transpiration Loss (CTL), Fresh weight, Vase life and microbial load of gerbera flowers

Treatments	CUV (g days^{-1})	CTL (g days^{-1})	Final fresh weight (g days^{-1})	Vase life (days)	Microbial load (10^{-5} cfu ml^{-1})
T_1: *Ocimum sanctum* @ 5.0% +*Ocimum sanctum* @ 2.5%	21.50	25.27	17.68	9.35	4.04
T_2: *Cymbopogon winterianus* @ 5.0%+*Ocimum sanctum* @ 5.0%	25.23	25.23	12.94	8.57	4.48
T_3: *Mentha viridis* @ 5.0%+*Ocimum sanctum* @5.0%	28.96	29.19	21.58	9.82	3.80
T_4: *Ocimum sanctum* @ 2.5%+*Cymbopogon winterianus* @5.0%	23.79	24.66	21.32	8.33	4.52
T_5: *Ocimum sanctum* @ 2.5%+*Mentha viridis* @ 5.0%	25.50	27.90	16.17	8.42	4.67
T_6: *Cymbopogon winterianus* @ 5.0%+*Mentha viridis* @ 5.0%	26.75	28.82	17.10	9.17	4.16
T_7: 8-HQS @0.8% (Standard check)	26.25	24.66	19.30	9.08	4.12
Mean	24.60	26.53	18.01	8.96	4.25
SEm±	0.38	0.41	0.28	0.13	0.06
CD (p=0.01)	1.59	1.72	1.17	0.57	0.27

CUV: Cumulative uptake of vase solution, CTL: Cumulative transpiration loss of vase solution, cfu: Colony forming unit

Antimicrobial activity of plant extracts reduced the xylem occlusion and therefore increased the translocation of sugar which was accumulated in the floral tissue which might have increased the osmotic concentration and improved their ability to absorb more water through the increased uptake of vase solution under these treatments. These results were in confirmation with the findings of Prashanth and Chandrasekhar (2007) in gerbera, similar results were also observed by Sathish et al. (2019) in rose and gerbera.

3.2. Cumulative transpiration loss of vase solution (CTL) (g days^{-1})

Data on effect of plant extracts oncumulative transpiration loss of vase solution in gerbera flowers during the vase period is presented in Figure 2 in which T_{16} (8 HQS @ 0.8%) showed maximum CTL (40.86 g days^{-1}) followed by T_2 (*Ocimum sanctum* @ 5.0%) (39.66 g days^{-1}) which was at par with standard check. Theeffect of combination of plant extracts on cumulative transpiration loss of vase solution in gerbera flowers during the vase period is mentioned in Table 1 where T_3 (*Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%) showed maximum CTL (29.19 g days^{-1}) followed by T_6 (*Cymbopogon winterianus* @ 5.0%+*Mentha viridis* @ 5.0%) (28.82 g days^{-1}).

This might be due to the fact that sugar helps to reduce moisture stress in flowers by affecting stomatal closure and preventing water loss due to transpiration. The findings of the experiment correlate the results of Sathish et al. (2019) in rose and gerbera andFanourakis et al. (2022) in gerbera.

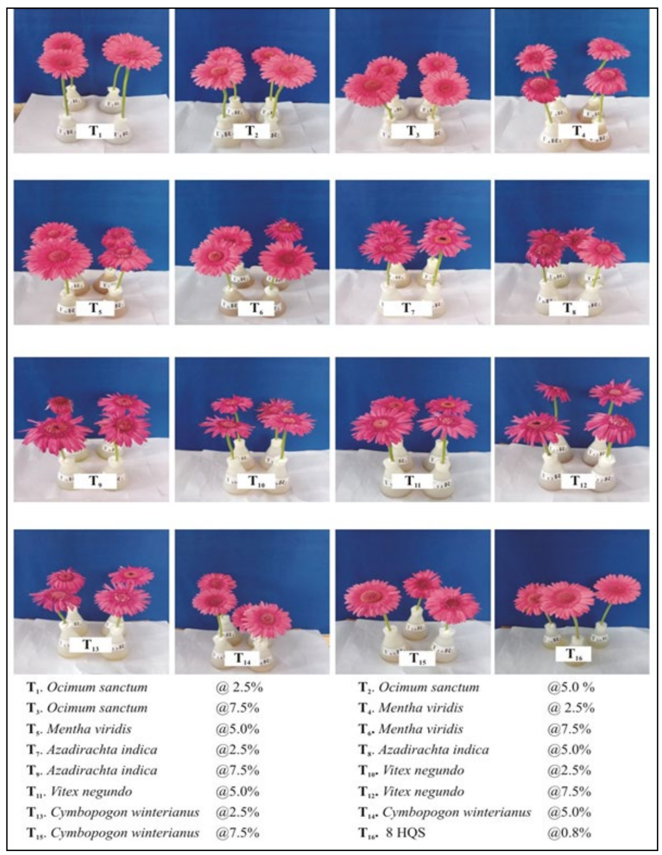

Figure 2: Vase life of gerbera cut flower placed in different plant extract on 9th day of vase period

3.3. *Vase life (days)*

The effect of plant extracts on vaselife ofgerbera flowers is presented in Figure 3. Higher vase life was seen in T_{16} (8 HQS @ 0.8%) (11.86 days) which was at par withT_2 (*Ocimum sanctum* @ 5.0%) (11.54 days). Among different combination the highest vase life (9.82 days) was found in flower treated with vase solution having T_2 (*Ocimum sanctum* @ 5.0%+*Cymbopogon winterianus* @ 5.0%) followed by in flower treated with T_1 (*Ocimum sanctum* @ 5.0%+*Ocimum sanctum* @ 2.5%) (9.35 days).

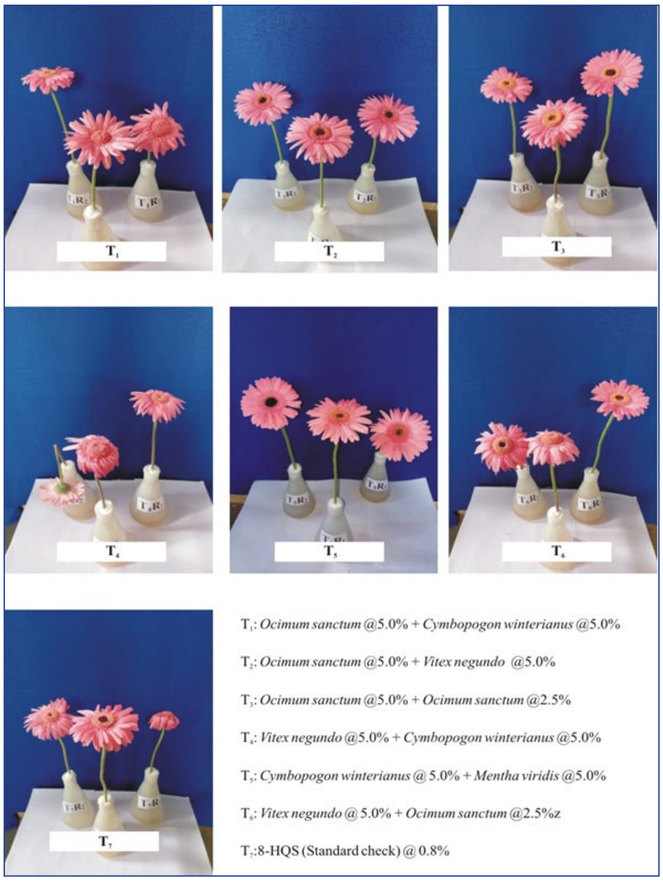

Figure 3: Vase life of gerbera cut flower placed in different combination of plant extract on 7th day of vase period

Antimicrobial activity of plant extracts reduced the xylem occlusion and therefore improved their ability to absorb more vase solution through the increased of vase period under these treatments.These results were in confirmation with the findingsof Bharathi et al. (2019) in which 8 HQS (300 ppm) showed vase life up to 11.95 days in gerbera and Sharma et al. (2015) who recommended that *Ocimum sanctum* @ 2.0% increased vase life in gladiolus.

3.4. *Fresh weight (g days^{-1})*

In different combination of plant extracts, significantly maximum fresh weight was seen in T_3 (*Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%) Day 9 (21.58 g days^{-1}) followed by T_4 (*Ocimum sanctum* @ 2.5%+*Cymbopogon winterianus* @ 5.0%) on Day 9 (21.32 g day^{-1}) as mentioned in Table 1.

Cut flowers remained fresh for a longer period mainly due to sucrose and biocide present in the vase solution influencing better uptake of vase solution maintains a better flower freshness which saves from early wilting and reflecting on vase life improvement. An increase in fresh weight could be attributed to improved vase solution balance in the floral tissue. Similar, findings observed by Solgi et al. (2009) in gerbera and Silva et al. (2013) in gerbera.

3.5. *Microbial load (cfu ml^{-1})*

Lowest microbial load (2.92×10^{-5} cfu ml^{-1}) was recorded in the treatment T_{16} (8 HQS @0.8%) which was at par with T_3 (*Ocimum sanctum*@ 7.5%) (3.11×10^{-5} cfu ml^{-1}) (Figure 1) whereas, minimum microbial load among different combination of plant extract was observed (3.80×10^{-5} cfu ml^{-1}) in flower treated with vase solution having T_3 (*Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%) followed by in flower treated with vase solution having T_1 (*Ocimum sanctum* @ 5.0%+*Ocimum sanctum* @ 2.5%) (4.04×10^{-5} cfu ml^{-1}).

The usage of plant extracts reduced microbial load in the vase solution. The antimicrobial mechanism of botanicals is also due to synthetic inhibition of DNA, RNA, protein and polysaccharides (Gogoi et al., 1997). The alteration of membrane permeability and the defects in the transport of molecules and ions result in a misbalance within the microbial cell. This subsequently leads to cytoplasm coagulation, the denaturation of several enzymes and of cellular proteins and the loss of metabolites and ions (Burt and Reinders, 2003).

4. Conclusion

Chemicalsused in extending the vase life of flowerare toxic in nature, alternatively using of the plant extract is ecofriendly and cost effective. Among the effects of plant extract on the vase life of gerbera flowers T_{16} (8 HQS @0.8%) was on par with T_2 (*Ocimum sanctum* @ 5.0%). T_3 (*Mentha viridis* @ 5.0%+*Ocimum sanctum* @ 5.0%) was found effective in the effect of a combination of plant extracts on the vase life of gerbera flowers.

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