Standardizing dehydration technique for *Centaurea cyanus and Chrysanthemum coronarium*

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Abstract

The present experiment was conducted on standardizing dehydration technique for *Centaurea cyanus* and *Chrysanthemum coronarium* by using embedding drying methods in room temperature (29˚ C). The experiment consisted of 5 treatments with 4 replications designed in completely randomized design. Treatments used were as: T_1 - Fine silica gel, T_2- silica gel + borax mixture (1:1 ratio), T_3 - borax, T_4 – soil, T_5 – sand. In case of *Centaurea cyanus*, maximum reduction in flower weight (0.48 g) and flower diameter (0.30 mm) was recorded in treatment 1 i.e. silica embedded medium at room temperature. Minimum reduction in flower weight (0.38 g) was recorded in treatment 4 i.e. soil embedded medium at room temperature, while the minimum flower diameter reduction (0.10 mm) was recorded in treatment 5 i.e. sand embedded medium at room temperature. In case of drying of *Chrysanthemum coronarium*, maximum reduction in flower weight (1.62 g) and flower diameter (0.30 mm) was recorded in treatment 1 i.e. silica embedded medium at room temperature. Minimum reduction in flower weight (0.42 g) was recorded in treatment 5 and flower diameter (0.12mm) in treatment 4 and treatment 5. Among all the treatments, embedded drying with silica medium was observed showing best results in terms of drying, texture and appearance of these flowers after drying.

Key words: borax, *Centaurea cyanus*, dehydration, dry flowers, embedding drying method, *Chrysanthemum coronarium*, sand, silica gel.

Introduction:

Flowers are closely associated with mankind from the dawn of civilization. The scope and importance of flowers have been realized throughout the world and in this modern age, floriculture has developed into a profitable industry (Sindhuja et al., 2017). Fresh flowers and foliages though exquisite in their beauty, are highly expensive, perishable and cannot retain their beauty and fresh look for a long time. Dried flowers have a great potential as a substitute of fresh flowers (Dhatt et al., 2007). Dry flowers are essential export items both in national and international markets. Indian export of flowers is composed of 71% dry flowers and exported mainly to USA, Japan, Australia, Russia and Europe (De et al., 2016). Dry flower arrangements have been popular in Europe for centuries, and Americans used dry flowers to brighten their homes, especially during the dark winter months as early as 1700 (Brown et al., 2013). Dehydration technique results in decreasing the moisture content and therefore helps to preserve the product for extended shelf life (Muller and Heindl, 2006). In this context, flowers can be dried, preserved and processed to retain its beauty as well as everlasting value and these are natural, inexpensive and have year around availability (Safeena et al., 2006, Shailza *et al*., 2018). Dried and preserved ornamental products offer a wide range of qualities like novelty, longevity, aesthetic properties and year around availability and are less expensive. There are different methods of drying of flowers like air drying, sun drying, hot air oven drying, embedded drying, glycerine drying. In glycerine drying method preserved plant material is less brittle than dried material, making it less prone to shattering and mechanical damage (Raj, 2014). Among all drying method, silica gel embedding drying method is considered as one of the best method for delicate flowers (Sharavani and Sree, 2018).

In India, we have never looked into the tremendous export potential of dry flower industry and till date it is the most neglected industry. After drying the flowers, to maintain the quality of the flowers is the difficult task (Nair et al., 2014). Numerous workers have described varied approaches to dehydrate the flowers and other ornamental plant parts (Bhutani, 1995; Dubois and Joyce, 1989; Westland, 1995). To produce best quality of decorative items and value added products, standardization of drying period of different flowers is necessary. The life of dried flowers varies according to species, texture of their petal and total consistency of flower (Safeena and Patil, 2013). The moisture content in the dried flowers influences the longevity and the moisture content is inversely proportional to longevity (Pandey, 2002).

Centaurea cyanus (corn flower) and *Chrysanthemum coronarium* (annual chrysanthemum) are winter season annuals and their self -life is very less. After harvesting, *Centaurea cyanus* and *Chrysanthemum coronarium* stay fresh for only 3 days. In order to use these flowers for longer duration and year around purpose for decorations and many other purposes drying of these annuals is preferred. Embedding drying is one of the best methods of drying flowers with respect to maintaining the texture and appearance of flower and cost involved as well. Based on this knowledge and importance of dry flowers the objective of present experiment formulated was to evaluate the best dehydration technique for the drying of *Centaurea cyanus* and *Chrysanthemum coronarium*

Material and Methods:

The experiment was carried out at Lovely Professional University, Phagwara from March 3 to April 22, 2021 in the horticultural laboratory of Agriculture block. Winter season annual flowers *Centaurea cyanus* and *Chrysanthemum coronarium* were sown and cultivated in agriculture farm of LPU, Phagwara. The healthy, fresh, good looking, uniform and disease free flowers of these crops were harvested at their commercial stage. After harvesting the flowers were precooled at 4˚ C. The experiment for both *Centaurea cyanus* and *Chrysanthemum coronarium* were laid out in completely randomized design with four repetitions. Experiment consisted of five different embedding material (Silica gel, silica gel + borax mixture in the ratio of 1:1, borax, sand and soil) used for drying of these flowers at room temperature (29˚C). Treatments used were T_1- Silica (room temperature), T_2- Silica gel + Borax [1:1ratio] (room temperature), T_3- Borax (room temperature), T_4 – Soil (room temperature) and T_5-Sand (room temperature).

For this experiment plastic containers was selected and about one inch layer of desiccant as per treatment was poured at the bottom of container and the flower stems were pushed into the medium. The flowers were kept in the erect position, then the desiccant was gently poured all around and over the flower around 4-5cm above, so as to fill the crevices in between the petals without disturbing the shape of flowers. According to the treatment concerns these containers were kept at room temperature (29˚C). While carrying out this experiment proper care was taken in terms of arrangement of flowers in respective desiccants in the containers without damage of petals and proper care was taken such that whole flower is covered with the desiccants. In all the five treatment of drying, after dehydration the containers were tilted for removing the desiccants over and around the flowers and the dried flowers from trays were picked up by hand, cleaned by inverting them and tapping the stems with fingers slowly and gently. After finishing all this process, observation for weight reduction (fresh flower weight – dry flower weight), reduction in flower diameter (fresh flower diameter – dry flower diameter) were recorded. For the color and the texture the rating was given based on their texture and appearance, and the ratings given were 1,2,3,4 and 5 (1- Very poor, 2- Poor, 3-Good, 4 – Very good, 5 - Excellent).

Result and Discussion:

The present experiment performed on standardizing dehydration technique of *Centaurea cyanus* and *Chrysanthemum coronarium* revealed the significant effect of different embedding material on dry flower parameters of these flowers. Data presented in Table 1 showed the significant effect of different dehydration treatment on drying of *Centaurea cyanus*. Maximum reduction in flower weight (0.48 g) was recorded in treatment 1(silica embedded medium at room temperature), which was found to be statistically more from all other treatment. Minimum reduction in flower weight (0.38 g) was recorded in treatment 4 (Soil embedded medium at room temperature). Maximum flower diameter reduction (0.30mm) was recorded in treatment 1 (silica embedded medium at room temperature) which was found to be statistically at par with treatment 2 (0.25 mm) and treatment 3(0.22 mm). Minimum flower diameter reduction (0.10mm) was recorded in treatment 5 (sand embedded medium at room temperature). *Centaurea cyanus* dried with silica embedded medium at room temperature showed good results in terms of texture and appearance after drying. Soil and sand when used as embedding medium showed poor results considering both texture and appearance of dry flower of *Centaurea cyanus* used in this experiment.

Data presented in Table 2 showed the significant effect of different dehydration treatment on drying of *Chrysanthemum coronarium.* Maximum reduction in flower weight (1.62 g) was recorded in treatment 1(silica embedded medium at room temperature). This treatment was found to be statistically superior in term of weight reduction and reduction in diameter of flower as compare to all other treatment used in this experiment. Minimum reduction in flower weight (0.42 g) was recorded in treatment 5 (sand embedded medium at room temperature). Maximum flower diameter reduction (0.30mm) is recorded in treatment 1 (silica embedded medium at room temperature) and the minimum flower diameter reduction (0.12mm) is recorded in treatment 4 (soil embedded medium at room temperature) and treatment 5 (sand embedded medium at room temperature). *Chrysanthemum coronarium* flowers dried with silica embedded medium at room temperature showed good results in terms of texture and appearance after drying. Soil and sand when used as embedding medium showed poor results considering both texture and appearance of dry flower of *Chrysanthemum coronarium* used in this experiment.

It was observed that using silica gel as a dehydration agent at room temperature gave good results when compared to other embedding drying methods. The flower petals became papery when silica gel is used with duration of 30-72 hrs in both *Centaurea cyanus* and *Chrysanthemum coronarium* (Fig. 1). The flowers did not show colour discoloration and were easy to handle and the texture was smooth and appearance was also good. Silica gel is composed of enormous network of interconnecting microscopic pores. These pores attract and hold moisture (Sindhuja et al., 2015) and therefore absorb moisture from fresh flowers. Similar finding has been reported by (Gantait and Mahato., 2015) and (Akram et al., 2021). Silica gel was found to be the best desiccant for fragile flowers as it has the capability to penetrate to microspore and hold the moisture by the action of capillary condensation and adsorption (Sharavani and sree, 2018). In present experiment minimum flower weight reduction has been reported when soil and sand were used as embedding material.

The lesser weight loss in soil and sand may be due to the reason that soil and sand has larger particle size and thus absorbs less moisture. Sand is not able to retain moisture for longer duration also and consequently the moisture is re-absorbed by the flowers (Dilta et al., 2014).

Table 1. Effect of different drying method on weight reduction, flower diameter reduction, texture and appearance of *Centaurea cyanus.*

Treatment (embedding material and temperature)	Weight reduction (g)	Reduction in flower diameter (mm)	Texture	Appearance
T_1 (Silica gel, room temperature)	0.48^{a}	0.30^{a}	5	5
T_2 (Silica gel : Borax, room temperature)	0.43^{c}	0.25^{a}	3	4
T_3 (Borax, room temperature)	0.46^{b}	0.22^{ab}	5	4
T_4 (Soil, room temperature)	0.38^{c}	0.15^{bc}	2	2
T_5 (Sand, room temperature)	0.41^{d}	0.10^{c}	3	2
CD (5 %)	0.01	0.08		

Table 2. Effect of different drying method on weight reduction, flower diameter reduction, texture and appearance of *Chrysanthemum coronarium.*

Treatment (embedding material and temperature)	Weight reduction (g)	Reduction in flower diameter (mm)	Texture	Appearance
T_1 (Silica gel, room temperature)	1.62^{a}	0.30^{a}	5	5
T_2 (Silica gel : Borax, room temperature)	0.94^{b}	0.22^{ab}	3	4
T_3 (Borax, room temperature)	0.88^{b}	0.22^{ab}	4	5
T_4 (Soil, room temperature)	0.74^{c}	0.12^{b}	2	3
T_5 (Sand, room temperature)	0.42^{d}	0.12^{b}	2	2
CD (5 %)	0.06	0.10		

Fig 1. Silica gel embedded dried/dehydrated flowers of A) *Centaurea cyanus* and B) *Chrysanthemum coronarium*

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