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Effect of essential Oils on Extension of Vase Life of Cut Chrysanthemum cv. Arcticqueen

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ABSTRACT: Cut flowers have become an export income in the global floriculture market. Each type of cut flower has a different vase life and the longevity of their freshness is linked to preharvest, harvest, and postharvest tools and conditions. The postharvest quality and vase life must be considered in order to obtain the desirable qualities of cut flowers, and factors that affect this are important in the floral industry. The use of floral preservative solutions is good practice for prolonging the vase life of cut flowers. Currently, the eco-friendly solutions, which are used as floral preservatives for extending cut flower vase life, have been discovered to be a low-cost and organic alternative as compared to chemical solutions. However, there are certain problems associated with the use of chemical and eco-friendly solutions. The experiment entitled "Effect of essential oils on extension of vase life of cut chrysanthemum cv. arcticqueen" was carried out find out the efficacy of essential oils on physical, physiological and biochemical parameters during the vase life period of chrysanthemum. Artemesia oil, ocimum oil, geranium oil, rosemary oil at 2.5% and 5% concentrations were used after pulsing with 10% sucrose solution. For all the parameter studied geranium oil 2.5% was found well, the reason to might be due to more water uptake more water retention in flower petals of cut chrysanthemum cv. Articqueen.

Keywords: Chrysanthemum, sucrose, Essential oil, Vase life.

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora*) is popularly known as "Queen of East". Chrysanthemum occupies prime position next to rose in the international market. Once the flower gets detached from their mother plant also it continues to perform the activities like respiration, transpiration etc and their ageing process accelerates. To delay their ageing process and to subsequently increase their vase life, postharvest treatment is crucial (Tsegaw *et al.,* 2011). Short postharvest life is one of the most important problems of the cut flowers. Using vase preservatives in vase solutions is one of the most common methods for prolonging cut flowers vase life.

Once flowers are purchased, the longer they last in a vase or flower arrangement, the purchasers would enjoy the aesthetic qualities, fragrance and fresh appearance of cut flowers and the consumers will be encouraged to buy them again. Hence, there is a dire need to explore possibilities of extending the vase life by using different preservatives, antioxidants, antitransparents, Nearly, 30-40 per cent losses of flowers occur due to improper postharvest handling during entire market chain (Singh and Tiwari 2002). Use of some chemical compounds as preservatives for maintaining the longevity of cut flowers are very expensive and most harmful for human, causing irritation to skin, eyes and respiratory tract *etc*. To counter these problems, the essential oils, organic natural substances are safe and environmental friendly due to their strong antimicrobial properties against some pathogens. These antimicrobial properties of organic compounds are attributed to their high levels of phenolic compounds (Lambert *et al.*,

2001; Mihajilov-Krstev *et al.*, 2010). Hence, these oils are widely used to prevent the microbial proliferation in vase solutions which in turn extend the cut flower vase life.

MATERIALS AND METHODS

Artimisia oil, ocimum oil, geraniol and rosemary oil at 2.5% and 5%, solutions were prepared by dissolving 25 ml and 50 ml in ethyl alcohol and Triton × 100 was added to dissolve the oil completely and then final volume was made to one litre by adding distilled water. Chrysanthemum cv. Arctic queen is a spray type. The plant is multi-headed producing white colour flowers with green centre making the flower elegant and attractive, which fetches it a good market price. The cut stem length is about 65 -70 cm. Flower head is 6 to 8 cm diameter. All the treatments in the experiment are pulsed for four hours with sucrose 10% solution (best treatment of first experiment) and kept indifferent concentrations of essential oil solutions for vase life studies (except control).Vase life was determined by recording the number of days 50% of the flowers in treatment remained in good condition without spoilage in each replication during storage, from the start of the experiment until the flower exhibited petal wilting /abscission / petals lost their turgidity (Abadi *et al.*, 2013).

RESULTS AND DISCUSSION

A. Flower weight (g)

The flower weight of cut chrysanthemum flowers differed significantly due to different essential oil treatments. The treatment T_5 (5.71 g) recorded significantly highest fresh weight and the treatment T_9 (4.78 g) recorded significantly lowest fresh weight of flowers which was on par with T_1 (4.96 g), T_2 (4.92 g). There were significant differences in flower weight of cut chrysanthemum flowers during different days of vase life period. The fresh weight of flowers increased from day 2 (5.40 g) day 4 (5.74 g) and fresh weight of cut chrysanthemum flower decreased from day 6 (5.05 g) to day 10 (4.52 g). Significantly highest fresh weight was recorded on day 2 (5.74 g). The data presented in the Table 1 confirms that treatment with geranium oil 2.5% recorded highest fresh flower weight could be due to maximum uptake of water and maximum retention of water due to lower transpiration loss of water which maintained better water relations in cut chrysanthemum flower. These results were in accordance with the findings of Solgi *et al.* (2009) in cut Gerbera, Shanan (2012) in cut Rose cv. Grand, Bhanumurthy (2013) in cut Gerbera cv. Savanna by using different essential oil treatments.

B. Flower diameter (cm)

The cut flowers held in different treatments with essential oils differed significantly for flower diameter of chrysanthemum. The treatment T_5 (5.4 cm) recorded the highest flower diameter which was on par with T_6 (5.1 cm), T_7 (5.1 cm), T_3 (5.0 cm), T_8 (5.0 cm) while the lowest flower diameter was recorded with T_9 (4.7 cm) and all other remaining treatments recorded intermediate values. There were significant differences in flower diameter of cut chrysanthemum during different days on vase life period with essential oil solution. The flower diameter. The data presented in the Table 2 revealed that geranium oil 2.5% recorded the highest flower diameter might be due to more water uptake more water retention in flower petals of cut chrysanthemum cv. Articqueen.

C. Water uptake (g/f)

The cut flowers held in different essential oils differed significantly for water up take of cur chrysanthemum flowers. The treatment T_5 (16.39 g/f) recorded significantly highest water up take (WU) which was on par with T_6 (15.81 g/f), the lowest WU was recorded with T_2 (12.05 g/f) and other treatments recorded intermediate values. There were significant differences in WU with regards to days of storage of cut chrysanthemum cv. Articqueen. Initially the WU increased from day 2 (15.34 g/f) to day 4(17.18 g/f) and then the water uptake gradually decreased from day 4 (17.18 g/f) to day 10 (9.38 g/f).

The observations from Table 3 confirm that the geranium oil at 2.5% recorded highest water uptake, this might be due to presence of sucrose that acts as a respiratory substrate and antibacterial activity of geranium oil prevented the vascular blockage by inhibiting formation of air embolism and colonizing bacterial growth in vase solution. The result were in accordance with findings of Solgi *et al.* (2009) in cut gerbera cv. Dure, Bayat *et al.* (2011) in cut carnations and Shanon (2012) in cut rose cv. Grand, Bhanumurthy (2013) in cut gerbera cv. Savannah.

D. Transpiration loss of water (g/f)

The cut flowers held in different essential oil solution differed significantly for TLW of cut chrysanthemum flowers. The highest TLW was recorded with treatment T_5 (12.31 g/f) which was on par with T_6 (12.05 g/f), T_7 (11.91 g/f), T_8 (11.90 g/f), the lowest TLW was recorded with T_9 (10.95 g/f) and other remaining treatments recorded the intermediate values. There were significant differences were recorded with TLW of cut chrysanthemum flowers with duration of vase life. The TLW gradually increased from day 2 (10.11 g/f) to day 10 (13.11 g/f). It was observed from the Table 4 that the treatments with geranium oil 2.5% recorded the highest transpiration loss of water which could be due to involvement of phenolic compounds of geranium oil in flower metabolic reactions and might have prevented wilting of cut flowers by maintaining better water relations in floral tissues. There results were in line of work by Bhanumurthy (2013) in cut Gerbera flower. From this table it is clear that all the treatments recorded more transpiration loss of water than control.

E. Fresh weight change (g)

The fresh weight change of cut chrysanthemum flowers differed significantly with different treatments of essential oils. The highest fresh weight change was recorded with treatment T_5 (95.82 g) which was on par with T_6 (93.32 g), T_7 (92.75 g), T_8 (90.93 g), the lowest fresh weight change was recorded with T_2 (81.59 g) and all other treatments recorded the intermediate values. There were significant differences in fresh weight change of cut chrysanthemum flowers during different

days of vase life period. The fresh weight change of flowers gradually decreased from day 2 (97.42 g) to day 10 (76.38 g). The data presented in Table 5 revealed that highest FWC was recorded with geranium oil 2.5% due to more WU than TLW. Geranium oil 2.5% has recorded higher fresh weight change, this might be due to the application of these essential oil compounds to cut flowers which reduced water stress damage, improved water uptake which in turn increased the fresh weight change.

F. Relative water content (%)

The RWC of cut chrysanthemum flowers differed significantly due to different essential oil treatments. The treatment T_5 (82.29 %) recorded significantly highest RWC of petals which followed by T_6 (79.52 %), the lowest RWC was recorded with T_9 (72.97 %) and all other remaining treatments recorded the intermediate values. There were significant differences in RWC of petals of cut chrysanthemum flowers during different days of vase life period. The RWC of flowers deserved gradually from day 2 (84.80 %) to day 10 (68.07 %). The data recorded in the Table 6 explains that the treatment with geranium oil 2.5% recorded the highest relative water content of petals might be attributed to the availability of respiratory substrate by pulsing with sucrose 10%, good water uptake by flowers and the flowers placed in control were under severe stress and could not take up and keep water properly, where as geranium oil 2.5% treatments in comparison, at the same time were in normal non-stress conditions. Relative water content is an index representing the amount of water present in the plant organs and shows the ability of a plant maintaining water under stress conditions (Abbaszadeh *et al.,* 2008).

G. Electrolyte leakage (%)

The cut chrysanthemum flowers differed significantly with regards to electrolyte leakage values for different treatments held in different essential oil solutions for holding treatments. The significantly highest electrolyte leakage was recorded with T_4 (89.31%), the lowest electrolyte leakage was recorded was recorded with T_5 (78.49 %) and all other remaining treatments recorded intermediate values for electrolyte leakage. There were significant differences in electrolyte leakage of cut chrysanthemum flowers with different days of vase life period. The electrolyte leakage values gradually increased from day 2 (71.15 %) to day 10 (93.49 %) and day 4 (76.38 %) day 6 (83.42 %), days 8 (88.42 %) recorded the intermediate value of electrolyte leakage with days of vase life period. The data presented in the Table 7 confirm that the treatment with geranium oil 2.5% recorded lowest electrolyte leakage due to better maintenance of membrane integrity. The flowers held in ocimum oil 2.5% recorded highest electrolyte leakage because of loss of cellular integrity due to disturbed water relations.

H. Vase life (days)

The vase life of cut chrysanthemum held in different vase solutions differed significantly. The highest vase life was recorded with T_5 (8.98 days) which was on par with T_6 (8.88 days), T_7 (8.81 days), T_8 (8.82 days) and the lowest vase life was recorded with T_3 (7.5 days) which was on par with T_4 (7.78 days), T_1 (7.94 days), T_2 (8.0 days) T_9 (8.94 days). The data recorded and presented in the Table 8 confirm that pulsing with sucrose 10% and holding in geranium oil 2.5% recorded highest vase life of cut chrysanthemum cv. Articqueen might be due to by maintaining the cell membrane integrity and reducing their sensitivity to ethylene during storage. The antibacterial activity of geranium oils is due to presence of citronella, geraniol, linalool, isomenthone, nerol and citronelly formate (Monika Bigos *et al.,* 2012).

Table 1: Effect of essential oils on flower weight (g) of cut chrysanthemum cv. Arcticqueen.

Treatments	2nd day	4th day	6th day	8th day	10th day	Mean
T1– Artemisia oil 2.5%	5.04	5.53	5.18	4.68	4.39	4.96
T2 –Artemisia oil 5%	5.30	5.51	4.75	4.93	4.14	4.92
T3–Ocimum oil 2.5%	5.30	5.65	4.95	4.73	4.56	5.04
T4–Ocimum oil 5%	5.10	5.59	5.03	4.68	4.43	4.97
T5 –Geranium oil 2.5%	6.17	6.54	5.50	5.29	5.06	5.71
T6 –Geraniumoil 5%	5.58	5.82	5.27	5.02	4.79	5.29
T7-Rosemaryoil 2.5%	5.49	5.69	5.25	4.98	4.71	5.23
T8-Rosemary oil 5%	5.22	5.64	4.96	4.83	4.55	5.04
T9-Control (Distilled water)	5.37	5.69	4.56	4.22	4.08	4.78
Mean	5.40	5.74	5.05	4.82	4.52	5.10
	F test		**S.Em±**		**CD(0.01)**	
Treatment	**		**0.05**		**0.20**	
Day	**		**0.04**		**0.15**	
TXD	*		**0.12**		**0.34**	

**Significant at(P≤0.01); *Significant at(P ≤ 0.05); NS: Not significant

Table 2: Effect of essential oils on flower weight (g) of cut chrysanthemum cv. Arcticqueen.

Treatments	2nd day	4th day	6th day	8th day	10th day	Mean
T1– Artemisia oil 2.5%	5.8	5.5	5.2	4.1	3.8	4.9
T2 –Artemisia oil 5%	5.5	5.3	4.9	4.5	4.2	4.9
T3–Ocimum oil 2.5%	5.4	5.2	5.0	4.7	4.4	5.0
T4–Ocimum oil 5%	5.8	5.4	4.8	4.3	4.2	4.9
T5 –Geranium oil 2.5%	5.8	5.6	5.5	5.2	4.9	5.4
T6 –Geranium oil 5%	5.6	5.3	5.2	4.9	4.4	5.1
T7-Rosemary oil 2.5%	5.6	5.3	5.1	4.9	4.4	5.1
T8-Rosemary oil 5%	5.7	5.3	5.0	4.6	4.3	5.0
T9-Control (Distilled water)	5.5	5.2	4.7	4.3	4.1	4.7
Mean	5.6	5.3	5.0	4.6	4.3	5.0
	F test		**S.Em±**		**CD(0.01)**	
Treatment	**		**0.07**		**0.25**	
Day	**		**0.05**		**0.19**	
TXD	*		**0.15**		**0.43**	

**Significant at(P≤0.01) *Significant at (P≤0.05); NS: Not significant

Table 3: Effect of essential oils on water uptake of cut chrysanthemum cv. Arcticqueen

Treatments	2nd day	4th day	6th day	8th day	10th day	Mean
T1– Artemisia oil 2.5%	15.97	17.77	16.08	14.68	6.48	14.20
T2 –Artemisia oil 5%	14.44	16.09	12.77	10.48	6.47	12.05
T3–Ocimum oil 2.5%	15.34	17.63	15.81	14.76	8.32	14.37
T4–Ocimum oil5 %	15.19	16.93	16.30	14.91	8.21	14.31
T5 –Geranium oil 2.5%	16.02	17.26	16.75	16.19	15.73	16.39
T6 –Geranium oil 5%	15.15	16.88	16.04	15.63	15.37	15.81
T7-Rosemaryo il 2.5%	15.95	18.37	17.81	15.90	8.46	15.30
T8-Rosemary oil 5%	16.45	18.13	16.91	15.32	7.14	14.79
T9-Control (Distilled water)	13.56	15.57	12.78	10.85	8.25	12.20
Mean	15.34	17.18	15.70	14.30	9.38	14.38
	F test		**S.Em±**		**CD(0.01)**	
Treatment	**		**0.15**		**0.54**	
Day	**		**0.11**		**0.41**	
TXD	**		**0.33**		**1.22**	

**Significant at(P≤0.01); *Significant at(P≤0.05); NS: Not significant.

Table 4: Effect of essential oils on TLW of cut chrysanthemum cv. Arcticqueen*

Treatments	2nd day	4th day	6th day	8th day	10th day	Mean
T1– Artemisia oil 2.5%	9.68	10.30	11.16	11.84	13.12	11.22
T2 –Artemisia oil 5%	10.27	10.83	10.92	11.39	11.69	11.02
T3–Ocimum oil 2.5%	10.22	10.85	11.64	12.81	13.46	11.80
T4–Ocimum oil 5%	10.35	10.40	12.11	12.74	13.19	11.76
T5 –Geranium oil 2.5%	10.42	11.65	12.60	12.98	13.89	12.31
T6 –Geranium oil 5%	10.39	11.05	12.30	13.48	13.03	12.05
T7-Rosemary oil 2.5%	9.82	11.11	12.13	12.80	13.69	11.91
T8-Rosemary oil 5%	10.26	10.66	11.81	12.94	13.84	11.90
T9-Control (Distilled water)	9.59	10.05	11.24	11.79	12.09	10.95
Mean	10.11	10.77	11.77	12.53	13.11	11.65
	F test		**S.Em±**		**CD(0.01)**	
Treatment	**		**0.13**		**0.49**	
Day	**		**0.10**		**0.37**	
TXD	*		**0.29**		**0.83**	

*Significant at(P≤0.01);*Significant at(P≤0.05); NS: Not significant

Table 5: Effect of essential oils on FWC of cut chrysanthemum cv. Arcticqueen.

Treatments	2nd day	4th day	6th day	8th day	10th day	Mean
T1– Artemisia oil 2.5%	90.28	88.39	87.92	82.63	77.13	85.27
T2 –Artemisia oil 5%	91.64	88.19	85.69	74.84	67.61	81.59
T3–Ocimum oil 2.5%	97.00	93.86	91.78	76.81	69.58	85.81
T4–Ocimum oil 5%	93.16	81.15	89.21	86.16	78.99	85.73
T5 –Geranium oil 2.5%	106.38	99.99	100.57	89.70	82.47	95.82
T6 –Geranium oil 5%	104.16	99.97	96.57	86.56	79.33	93.32
T7-Rosemary oil 2.5%	101.12	94.64	97.25	88.97	81.74	92.75
T8-Rosemary oil 5%	101.62	98.44	95.49	83.17	75.93	90.93
T9-Control (Distilled water)	91.44	85.90	87.58	81.72	74.65	84.26
Mean	97.42	92.28	92.45	83.39	76.38	88.38
	F test		**S.Em±**		**CD(0.01)**	
Treatment	**		**1.02**		**3.80**	
Day	**		**0.76**		**2.83**	
TXD	**		**2.28**		**8.50**	

**Significant at(P≤0.01); *Significant at(P≤0.05); NS: Not significant

Table 6: Effect of essential oils on RWC of cut chrysanthemum cv. Arcticqueen.

Treatments	2nd day	4th day	6th day	8th day	10th day	Mean
T1– Artemisia oil 2.5%	82.61	79.37	74.98	71.00	64.10	74.41
T2 –Artemisia oil 5%	85.39	79.19	73.33	68.67	64.79	74.27
T3–Ocimum oil 2.5%	81.10	79.84	76.70	73.04	68.21	75.78
T4–Ocimum oil 5%	81.29	76.90	76.65	71.23	67.59	74.73
T5 –Geranium oil 2.5%	88.78	86.28	84.72	78.44	73.23	82.29
T6 –Geranium oil 5%	86.97	82.39	79.89	75.24	73.13	79.52
T7-Rosemary oil 2.5%	85.60	81.70	79.39	76.60	71.78	79.02
T8-Rosemary oil5 %	83.40	81.09	76.17	71.87	67.74	76.05
T9-Control (Distilled water)	88.05	73.95	72.29	68.49	62.08	72.97
Mean	84.80	80.08	77.12	72.73	68.07	76.56
	F test		**S.Em±**		**CD(0.01)**	
Treatment	**		**0.63**		**2.33**	
Day	**		**0.47**		**1.73**	
TXD	**		**1.40**		**5.20**	

**Significant at(P≤0.01); *Significant at(P≤0.05); NS: Not significant

Table 7: Effect of essential oils on EL of cut chrysanthemum cv.Arcticqueen.

Treatments	2nd day	4th day	6th day	8th day	10th day	Mean
T1– Artemisia oil 2.5%	73.42	81.14	83.90	87.22	92.74	83.68
T2 –Artemisia oil 5%	72.86	81.13	86.11	88.04	92.68	84.17
T3–Ocimum oil 2.5%	71.21	76.73	82.80	88.32	93.84	82.58
T4–Ocimum oil 5%	81.14	86.11	90.53	92.18	96.68	89.31
T5 –Geranium oil 2.5%	67.34	70.66	77.83	85.56	91.08	78.49
T6 –Geranium oil 5%	69.00	75.07	81.14	87.22	91.63	80.81
T7-Rosemary oil 2.5%	69.06	71.21	78.94	89.98	96.05	81.03
T8-Rosemary oil 5%	63.48	67.34	86.66	91.18	96.60	81.05
T9-Control (Distilled water)	72.86	78.00	82.98	86.17	90.20	82.04
Mean	71.15	76.38	83.43	88.42	93.49	82.57
	F test		**S.Em±**		**CD(0.01)**	
Treatment	**		**1.13**		**4.20**	
Day	**		**0.84**		**3.13**	
TXD	*		**2.52**		**7.09**	

**Significant at(P≤0.01);*Significant at(P≤0.05); NS: Not significant

Table 8: Effect of essential oils on vase life of cut chrysanthemum cv. Arcticqueen

Treatments	Vase life
T1– Artemisia oil 2.5%	7.94c
T2 -Artemisia oil 5%	8.00c
T3–Ocimum oil 2.5%	7.50c
T4–Ocimum oil 5%	7.78c
T5-Geranium oil 2.5%	8.98a
T6 –Geranium oil 5%	8.88ab
T7- Rosemary oil 2.5%	8.81ab
T8-Rosemary oil 5%	8.82ab
T9-Control(Distilled water)	8.34ab
Mean	8.32
F test	**
S.Em±	**0.20**
CD(0.01)	**0.87**

**Significant at(P≤0.01); *Significant at(P≤0.05); NS: Not significant

CONCLUSIONS

Essential oils derived from Artemesia, ocimum, geranium, rosemary have the ability to maintain the quality and prolong the vase life of cut chrysanthemum cv. Arctic queen. Geranium oil was most effective followed by rose mary oil, ocimum oil and artemesia oil. The essential oils by virtue of their active constituents, were capable of inhibiting microbial growth in the vase solution and stem ends of cut flowers. The effective concentration of geranium oil was found to be 2.5%. Among all the essential oil treatments highest vase life (8.98 days) was recorded with geranium oil 2.5% due to better maintenance of cell water balance, by reducing the cut flower sensitivity to ethylene due to the anti bacterial activity of geranium oil due to the preserve of citranellol, gernaoil, linalool, isomethone. These essential oils are eco friendly alternative to manytoxic preservatives currently used in the flower market. Based on the study, we recommend geranium oil 2.5% to use as preservative solution for commercial application in cut chrysanthemum.

FUTURE SCOPE

The effect of essential oils as vase chemicals on vase life of cut chrysanthemum needs to be explored at different storage temperatures. Exploring different types of packaging materials with different percentages of ventilations after pulsing treatment and holding treatment containing different locally available preservatives, essential oils as vase chemicals for long distance transportation and to ensure proper shipping of flowers without any quality loss. Further research may be carried on histological studies with reference to uptake of water by xylem vessels by using locally available preservatives, essential oils as vase chemicals that are studied in this research work.

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