

THE ENLARGEMENT OF MADONNA LILY BULBLET IN DIFFERENT SUCROSE CONCENTRATIONS


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ABSTRACT. *Lilium candidum* L. (Madonna lily) is a rare bulbous plant species. It has more than 15 fragrant, bright, white flowers in the racemous form at the end of the long vertical stem. It is widely propagated by scaling method. It is very important commercially to enlarge the bulblet size in a short time. This study was performed to determine the effects of the different sucrose concentrations on the formation and development of the bulblet propagated by the scaling method. After *Lilium candidum* L. bulbs with a circumference of 22-24 cm were cleaned, they were separated into scales and 15 scales were placed in black polyethylene bags with a volume of 5 L. Later, 0, 1, and 2% sucrose solution were given to the bags. The scales were incubated in the storeroom with 18-20 °C temperature for 14 weeks to form bulblets. The highest bulblet number was found in 0% sucrose (control) treatment (2.39 piece/scale). The highest bulblet diameter and bulblet height were determined at 1% and 2% sucrose concentrations.

Keywords: *lilium candidum*, flower bulbs, scaling, propagation, ornamental plants

INTRODUCTION

Lilium candidum L. is a rare bulbous plant species naturally distributed in Türkiye, Greece, Syria, Lebanon and Israel [1]. It is commonly known as “Madonna lily” [2]. Madonna lily is a perennial herbaceous plant species belonging to the *Liliaceae* family. It has an upright stem developing from the bulb. The plant height is between 70 and 150 cm. The flowers bloom between June and July. It has more than 15 flowers in the racemous form on the stem. Its fragrant bright white flowers are larger than 10 cm. The fruits are in the form of capsules [1-4]. The bulb, which is an underground organ, does not have a protective outer scale. It is propagated by generative (seed) and vegetative (scaling, aerial axillary stem bulbils, tissue culture) methods [5]. The plant propagated from seed requires more than 5-6 years to reach enough bulb size to be able to flower. This period can be partially shortened by preferring vegetative propagation methods. The scaling method is commonly used in the propagation of Madonna lily. It is very important commercially to enlarge the size of the bulblet obtained by this method in a short time. The growers are looking for alternative methods which are low cost and require little investment in order to increase the diameter of the bulblet in the bulb propagation. However, most of the researches are on subjects that require high cost and technology such as micropropagation under tissue culture conditions, virus-free bulb production, genetics, plant growth regulators and cold treatment [5, 6, 7, 8]. Except for these studies, the studies on the enlargement of the bulblet in bulb propagation are very limited [9, 10]. There is not any study on *Lilium candidum* L. on this subject. This study is the first research

in which bulblet growth of *Lilium candidum* L was performed with sucrose application. This study was performed to determine the effects of the different sucrose concentrations on the formation and development of the bulblet in the scaling method of *Lilium candidum* L.

MATERIAL AND METHOD

The study was conducted under storeroom conditions with 18-20 °C temperature. *Lilium candidum* L. bulbs with a circumference of 22-24 cm provided from a private company (Yasemin Tarım, İzmir, Türkiye) exporting natural flower bulbs were used in the experiment. The bulbs were kept in a container filled with water for 2 minutes in order to remove the soil on the bulbs. Afterwards, they were cleaned from their soil with a soft brush under tap water. The bulbs were kept on the paper towel until the excess water on the bulbs was removed. Then, the dried outer scales and roots of the bulbs were cleaned with a stationery knife. During the cutting operations, the cutting surface and the stationery knife were frequently wiped with alcohol. Bulb scales were plucked from the bulb base by hand. Then, healthy, plump scales were classified according to length and width. Madonna lily scales with an average length of 34.80 mm and a width of 12.88 mm were used to form bulblets.

Before incubation, the scales were kept for 20 minutes in a solution of 1% Captan and 0.5% Mancozeb (Koruma, Kocaeli, Türkiye) against fungal diseases. Afterwards, the scales were kept in a plastic case to release excess solution under shade conditions. Perlite was used as an incubation media having 0-6 mm particle diameter, pH 7.0, volume weight 70-80 kg/m³ (Genper company, İstanbul, Türkiye). After the black polyethylene bags with a volume of 5 L were filled with 3 L of perlite, 15 scales were placed on the perlite in each bag. Planting was completed by adding 2 L of perlite to the bags. After scale planting, three different treatments were applied to the bags in the form of tap water (0% sucrose), 1% sucrose and 2% sucrose solution.

The experiment was set up according to randomized plot design with three replications and 15 Madonna lily scales were used in each replication (each bag). The scales were incubated in the storeroom with 18-20 °C temperature for 14 weeks to form bulblets. At the end of the incubation, the bags were emptied and bulblet number (piece/scale), bulblet diameter (mm), bulblet weight (g), bulblet length (mm), bulblet scale number (piece/bulblet), and scale weight (g) of the bulblets formed on the scales were measured. Variance analysis (ANOVA), Duncan multiple comparison test ($P \leq 0.05$), and Pearson correlation test were performed with SPSS 26 (IBM SPSS Statistics, Chicago, USA) statistics program.

RESULTS AND DISCUSSIONS

According to the variance analysis, the effect of sucrose treatments in different concentrations on the bulblet weight and scale weight was found to be statistically insignificant. With increasing sucrose concentrations, the bulblet weight increased (Fig. 1a), while scale weight decreased (Fig.1b). The bulblet weight was between 0.79 g and 0.96 g, and the scale weight was between 1.09 g and 1.33 g.

The effect of sucrose treatments on the bulblet number, bulblet diameter, bulblet height and the bulblet scale number was found to be statistically significant ($P \leq .05$). The highest bulblet number was in 0% sucrose (2.39 piece/scale). 1% and 2% sucrose doses were

found in the second statistical group in terms of the bulblet number (Fig. 1c). With increasing sucrose concentration, the bulblet diameter and bulblet height increased (Fig. 1d, e). In terms of the bulblet diameter and bulblet height, 1 and 2% sucrose treatments were in the first statistical group. The concentration of 1% sucrose (3.07 piece) and 0% sucrose (2.94 piece) were found in the first statistical group in terms of the bulblet scale number (Fig. 1f).

Zhang et al. [11] found that the highest percentage of bulblet formation was in the incubation for 75-days in the twin scale propagation of *Hippeastrum vittatum* 'Red lion' bulbs with 30-35 cm bulb circumference under tissue culture conditions. They found the highest bulblet weight and bulblet diameter value in the incubation for 100 days at 25 °C.

Akcal and Kahraman [12] found that the effects of different incubation periods (10, 12, and 14 weeks) on the bulblet diameter, bulblet height, bulblet weight, and bulblet scale number were statistically insignificant in the scale propagation of Madonna lilly bulbs with a circumference of 22-24 cm. During similar incubation periods, larger bulblet were obtained from this study compared to both studies.

Lian et al. [13] found larger and heavier bulblets produced by the medium exchange method (90 g/L sucrose) in *Lilium* Oriental Hybrid 'Casablanca' meristem culture. They stated the uniform availability of NH_4^+ , H_2PO_4^- ions and a relatively high sucrose concentration were probably important for optimum bulblet growth. In this study, higher values were obtained than sucrose treatments.

Kahraman [9] found the effect of different sucrose treatments (control, 1% and 2% sucrose) on the bulblet number, bulblet diameter, bulblet height, and bulblet weight was insignificant in the propagation of summer snowflakes bulbs by chipping technique. In this study, the effect of different sucrose ratios was found to be significant on parameters other than the bulblet weight.

Kahraman [10] found the effect of different sucrose treatments (control, 1% and 2% sucrose) on the bulblet number, bulblet height, and bulblet weight was insignificant, and the effect on the bulblet diameter was significant in the propagation of Snowdrop bulbs by chipping technique. Kahraman [10] noted an increase in bulb diameter and bulb height along with increased sucrose ratios, and the highest bulblet diameter in the 1% and 2% sucrose treatments. In sucrose treatments, the bulblet number was found to be smaller.

A positive correlation was found between the bulblet diameter and bulblet height, bulblet diameter and bulblet weight, bulblet scale number and bulblet diameter, bulblet scale number and bulblet height, bulblet weight and bulblet height ($P \leq .01$). With the increase in the bulblet diameter, the bulblet height (Fig. 2a), the bulblet weight (Fig. 2b), and the bulblet scale number (Fig. 2c) increased. A positive correlation was determined between the bulblet height and the bulblet weight (Fig. 2d), the bulblet scale number and (Fig. 2e).

CONCLUSION

These studies show that plant species respond differently to sucrose doses in bulb propagation. 2% sucrose treatment can be used to enlarge the bulblet in the bulb propagation of Madonna lily, considering the obtained the bulblet diameter, bulblet height, and bulblet weight. Other bulb growing methods can be used together with sucrose doses. For example, after the propagation of Madonna lily, the bulblet can be grown in soilless culture method. It will be useful to investigate such combined methods in future studies.

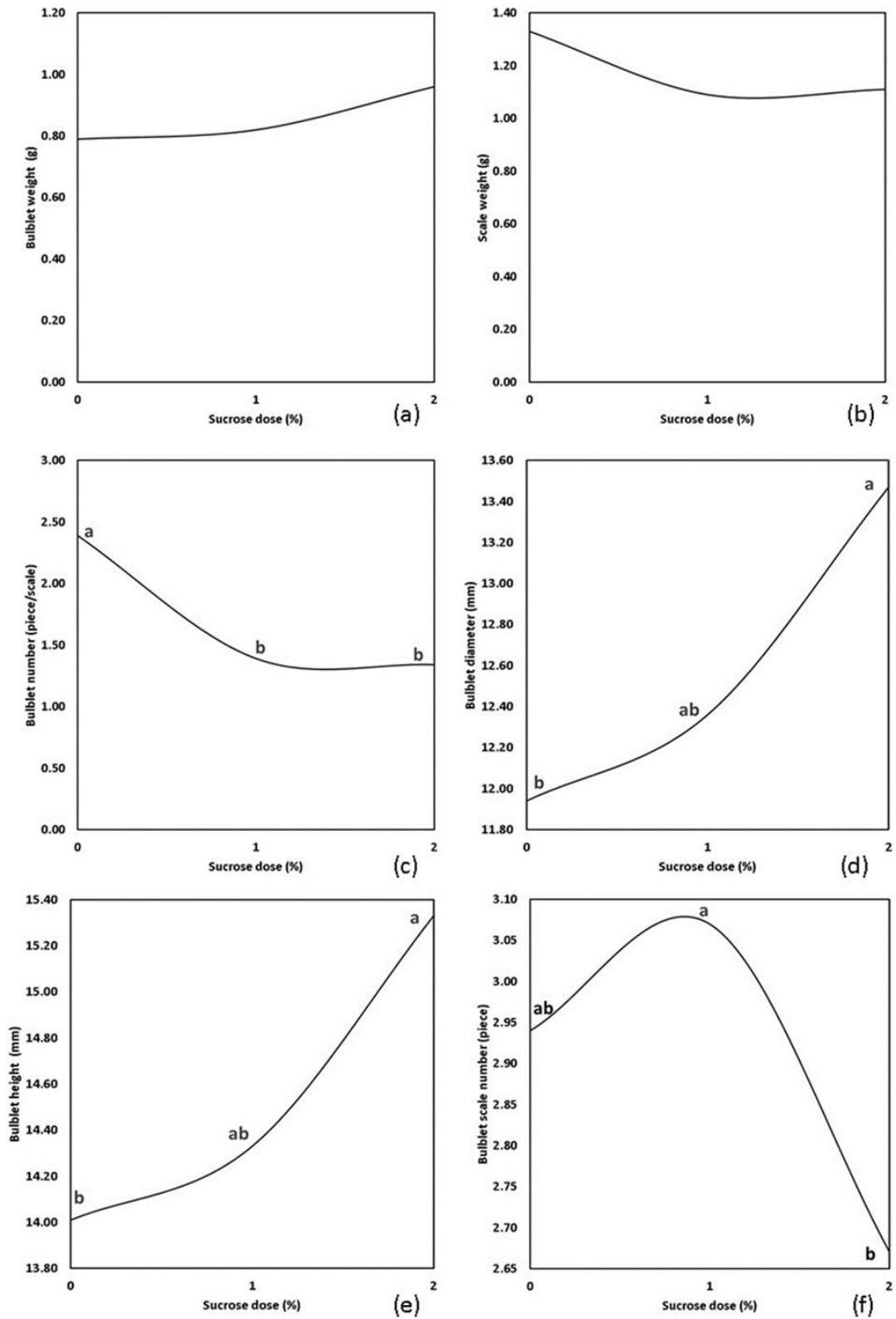


Fig. 1. Effect of sucrose dose rate on bulblet weight (a), scale weight (b), bulblet number (c), bulblet diameter (d), bulblet height (e) and bulblet scale number (f) significant according to $P \leq .01$.

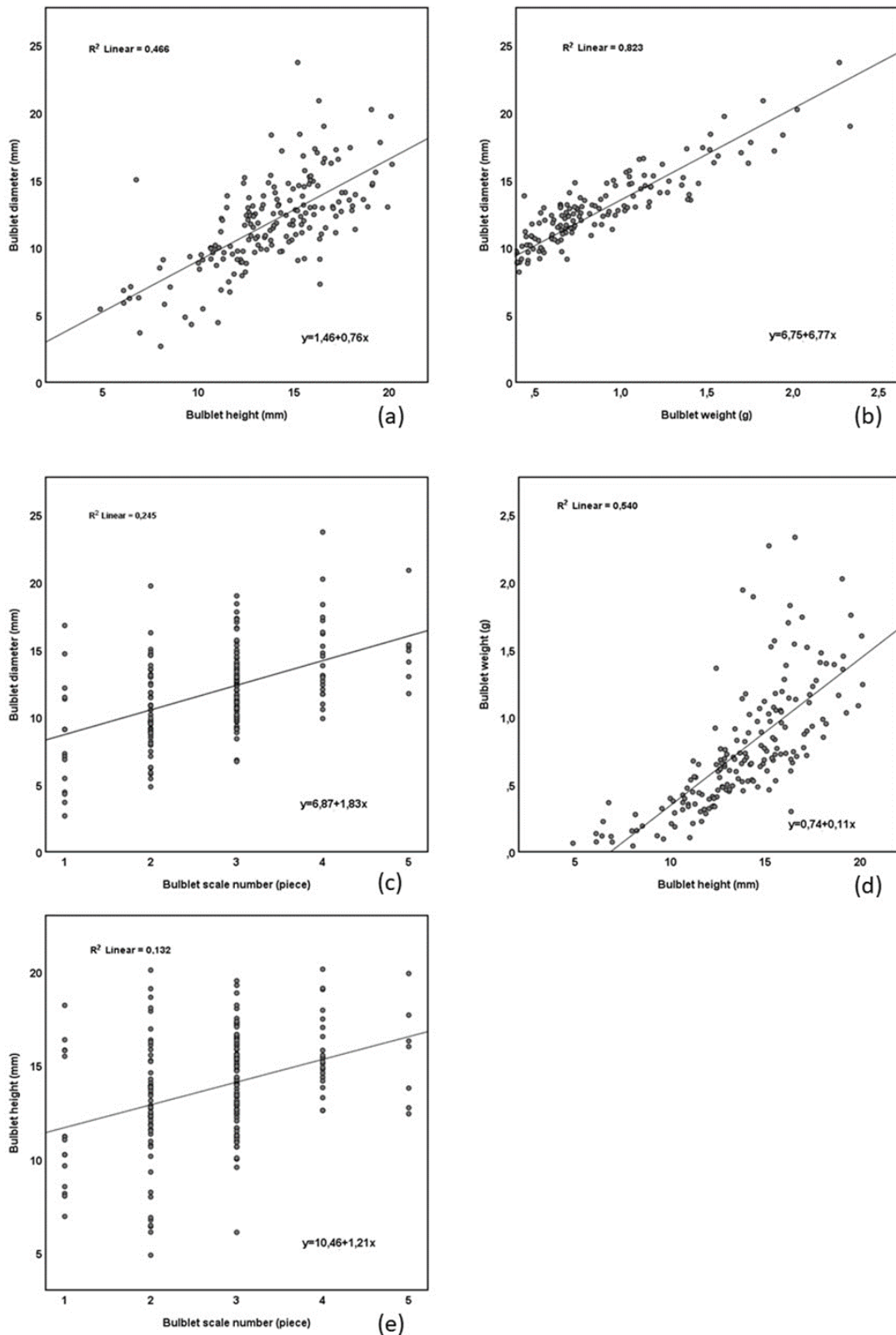


Fig. 2. Correlation between bulblet diameter and bulblet height (a), bulblet diameter and bulblet weight (b), bulblet diameter and bulblet scale number (c), bulblet height and bulblet weight (d), bulblet height and bulblet scale number (f) significant according to $P \leq 0.01$

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