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# Stages of Flower Development and Postproduction Longevity of Potted *Zantedeschia aethiopica* 'Childsiana'

**Julie A. Plummer and T. Eddie Welsh**
*Department of Horticultural Science, Massey University, Palmerston North, New Zealand*

**Allan M. Armitage**
*Department of Horticulture, University of Georgia, Athens, GA 30602*

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***Abstract. Zantedeschia aethiopica* (L.) K. Spreng. 'Childsiana' is a dwarf white calla lily with potential for pot culture. Nine stages of flower development from macrobud to senescence were described and shelf life under a low-light postproduction environment was examined. Flowers at the macrobud stage opened in the postproduction environment. Plants with flowers at the macrobud stage (Stage 1) and plants with spathes fully opened but before pollen shed (Stage 5) had shelf lives of 26 and 11 days, respectively.**

'Childsiana' is a dwarf variant of the common white calla lily and differs from species with colored flowers by having evergreen foliage, rhizomatous storage organs, and handsome prolific white flowers in winter and spring (Bailey and Bailey, 1976) .Dwarfness is a desirable characteristic for pot plant production in this genus, as growth retardants are required to reduce plant height in many of the colored calla hybrids (Tjia, 1987). In *Zantedeschia,* as in other Araceae, the inflorescence consists of many reduced unisexual flowers on a spadix enclosed by a spathe. The spadix and spathe are together referred to as the flower. Propagation techniques have been investigated (Welsh et al., 1988) and potential for pot culture has been recognized (Tjia, 1988).

For new crops to be accepted, flower quality must be maintained in low-light environments-for the retailer and the purchaser (Armitage, 1986). Plant outlets generally have low irradiance, compared with the greenhouse. Removal of plants from the greenhouse to the outlet before development and general quality maintenance of fully open flowers would be beneficial if flower development continued under low-light conditions. The objective of this work was to determine the minimum postproduction life of potted *Z. aethiopica* 'Childsiana' at various flower development stages. However, to evaluate postproduction life, the sequence of flower development from macrobud to flower senescence had to be established. Increased stem and peduncle elongation, and leaf chiorosis occur in many plants when they are grown under reduced light intensity (Einert and Box. 1967: Mackay et al.. 1987). such as found in plant retail outlets. Flower and foliage height were investigated to determine the influence of low light during postproduction treatment.

On 4 Mar. 1988, 2-cm-diameter rhizomes were potted in 700-ml containers using a 80 peat : 20 pumice (v/v) medium. Osmocote (14N-6.2P-11.6K, 1 kg·m$^{-3}$), Osmocote (18N-2.6P-10K, 2 kg·m$^{-3}$), dolomite (5 kg·m$^{-3}$), and Micromax (600 g·m$^{-3}$) were incorporated and water was applied as necessary to maintain vigorous growth. Plants were grown outdoors under ambient light and temperature regimes (Palmerston North, lat. 40°20'S, 12 weeks, average minimum night/day temperature 10/19C).

Plants were brought into a 22 ± 5/13 ± 2C (day/night) greenhouse before flower bud appearance to determine the stages of flower development from macrobud to senescence and for later experiments. The date or' macrobud appearance and subsequent macroscopic changes (Fig. 1) in the flower stages were characterized (Table 1).

For the postproduction experiment, 100 plants were selected for uniformity before macrobud appearance. Plants were randomly placed in five treatment groups. Each group was assigned to be moved to the postproduction area at either Stage 1, 2, 3, 4, or 5 (Fig. 1, Table 1). Peduncle lengths from the medium surface to the base of the spathe were measured when plants were transferred to the postproduction room. It was maintained at 15 µmol·s$^{-1}$·m$^{-2}$, a low light intensity, a 12-hr photoperiod, 20 ± 2C, 60% ± 10% RH, and a ventilation rate of one air exchange every 2 hr, conditions similar to those suggested by Reid and Kofranek (1980) for vase life evaluation of cut flowers. The number of days to reach Stages 5 and 8 (Fig. 1) were recorded, at which time peduncle length was measured. The length from the medium surface to the top of the lamina of the tallest leaf was used to measure foliage height at Stage 8.

Seven of the 100 plants selected for the postproduction experiment did not produce flowers; therefore, each stage consisted of 17 single-plant replicates. In the postproduction room, four flowers did not develop to Stage 5 and a further eight that reached Stage 5 developed distortions, particularly in the spathe, by Stage 8 (Table 2).

In general, flowers from all stages opened in the postproduction room. Plants transferred at Stage 1 reached Stage 8 after 26 days, but those transferred at later stages had successively shorter shelf lives. For example, plants transferred at Stage 5 reached Stage

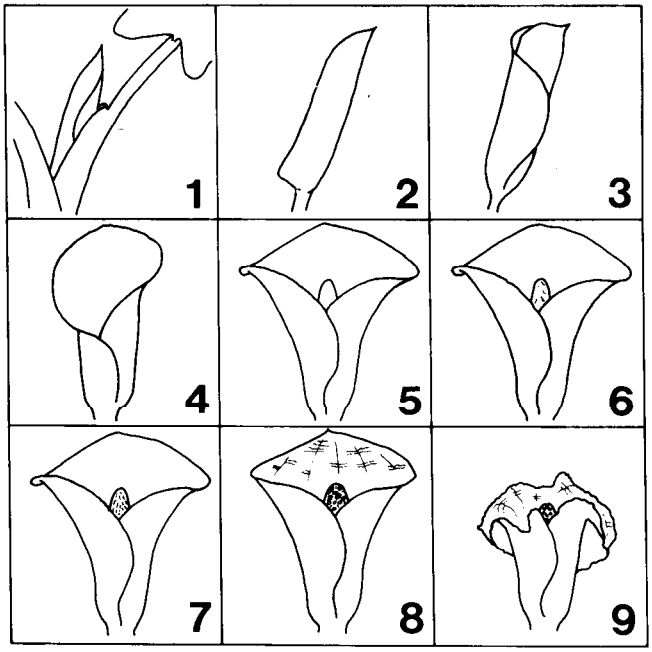


Fig. 1. Stages of flower development in *Zantedeschia aethiopica* 'Childsiana' from macrobud until senescence.

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Table 1. Stages of flower development in potted plants of *Zantedeschia aethiopica* 'Childsiana' grown in a 22/13C (day/night) greenhouse. Descriptions mark the commencement of the stage. Duration ± SE; mean of 20 flowers.

| Stage | Duration (days) | Description |
|---|---|---|
| 1 | 3.1 ± 0.2 | Spathe green and at least partially enclosed by leaf sheath. |
| 2 | 3.8 ± 0.3 | Spathe green, tightly closed around spadix. Peduncle visible. |
| 3 | 3.5 ± 0.3 | Spathe beginning to open and turn white. |
| 4 | 4.0 ± 0.3 | Spathe white and opening. Spadix visible down tube of spathe. |
| 5 | 4.2 ± 0.2 | Spathe white, fully open. No pollen shed. |
| 6 | 4.7 ± 0.3 | Spathe white, fully open. Pollen shed commences. |
| 7 | 5.0 ± 0.3 | Spathe white, fully open. All pollen shed. |
| 8 | 4.5 ± 0.3 | Spathe blemished. Outer spathe translucent. Spathe edge beginning to turn brown. |
| 9 | Until senescence | Spathe brown and withered. |

Table 2. The effect of flower stage on postproduction flower development of *Zantedeschia aethiopica* 'Childsiana' plants that produced flowers.[z]

| Flower stage | Plants to reach Stage 5 (%) | Days to Stage 5 | | Plants to reach Stage 8 (%) | Total shelf life (days) |
|---|---|---|---|---|---|
| 1 | 90 | 12.2 | a | 85 | 26.0 a |
| 2 | 100 | 6.6 | b | 85 | 18.6 b |
| 3 | 89 | 5.2 | b | 78 | 16.1 c |
| 4 | 100 | 5.3 | b | 94 | 14.4 d |
| 5 | 100 | NA | | 94 | 11.4 e |

[z]Mean separation within columns by LSD, $\alpha = 0.05$.

8 after 11 days (Table 2). Shelf life commenced when plants were transferred to the postproduction room. In plants transferred at an early stage, this included a period when spathes were closed. The beginning of Stage 8 (Fig. 1) was regarded as the termination of shelf life, as spathes began to blemish and turn brown. Spathes did not regreen as with colored calla hybrids (Funnell and Downs, 1987). Flowers were fully opened and unblemished from Stage 5 to the commencement of Stage 8. Neither the duration of this period nor the total period of flower development (Stages 1 to 8) was affected by the differences in environment experienced between the greenhouse (Table 1) and the postproduction room (Table 2). The most important period was the display of opened, unblemished spathes (Stages 5 to 8), which was the same, regardless of the time of transfer. This fact certainly suits the plant for early removal from the production environment and allows shipping at a stage when the spathe would not be damaged.

The rate of peduncle elongation in the greenhouse was greatest during Stage 1 when there was a 6-fold increase in peduncle length. Peduncles continued to elongate during later stages (Table 3), but at reduced rates. There were no differences in peduncle elongation between transfer at Stage 1 and holding plants in the greenhouse until Stage 4 (Table 3). However, at Stage 8, plants transferred to the postproduction room at Stage 1 had 32% longer peduncles than those transferred at Stage 5. We attribute this difference to the longer period of low light experienced by plants transferred at Stage 1 (Einert and Box, 1967; Mackay et al., 1987). Differences in foliage height were insignificant (Table 3), and no leaf color changes were observed in response to low light. The minimal decrease in peduncle length seen in plants transferred at Stage 5 did not affect the visual appeal of the plant.

In summary, the majority of flowers developed to Stage 8 in the postproduction room, regardless of the stage at which they were transferred. Low light had little effect on peduncle length and foliage height and this did not detract from the aesthetics of the plant. The data suggest that growers of potted 'Childsiana' could transport and sell plants at Stage 1 to a plant outlet with dim light without loss of flower development or flower quality. However, ≈13% of plants would not develop flowers to maturity. Waiting until the spathes opened would increase the ability to detect abnormal flowers, but would increase the risk of damage to flowers in transit. This work has indicated *Z. aethiopica* 'Childsiana' to be a unique and long-lasting potted plant and its tolerance to low light makes 'it ideally suited to indoor environments.

Table 3. The effect of flower stage on peduncle elongation in *Zantedeschia aethiopica* 'Childsiana' in a postoroduction environment.

| Flower stage at transfer | Initial peduncle length (cm) | Postproduction[z] | | |
|---|---|---|---|---|
| | | Peduncle length at Stage 5 (cm) | Peduncle length at Stage 8 (cm) | Foliage height at Stage 8 (cm) |
| 1 | 0.9 a | 16.3 a | 19.7 a | 17.1 a |
| 2 | 5.6 b | 14.2 ab | 17.1 ab | 16.8 a |
| 3 | 9.3 c | 14.8 ab | 17.2 ab | 16.5 a |
| 4 | 10.0 c | 14.2 ab | 16.4 ab | 14.5 a |
| 5 | 12.1 d | 12.1 b | 15.3 b | 15.1 a |

[z]Mean separation within columns by LSD, $\alpha = 0.05$.

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