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POSTHARVEST STUDIES OF THE WHITE CALLA LILY,
ZANTEDESCHIA AETHIOPICA

B. Tjia
Department of Ornamental Horticulture
University of Florida
Gainesville, FL 32611

ABSTRACT

Inflorescences of Zantedeschia aethiopica Sprenge (calla lily) were placed in various holding solutions for postharvest life comparisons. Solutions containing deionized water (DI), 200 ppm eight-hydroxyquinoline citrate (8-HQC), 200 ppm 8-HQC + 0.025 M sucrose, 200 ppm 8-HQC + 0.025 M sucrose + 50 ppm dithiothreitol (DTE), or 50 ppm DTE did not significantly increase the vase life of Z. aethiopica; all lasted 6 to 7 days. Removal of spadices prior to placement in the solutions also did not increase the vase life. Holding solutions buffered to pH's of 3, 5, or 7 did not affect spathe longevity. A steady decrease in weight of spathe was observed with time, whereas an increase in weight was observed in the scapes and spadices. It is suspected that a greater percentage of water was translocated and transpired through the scape than through the spathes. Scanning electron micrographs showed no obstructions or disjunction of water conduction tissue from the scape to the spathes and spadices.

RESUMEN

Inflorescencias de Zantedeschia aethiopica Sprenge (calla lily) fueron metidas en varias soluciones para comparar la duración de vida pos-cosecha. Soluciones de agua deionizada, 200 ppm ocho-hidroxiquinolina citrato (8-HQC), 200 ppm 8-HQC + 0.025 M sacarosa, 200 ppm 8-HQC + 0.025 M sacarosa + 50 ppm diotioetil (DTE), o 50 ppm DTE no aumentaron significativamente la vida pos-cosecha de Z. aethiopica; todas duraron 6 a 7 días. Eliminación de espadices antes de poner las inflorescencias en solución tampoco aumentó la vida pos-cosecha. El ajuste de las soluciones al pH de 3, 5, o 7 no afectó la longevidad de las espatas. Con tiempo, una diminución constante del peso de las espatas fue observado, mientras se notó un aumento en peso en los escapos y las espadices. Se sospecha que un mayor porcentaje de agua fue translocada y transpirada por el escapo que por las espatas. Exámen con electronmicroscopio no reveló obstrucciones o desincidencia en tejidos de conducir agua desde el escapo a las espatas y espadices.

Limited investigations have been conducted on the keeping quality of Zantedeschia aethiopica (calla lily) inflorescences. Several commercially available preservatives were reported to not increase vase life of Zantedeschia and to decrease keeping quality by causing accelerated dehydration and browning of spathes (1). The lack of data on the beneficial effect of present day preservatives on Z. aethiopica and to investigate if the vascular tissue from the scape connects to the spathes and spadices.

Materials and Methods

Experiment 1. Inflorescences from field grown Zantedeschia aethiopica were harvested during late afternoon and transported to the Plant Health and Horticulture laboratories at Massey University, Palmerston North, New Zealand, and scapes recut to uniform 40-cm lengths, measured from the bottom of the spathe. They were then placed in a pulsing solution containing 0.1 M sucrose and 0.5 g iprodione for 12 hours to prevent splitting of scapes and alternaria flower spot from developing (2). Following pulse treatment, the scapes were wiped clean and placed in either deionized water (DI), 200 ppm eight hydroxyquinoline citrate (8-HQC), 8-HQC + 0.025 M sucrose, 8-HQC + 0.025 M sucrose + 50 ppm dithiothreitol (DTE) or 50 ppm DTE. Each treatment consisted of 6 flowers. Laboratory conditions where flowers were placed were as follows: relative humidity 55-65%, temperature 20-24°C, and fluorescent lights were turned on from 0700 to 1700 hours. Flowers were discarded when either the spathe began to wilt or edges began to show signs of browning.

Experiment 2. Another set of 108 flowers were pulsed the same way as in Experiment 1. Each flower served as a replicate. The spadices on half of them were carefully removed with a sharp razor blade and all flowers were then placed in DI water. Each day spathes of flowers with spadices intact and 6 flowers which had the spadices removed were cut. Weights of spathes were expressed as percentages of the total inflorescence weight.

Experiment 3. Another set of Zantedeschia inflorescences were harvested and pulsed as in Experiment 1 and then placed in a phosphate buffer solution adjusted to pH of 3, 5, or 7. Each day, for 7 days, 6 inflorescences were cut into scapes, spathes, and spadices and weighed separately. Weights of scapes, spathes, and spadices were expressed as percentages of the total inflorescence weight.

Experiment 4. For electron micrograph studies, Zantedeschia flowers were held in DI water for 1 day. Then scape tissue samples were taken 35 cm below the spathe, at the base of spadix and spath, and at the junction of spathe and scape (longitudinal section). Three- to 4-mm slices of tissue were fixed overnight in 3% glutaraldehyde, plus 2% formaldehyde in 0.1 M phosphate buffer at pH 7.2. They were vacuum infiltrated to remove air pockets. The pieces were sliced with a razor blade into 1-mm slices and left in the primary fixative for 2-3 hours, followed by 4 buffer washes.
and an ethanol dehydration series. Samples were
critical point dried by liquid CO₂ in a Polaron E-3000
critical point drier. The dried specimens were
ruled to aluminum stubs with conducting silver paint,
sputter coated with 100-200 A of gold, and viewed
in a Cwikscan 100 field emission scanning electron
microscope wing at 16 Kv acceleration voltage.

Results and Discussion

Placing inflorescences of Zantedeschia in various
holding solutions did not increase vase life (Table 1),
which suggests that the lack of respiratory substrates
may not be the main cause for decline. All inflorescences
in the various holding solutions eventually dry
out at the same time, which caused a gradual shrivel-
ing and brown necrotic spots on margins of spathes.
The desiccation may have been due to reduced water
supply caused by increased resistance of water flow
in the scape.

When spathes with intact inflorescence fresh weights
were compared to inflorescences with spadices
removed prior to placement in the vase solution,
there were no differences in weight change (Fig.1).
This means that there is no advantage in removing
spadices of Zantedeschia prior to placement in the
vase to retain higher fresh weight of spathes.

Placement of inflorescences in solutions with increas-
ing alkalinity (pH 3, 5, or 7) did not increase the vase
life. When spathes, scapes, and spadices were separat-
ed and weighed, solution pH did not cause differences
with respect to weight distribution patterns over the
7 days. Spathe weight as a percent of total inflor-
escence weight gradually decreased with time (Fig. 2)
in all 3 pH solutions, but percentages increased on
scapes (Fig. 3) and spadices (Fig. 4).

Previous observations on the presence and distribu-
tion of stomates revealed smaller numbers of
stomates per unit area on the upper and lower
side of spathes, compared to scapes (3). This suggests
that most water loss was through the scapes. How-
ever, transverse and longitudinal sections taken at
the junction of scapes and spathes revealed water
conducting tissue to continue all the way to the
spathes and spadices (Fig. 5).

In conclusion Zantedeschia did not show any increase
in postharvest life when placed in solutions contain-
ing preservatives or preservatives with sucrose. Rem-
oval of spadices prior to placement in holding
solutions also did not increase postharvest life.
Inflorescences lasted 6 to 7 days. Scapes and spadices
gradually increased in fresh weight with time, whereas
spathes gradually decreased. The conducting tissue of
Zantedeschia was found to be continuous from the
scapes to the spathes and spadices.

Table 1 Post-harvest life of Zantedeschia aethiopica held in various
holding solutions.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average vase life *</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI water</td>
<td>7.0 a</td>
</tr>
<tr>
<td>200 ppm 8-HQC</td>
<td>6.8 a</td>
</tr>
<tr>
<td>200 ppm 8-HQC + 0.025 M sucrose</td>
<td>6.0 a</td>
</tr>
<tr>
<td>50 ppm DTE</td>
<td>7.6 a</td>
</tr>
<tr>
<td>200 ppm 8-HQC + 50 ppm DTE</td>
<td>6.7 a</td>
</tr>
<tr>
<td>200 ppm 8-HQC + ppm DTE + 0.025 M Sucrose</td>
<td>7.3 a</td>
</tr>
</tbody>
</table>

*8-hydroxy quinoline citrate (8 HQC)
y dithiothreitol (DTE)
* Duncan's multiple range test, 5% level. Means with the same letter are not significantly
different.

Literature Cited

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Fig. 1. Comparison of weight distribution of *Zantedeschia aethiopica* intact spathes placed in DI water \( (y = 38.537 - 11.407x + 1.741x^2 - 0.089x^3) \) with those that had the spadices removed \( (y = 31.029 - 6.813x + 1.138x^2 - 0.068x^3) \).

Fig. 2. Effect of phosphate buffer adjusted to pH 3, 5, and 7 on weight distribution of *Zantedeschia aethiopica* spathes. Spathes placed at pH 3 \( (y = 18.746 - 1.209x) \), pH 5 \( (y = 19.464x) \) or pH \( (y = 19.724 - 1.438x) \) did not show any appreciable differences.
Fig. 3. Effect of phosphate buffer adjusted to pH 3, 5, 7 on weight increase of *Zantedeschia aethiopica* scapes. pH 3 \(y = 75.482 + 0.904x\), pH 5 \(y = 75.370x + 1.004x\) or pH \(y = 73.728 + 1.178x\).

Fig. 4. Effect of phosphate buffer adjusted to pH 3, 5, and 7 on weight distribution of *Zantedeschia aethiopica* spadices. pH 3 \(y = 5.655 + 0.306x\), pH 5 \(y = 1.00x\), pH 7 \(y = 5.260 + 0.385x\).
Fig. 5. SEM photomicrograph of *Zantedeschia aethiopica* water conducting tissue.

A. Scape 35cm from the base of the spathe (transverse section)
B. Scape below the spathe (transverse section)
C. Junction of spathe and scape (longitudinal section)
D. Base of spadix (transverse section)