The Effect of Initial Bulb Size on Snowdrop (*Galanthus elwesii* Hook.f.) Bulb Propagation by Chipping

E. Aksu and F.G. Çelikel
Atatürk Central Horticultural Res. Inst.
77102 Yalova, Turkey
e-mail: fgcelikel@ttnet.net.tr

Abstract

Different size (5/6, 6/7, 7/8 and 8/9 cm circumference) of initial bulbs were chipped longitudinally into four equal-sized segments. The bulbil formation and length on the chips after the incubation in perlite at 20°C for 12 weeks were measured. The propagation ratio and the percentage of saleable bulbs were determined after one year growing cycle.

The results showed that initial bulb size is critical for rapid propagation of *Galanthus elwesii* by chipping technique. After incubation, the bulbil formation on the chips was between 91.6 % and 97.5 %. Mean bulbil length on the chips varied from 6.6 mm for the smallest bulbs to 8.6 mm for the largest bulbs. Initial bulb size significantly affected the bulb propagation ratio and harvested bulb size. After one growing season, the number of bulbs obtained per initial bulb varied from 2.6 for 5/6 cm circumference to 5.7 for 8/9 cm bulbs. The ratios of harvested bulbs with a saleable size (larger than 4 cm) for 5/6, 6/7, 7/8 and 8/9 cm circumference were 4 %, 36 %, 59 % and 84 %, respectively.

INTRODUCTION

The greater snowdrop (*Galanthus elwesii* Hook.f.) is the most important and endangered species of wild-collected bulbs in Turkey's flora. It has been collected from the Western Taurus Mountains and exported for more than hundred years. The bulb trade should change away from unsustainable wild collection towards sustainable cultivated propagation in order to protect *Galanthus elwesii*.

Chipping is a good method for *Narcissus* propagation (Fenlon et al., 1990). The apical dominance is broken by cutting bulb longitudinally into chips. It has been shown that *Galanthus nivalis* can be propagated successfully by chipping technique (Hanks, 1991; Leeuwen and Weijden, 1997).

This study aimed to investigate chipping technique and to determine the effect of initial bulb size on propagation of *Galanthus elwesii.*

MATERIAL AND METHODS

Plant Material: The bulbs of snowdrop (*Galanthus elwesii* Hook.f.) collected from the Western Taurus Mountain were obtained from an exporter company at the end of May.

Chipping: In June, after removing the outer scales and outer crust of the basal plate, the top of bulbs were cut off about 0.5 cm. The bulbs were then cut longitudinally by hand into four equal sized segments (chips) as described by Hanks and Phillips (1982).

Incubation: The chips later were dipped in a fungicide solution with 1 % captan + 0.4 % benomyl (Benlate) for half an hour. After dipping and draining, the chips were placed in thin polyethylene bags filled with coarse perlite and distilled water (4: 1, v/v). The bags were then shaken by providing a good mixture of chips with perlite and sealed by ensuring air space at top. The bags were stored in single layers in the dark at 20°C for 12 weeks.

Growth: After incubation, the chips were dipped in the same solution used before incubation for 15 minutes. Six volumes of loamy soil, 4 volumes of coarse sand, 3 volumes of leaf mould and one volume of farmyard manure were mixed. In addition, 6.6 ml super phosphate per liter of the mixture was added. Growth medium was sterilized by

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steam before planting in September. Growth was in polystyrene box (30x45x16 cm) placed in an unheated glasshouse. At the end of one growing season, the bulbs were lifted at the end of May.

Experimental Treatments: The initial bulbs sizes 5/6, 6/7, 7/8, and 8/9 cm circumference were used for the experiment as a variable.

Measurements: The bulbil formation (the percentage of chips with visible bulbil) and the length of each bulbil were measured after incubation. Total number and the size (the largest circumference) of bulbs were determined after harvest. The propagation ratio (the number of harvested bulbs per initial bulb) and the percentage of saleable bulbs (larger than 4 cm size) were calculated.

Statistical Analysis: The experiments were designed as to randomize blocked with 3 replicates. Each replication included 40 chips from 10 bulbs. The data were statistically analyzed using ANOVA and by Duncan test.

RESULTS

Effect of the Initial Bulb Size on Bulbil Formation and Growth

After incubation, the bulbil formation on the chips was between 91.6 % and 97.5 % (Table 1). The initial bulb size significantly ($P<0.05$) affected the bulbil growth during incubation. Mean bulbil length varied from 6.6 mm for the smallest initial bulbs to 8.6 mm for the largest ones (Table 1).

Effect of the Initial Bulb Size on Bulb Propagation Ratio and the Percentage Harvested Bulbs with a Saleable Size (Larger than 4 cm)

Initial bulb size significantly ($P<0.05$) affected the bulb propagation ratio (Table 2). After one growing season, the number of bulbs obtained per initial bulb varied from 2.6 for 5/6 cm circumference to 5.7 for 8/9 cm bulbs. The percentages harvested bulbs with a saleable size (larger than 4 cm) for 5/6, 6/7, 7/8 and 8/9 cm circumference bulbs were 4 %, 36 %, 59 % and 84 %, respectively (Table 2).

The size distributions of the bulbs obtained from each size grade of initial bulbs were given in Table 3. As the initial bulb size increased, the size of the bulbs propagated increased.

DISCUSSION

This research showed that the greater snowdrop (*Galanthus elwesii* Hook.f.) can be propagated successfully by chipping which is commonly used for *Narcissus* (Fenlon et al., 1990), as shown before for *Galanthus nivalis* (Hanks, 1991; Leeuwen and Weijden, 1997). In the study by Hanks (1991) the propagation ratio was between 3.1 and 5.0 in the initial bulbs with 2/3-8/9 cm circumference. In this study, the propagation ratio was 2.6 for 5/6 cm bulbs, and 5.7 for 8/9 cm size (Table 2) and it showed that the initial bulb size significantly affects the bulb propagation in *Galanthus elwesii.* The smallest size gave the lowest propagation ratio and only 4 % of harvested bulbs were saleable. The results suggest that the initial bulb size is critical to increase the yield. The minimum initial bulb size should be 6/7 cm for four chips. The number of chips can be increased for larger grades.

In another previous work on *Galanthus nivalis* by Leeuwen and Weijden (1997), the propagation ratio was 4.0 to 6.5 in initial bulbs of 7/8 and 8/9 cm circumference. The percentage harvested bulbs after two growing seasons with a saleable size (>4 cm) was 60 %. We had similar result for 7/8 bulbs with a higher ratio (84 %) for 8/9 bulbs (Table 2) in one growing season. In spite of shorter period of growth, the higher yield may due to differences in methods (incubating the chips before, instead of direct planting) and species. The high temperature in Marmara Region during summer makes it impossible to plant the chips directly after chipping.

As a conclusion, chipping is a good propagation method for *Galanthus elwesii*, which is of great importance in sustainable use. Further investigation is needed to practice

the method for commercial cultivation by investigating different variable such as longer growing period and planting the chips immediately after chipping in suitable condition to eliminate the incubation.

Literature Cited

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Tables

Table 1. Effect of initial bulb size on bulbil formation (%) and bulbil length (mm) at the end of the incubation period.

Initial bulb size (cm)	Bulbil formation (%)	Bulbil length (mm)
5/6	95.0	6.6 d
6/7	97.5	7.1 c
7/8	93.3	7.8 b
8/9	91.6	8.6 a

Values followed by different letters are significantly different at P<0.05 (Duncan's test).

Table 2. Effect of initial bulb size on bulb propagation ratio (the number of harvested bulbs per initial bulb) and the percentage harvested bulbs with saleable size (larger than 4 cm) after one growing season.

Initial bulb size (cm)	Propagation ratio	% Saleable (>4cm) bulb
5/6	2.6 c	3.8
6/7	4.7 b	35.9
7/8	5.0 ab	59.0
8/9	5.7 a	84.1

Values followed by different letters are significantly different at P<0.05 (Duncan's test).

Table 3. The size distributions of the bulbs produced from different size of initial bulbs (each figure is the mean of 3 replicates and each replicate is a mean for 40 chips, the product of 10 initial bulbs).

Initial bulb	The number of harvested bulbs at different size of circumference						
size (cm)	*0/2*	*2/3*	*3/4*	*4/5*	*5/6*	*6/7*	*7/8*
5/6	5.7	13.3	6.3	1.0	0.0	0.0	0.0
6/7	0.3	7.3	22.7	12.4	4.3	0.3	0.0
7/8	0.3	3.7	16.4	16.3	8.0	4.7	0.3
8/9	0.0	2.0	7.0	14.3	18.0	11.7	3.7