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Short communication

Studies on keeping quality of dried and dyed Chincherinchee flowers

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ABSTRACT

Chincherinchee flowers were harvested when 10-11 florets were open for conducting studies on keeping quality. Flowers dried in hot air oven and in microwave oven as well as dyed flowers were kept upto 120 days under three conditions of storage *i.e.,* without cover, in cellophane sheets and in paper envelopes. The results indicated that after 120 days of storage duration, maximum score was allotted to flowers which were dried in microwave oven and were kept covered in paper envelopes. Similarly, in case of dyed flowers maximum presentability was found in Yellow fabric dye stored in paper envelopes followed by those stored in cellophane sheets as compared to open (without cover) conditions.

Key words: Dry flowers, microwave drying, hot air oven drying, dyeing, keeping quality.

Dry flowers are rapidly gaining popularity amongst the floriculturists and buyers since they are inexpensive, long lasting and eco-friendly. The products are available throughout the year. Fresh flowers though exquisite in their beauty, are expensive, short lived and available only during a particular season. India's export of floriculture products in the year 2011-12 was 365.32 Rs crores (APEDA, 2). Out of this much of export the dried flowers contribute to 77.1 % followed by cut-flowers, bulbs and rhizomes, cut-foliage and others (APEDA, 3). The top ten cultivated dried flower genera are *Helichrysum* spp, *Helipterum* spp, *Limonium* spp, *Nigella* spp, *Gypsophilla* spp, *Delphinium* spp, *Amaranthus* spp, *Papaver* spp, *Carathamus* spp and *Rosa* spp (APEDA, 1). However, the quest for searching new material which can be utilized as dried flowers never ends and in fact is the demand of the hour. Therefore, the present study was carried out to test *Ornithogalum thyrsoides* Jacq. (Chincherinchee) as a new dry flower crop. It is a bulbous plant of family Liliaceae and is native to South Africa. It produces white coloured cup-shaped flowers in dense racemes. Flower stalks are leafless and produce either a tight cluster of flowers or few flowers in a loose corymb with flowers reaching almost the same height. It is a showy garden plant and the flower sticks are used as cut flowers and are very long lasting. Flower stalks remain in presentable condition even after termination of vase life and hence, can be used as dry flowers. Drying techniques play an important role in the overall quality of the dried produce and the colouring/dyeing enhances their value. But, there is a dearth of literature on the drying aspects of chincherinchee. Also presentability up to a certain length of time is an important aspect to be considered for dry flower produce, therefore an experiment on keeping quality of dried and dyed flowers was conducted. The investigations were conducted in the Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during November 2013 to August 2014. The bulbs of *Ornithogalum thyrsoides* Jacq. were planted in the field in November 2013 under naturally-ventilated polyhouse at the experimental farm of the Department. Standard cultural practices were followed throughout the cropping period till flowering. The flowers were harvested in the months of March and April. Healthy, disease-free and uniform flower stems were harvested when 10-11 florets were open. Flowers were harvested in the morning and immediately after harvesting they were put in water. They were then brought to the laboratory to give various treatments.

The stem length of each cut flower selected for microwave oven experiment was kept 18 cm. Glass jars (20 cm height and 5.5 cm diameter) selected for drying were filled evenly with silica gel up to 5 cm of height. After putting the flowers into the containers the media were poured gently for uniform covering of the florets and filled up to the rim. Drying media were evenly distributed so as to equalize the pressure on all sides of the flower. After this the containers were kept inside the microwave oven for specified duration (microwave time) 3 min. The glass jars were removed after the treatment from the microwave and were kept as such for 24 hours (setting durations).

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For hot air oven drying, the stem length of each cut flower selected for experiment was kept 30 cm. Plastic containers (35 cm height and 3 cm diameter) selected for drying were filled evenly with silica gel. After this, the containers were put for drying in the hot air oven at 50°C for 24 hours.

Flowers dried in hot air oven in silica gel at 50°C for 24 hours (T_1) and those dried in microwave oven in silica gel for 3 min and kept for 24 hours for setting outside the microwave (T_2) were kept upto 120 days under three conditions of storage *i.e.,* without cover (C_1), in cellophane sheets (C_2) and in paper envelopes (C_3). 30 treatment combinations were replicated thrice and the data recorded on various parameters were subjected to statistical analysis with Completely Randomized Design (factorial).

Dried flowers were used for dyeing purpose. Flowers were dyed with Green fabric dye (T_1) , Yellow fabric dye (T_2) , Lemon Yellow food dye (T_3) , Brilliant Green indicator dye (T_4) , Eosin Yellow indicator dye (T_5) and with turmeric *(Curcuma longa)* powder (T_6) as organic dye. Then, the flowers were allowed to dip for 30-60 seconds until complete colour was taken up by the flowers and then taken out from the boiling solution and shade dried over the blotting sheets and later vertically hang dried. After complete drying of dyed flowers, these were transferred in cellophane sheets (C_2), paper envelopes (C_3) and remaining flowers were kept without any cover (C_1) under room conditions for quality evaluation upto 120 days. These 120 days were divided into five durations for taking observations i.e., 0 days (D_1), 30 days (D_2), 60 days (D_3), 90 days (D_4) and 120 days (D_5). 90 treatment combinations were replicated thrice and the data recorded on various parameters were subjected to statistical analysis with Completely Randomized Design (factorial).

Scores for quality parameters were given out of a total of 10 on the basis of flower colour retention (5) and shape retention (5). The colour was recorded as per the colour chart of Royal Horticulture Society, London. Any deviation from the colour recorded on the day after removing the flowers from desiccant or dye solution from 0 day up to 120 days of storage was noted and the points were allotted accordingly. The points were divided into 5 categories *i.e.,* excellent (5 points), very good (4 points), good (3 points), poor (2 points) and very poor (1 point). The shape of flowers was observed on the basis on the shrinkage observed from 0 day onwards for both dried as well as dyed flowers. The points were divided into 5 categories *i.e.,* excellent (5 points), very good (4 points), good (3 points), poor (2 points) and very poor (1 point). Although highest scores for both dried as well as dyed flowers for quality parameters were obtained on 0 day storage under different storage conditions, and subsequently reduced with prolonged storage durations, however for studying the keeping quality, only scores of flowers kept for 120 days were compared so that their keeping quality could be evaluated.

It was found that microwave oven dried (T_2) flowers scored more (8.56) as compared to hot air oven (T_1) dried flowers (7.41). In case of conditions of storage, maximum score (8.37) was allotted when dried flowers were covered with paper envelopes (C_3) whereas minimum score (7.65) was obtained by the flowers which were kept without cover (C_1). On comparing the storage durations, maximum score (9.20) was allotted to the flowers when observed immediately after drying (D_1), while minimum score (7.34) was allotted when flowers were observed after 120 days of storage (D_5).The interaction of treatments × conditions of storage up to 120 days reveals that maximum score (8.95) was allotted to the flowers dried in microwave oven and were covered with paper envelopes (T_2C_3), while minimum score (6.65) was allotted when flowers were dried in hot air oven and were kept without cover (T_1C_1). On comparing storage duration of 120 days, it was found that more score (8.20) was allotted when flowers were dried in microwave oven and were observed after 120 days of storage duration (T_2D_5) as compared to flowers dried in hot air oven (6.49). The interaction conditions of storage × storage duration in Table 1 clearly shows that maximum score for keeping quality were scored by the dried flowers at 0 days storage and reduced with increasing storage duration. After 120 days of storage those flowers scored maximum (7.80) which were covered with cellophane sheet which was found to be statistically at par (7.57) with the flowers covered with paper envelopes. Whereas, minimum score (6.67) was obtained when the flowers were kept without any cover. The interaction of treatments × conditions of storage × storage durations shows that maximum score for keeping quality was scored by the flowers which were stored for 0 days and covered with paper envelopes (9.40). However; after 120 days of storage; maximum score for keeping quality was obtained by microwave dried flower (8.53) covered with paper envelopes ($T_2C_3D_5$) which was found to be statistically at par (8.27) with the microwave dried flowers covered with cellophane sheets ($T_2C_2D_5$). Whereas, minimum score (5.53) was obtained by hot air oven dried flowers stored without any cover after 120 days ($T_1C_1D_5$). Similar observations were confirmed by Biswas and Saha (5) on standardization of drying techniques of calendula where overall acceptability of microwave oven dried flowers was excellent up to a period of 154 days.

Table 1. Effect of conditions of storage (C), storage duration (D) and their interaction on keeping quality of dried *Ornithogalum thyrsoides* Jacq. (Scoring out of 10).

	C_1						C_2						C_3						TxD					T
	D_1	D_2	D_3	D_4	D_5	TxC	D_1	D_2	D_3	D_4	D_5	TxC	D_1	D_2	D_3	D_4	D_5	TxC	D_1	D_2	D_3	D_4	D_5	
T_1	9.00	7.33	6.73	6.13	5.53	6.65	9.00	7.93	7.73	7.53	7.33	7.91	9.00	8.40	7.80	7.20	6.60	7.80	9.00	7.89	7.42	6.96	6.49	7.55
T_2	9.40	8.40	8.20	8.00	7.80	8.36	9.40	8.67	8.53	8.27	8.27	8.66	9.40	9.20	8.87	8.73	8.53	8.95	9.40	8.76	8.53	8.33	8.20	8.56
CxD	9.20	7.87	7.47	7.07	6.67	7.65	9.20	8.30	8.13	7.90	7.80	8.27	9.20	8.80	8.33	7.97	7.57	8.37	9.20	8.32	7.98	7.64	7.34	

$CD_{0.05}$
T=0.12
C=0.14
D=0.18
T×C=0.20
T×D=0.26
C×D=0.32
T×C×D=0.45

T_1= $M_1T_1D_1$(hot air oven dried in silica gel + 50°C + 24 hours)
T_2= $M_1T_1D_1$(microwave oven dried in silica gel + 3 min + 24 hours)

C_1=without cover
C_2=cellophane sheets
C_3= paper envelopes

D_1=0 day
D_2=30 days
D_3=60days
D_4=90 days
D_5=120 days

Moona (8) also reported that hot air oven dried flowers can be stored in a presentable condition for 90 days, if dried in silica gel at 60°C for 24 hours, whereas when dried in a microwave oven they can be stored for a maximum of 150 days with good presentability for which they should be dried by embedding in silica gel for 90 seconds. In both the cases keeping quality was better when they were stored under covered conditions as compared to those stored under open conditions. Oulakh (9) also observed that better keeping quality of dried flowers was observed in selected packaging materials while poor keeping quality was observed in the flowers which were stored in open condition. It might be due to the direct exposure of dried flowers with the environmental factors. The dried flowers arranged in different packaging material in his study resulted in more resistance to shrinkage, colour retention and enhanced keeping quality.

Amongst different treatments of dyed flowers, maximum score (9.26) was attained when flowers were dyed with Yellow Fabric dye in salt (T_2), whereas minimum score (3.26) was given when flowers were dyed with Lemon Yellow Food dye in ordinary water (T_3). In case of conditions of storage, maximum score (6.88) was allotted when dyed flowers were covered with paper envelopes (C_3) while minimum points (6.13) was obtained when flowers were kept without cover (C_1). On comparing the storage durations, maximum score (6.87) was allotted to the flowers when observed immediately after dyeing (D_1), while minimum score (6.08) was assigned when dyed flowers were observed after 120 days of storage (D_5). The interaction of different treatments × conditions of storage reveals that maximum score (9.56) were allotted to the flowers which were dyed with Yellow Fabric dye and were covered with paper envelopes (T_2C_3), while minimum score (2.70) was allotted when flowers were dyed Lemon Yellow Food dye and were kept under open conditions (T_3C_1). The interaction of conditions of storage × storage duration given in Table 2 shows that maximum score (6.68) after 120 days of storage was attained by those flowers which were kept covered in paper envelopes (C_3D_5) while minimum scores (5.54) was allotted to those flowers which were kept without cover and were observed after 120 days of storage (C_1D_5).

In case of dyed flowers maximum presentabilty up to 120 days was recorded in flowers which were dyed with Yellow fabric dye along with addition of sodium chloride in dye solution and kept under paper envelopes followed by cellophane sheets covering than open conditions. The higher score of keeping quality of dried as well as dyed flowers under paper envelopes can be agreed to the reason that the

Table 2. Effect of conditions of storage (C), storage duration (D) and their interaction on keeping quality of dyed *Ornithogalum thyrsoides* Jacq. (Scoring out of 10).

	C_1						C_2						C_3						T
	D_1	D_2	D_3	D_4	D_5	TxC	D_1	D_2	D_3	D_4	D_5	TxC	D_1	D_2	D_3	D_4	D_5	TxC	
T_1	9.10	8.80	8.50	8.20	7.90	8.50	9.10	8.90	8.70	8.50	8.30	8.70	9.30	9.20	9.10	9.00	8.90	9.10	8.77
T_2	9.50	9.20	8.90	8.60	8.30	8.90	9.70	9.50	9.30	9.10	8.90	9.30	9.77	9.67	9.57	9.47	9.37	9.56	9.26
T_3	3.30	3.00	2.70	2.40	2.10	2.70	3.77	3.57	3.37	3.17	2.97	3.37	3.90	3.80	3.70	3.60	3.50	3.70	3.26
T_4	7.10	6.80	6.50	6.20	5.90	6.50	7.03	6.83	6.63	6.43	6.23	6.63	7.50	7.40	7.30	7.20	7.10	7.30	6.81
T_5	8.20	7.90	7.60	7.30	7.00	7.60	8.30	8.10	7.90	7.70	7.50	7.90	8.50	8.40	8.30	8.20	8.10	8.30	7.93
T_6	4.40	4.10	3.80	3.50	3.20	3.80	4.60	4.40	4.17	3.97	3.77	4.18	4.83	4.73	4.63	4.53	4.43	4.63	4.20
C×D	6.70	6.40	6.14	5.84	5.54	6.13	6.83	6.63	6.43	6.23	6.03	6.43	7.08	6.98	6.88	6.78	6.68	6.88	

$CD_{0.05}$ T = 0.06; C = 0.04; D =0.05; TxC=0.10; T_5=(Eosin Yellow indicator dye); CxD =0.08; TxCxD=NS

T_1= (Green fabric dye); T_2= (Yellow fabric dye); T_3= (Lemon Yellow food dye); T_4= (Brilliant Green indicator dye); D_5= 120 days; T_6= *(Curcuma longa*)

D_1= 0 day; D_2= 30 days; D_3= 60 days; D_4= 90 days

C_1= Without cover; C_2= Cellophane sheets; C_3= paper envelopes

flowers have the least exposure to all the factors which reduce the keeping quality *i.e.*, light, relative humidity, dust and insect pest attack under covered conditions. Kumari (7) reported presentability up to 120 days in gomphrena flowers which were dyed with Yellow fabric dye along with addition of sodium chloride in dye solution and kept under newspaper covering followed by cellophane sheets and open conditions. The higher score of keeping quality in newspaper coverings can be agreed to the reason that the flowers have the least exposure to all the factors which reduce the keeping quality i.e., light, relative humidity, dust and insect pest attack under covered condition. These findings are in congruence with the findings of Bhalla *et al.* (4) who also found more perishable flowers of chrysanthemum cv. 'Nanako' under covered conditions as compared to open conditions. Kashyap *et al.* (6) also reported that yellow, dark green, violet, magenta pink fabric dyes and brilliant green, eosin yellow and crystal violet indicator dyes were excellent in performance for dyeing of *Lagurus ovatus* in terms of colour intensity and colour absorption. Food dyes had good quality but the colours fade very fast and retention is poor even after ten months. Among bio-colours, turmeric and lilium pollen are satisfactory, whereas other colours like henna powder, gulmehndi (wild henna), coffee, butea, punica, beet root are very poor in performance, thus cannot be recommended for dyeing.

The results indicated that after 120 days of storage duration, maximum score was allotted to Chincherinchee flowers which were dried in microwave oven and were kept covered in paper envelopes followed by cellophane sheets covering compared to open (without cover) conditions. In case of dyed flowers maximum presentability up to 120 days of storage was found in Yellow fabric dye (6.68) stored in paper envelopes followed by those stored in cellophane sheets as compared to open (without cover) conditions. These dried and dyed flowers with a reasonable presentability of atleast 120 days can be utilized for making different value added products like flower arrangements, hair accessory, doll, magazine holder and greeting card. Value addition creates product diversification that can open new avenues in the floriculture industry.

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