JOINT PROCEEDINGS

TROPICAL REGION

21st Annual Meeting of the Caribbean Food Crops Society and 32nd Annual Meeting of the American Society for Horticultural Science — Tropical Region

technology for agricultural development

Hilton Hotel, Port of Spain, Trinidad
8 - 13 September 1985

Host Institutions

— Caribbean Agricultural Research and Development Institute

— Ministry of Agriculture, Lands and Food Production, Trinidad & Tobago

— Faculty of Agriculture, University of the West Indies

Published by the Caribbean Food Crops Society, Box 506, Isabela, Puerto Rico 00662

POSTHARVEST STUDIES OF THE WHITE CALLA LILY, *ZANTEDESCHIA AETHIOPICA*

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ABSTRACT

Inflorescences of *Zantedeschia aethiopica* Spreng (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 spathes 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 disjuction of water conduction tissue from the scape to the spathes and spadices.

RESUMEN

Infloresencias de *Zantedeschia aethiopica* Spreng (calla lily) fueron metidas en varias soluciones para comparar la duración de vida pos-cosecha. Soluciones de agua deionizada, 200 ppm ocho-hydroxyquinoline citrate (8-HQC), 200 ppm 8-HQC + 0.025 M sucrosa, 200 ppm 8-HQC + 0.025 M sucrosa + 50 ppm dithiothreitol (DTE), o 50 ppm DTE no aumentaron significativamente la vida pos-cosecha de *Z. aethiopica;* todas duraron 6 o 7 días. Eliminación de espadices antes de poner las infloresencias 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. Examinación con electromicroscopio no reveló obstrucciones o disyunción en tejidos de conducir agua desde el escapo a las espatas y espadices.

Additional index words: 8-hydroxy quinoline citrate, flower preservative, dithiothreitol.

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 *Zantedeschia* inflorescences prompted this study, designed to determine if preservatives or water with increasing alkalinity would increase the keeping quality of *Zantedeschia* 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 hydroxy quinoline 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 spathe, 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 CO_2 in a Polaron E-3000 critical point drier. The dried specimens were glued 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 shrivelling 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 increasing alkalinity (pH 3, 5, or 7) did not increase the vase life. When spathes, scapes, and spadices were separated 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 inflorescence 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 distribution 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. However, 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 containing preservatives or preservatives with sucrose. Removal 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.

Literature Cited

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2. Tjia, B. and K.A. Funnell. 1985. *Zantedeschia aethiopica* control of stem split and alternaria flower spot following harvest. New Zealand Horticulture, April: 28-29.

3. Tjia, B. and K.K. Funnell. 1985. Postharvest studies of cut *Zantedeschia* inflorescences. Proceedings. Intl. Post Harvest Symposium Noordwykerhout, Netherlands, July 1-4 (in press).

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

Treatment	Average vase life[z] (days)
DI water	7.0 a
200 ppm 8-HQC	6.8 a
200 ppm 8- HQC + 0.025 M sucrose	6.0 a
50 ppm DTE	7.6 a
200 ppm 8 HQC[x] + 50 ppm DTE[y]	6.7 a
200 ppm 8 - HQC + ppm DTE + 0.025 M Sucrose	7.3 a

[x]8-hydroxy quinoline citrate (8 HQC)

[y] dithiothreitol (DTE)

[z]Duncan's multiple range test, 5% level. Means with the same letter are not significantly different.

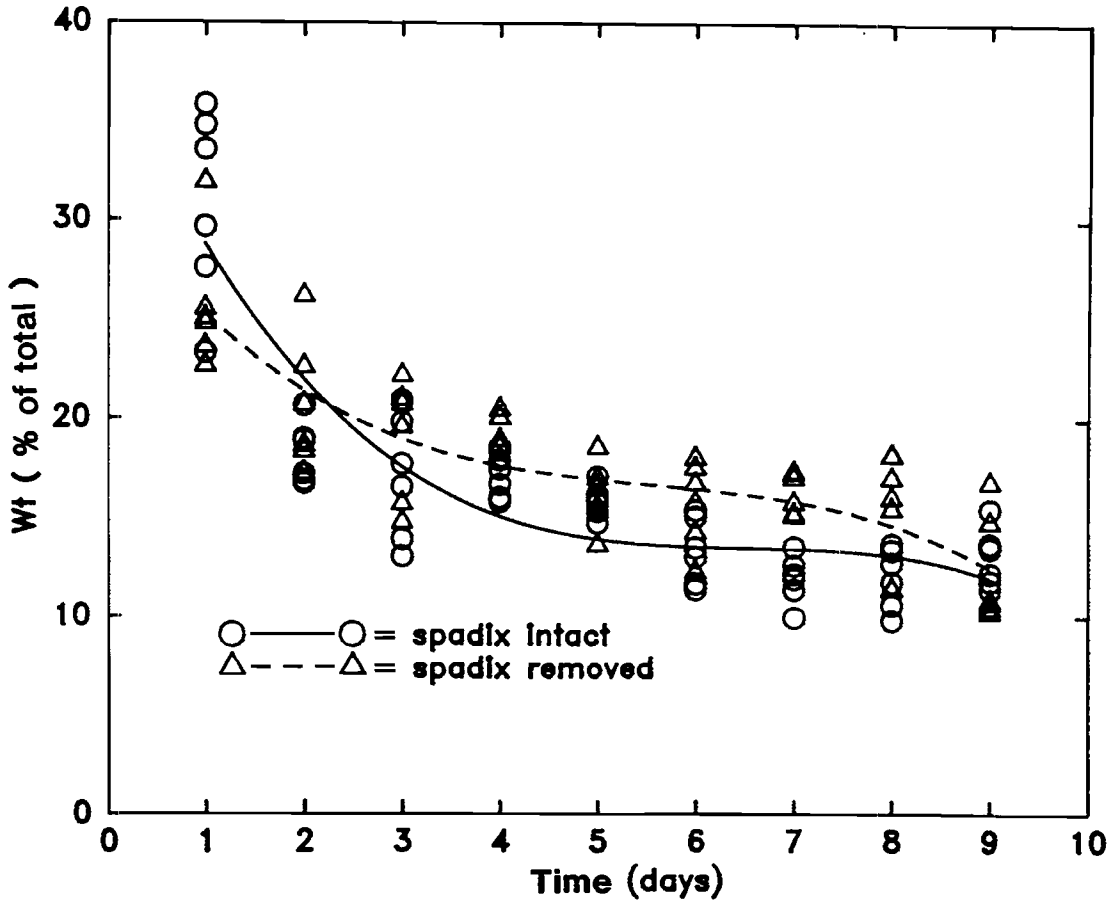

Fig. 1. Comparison of weight distribution of *Zantedeschia aethiopica* intact spathes placed in DI water ($y = 38.537 - 11.407x + 1.741x^2 - 0.089x^3$) with those that had the spadices removed ($y = 31.029 - 6.813x + 1.138x^2 - 0.068x^3$).

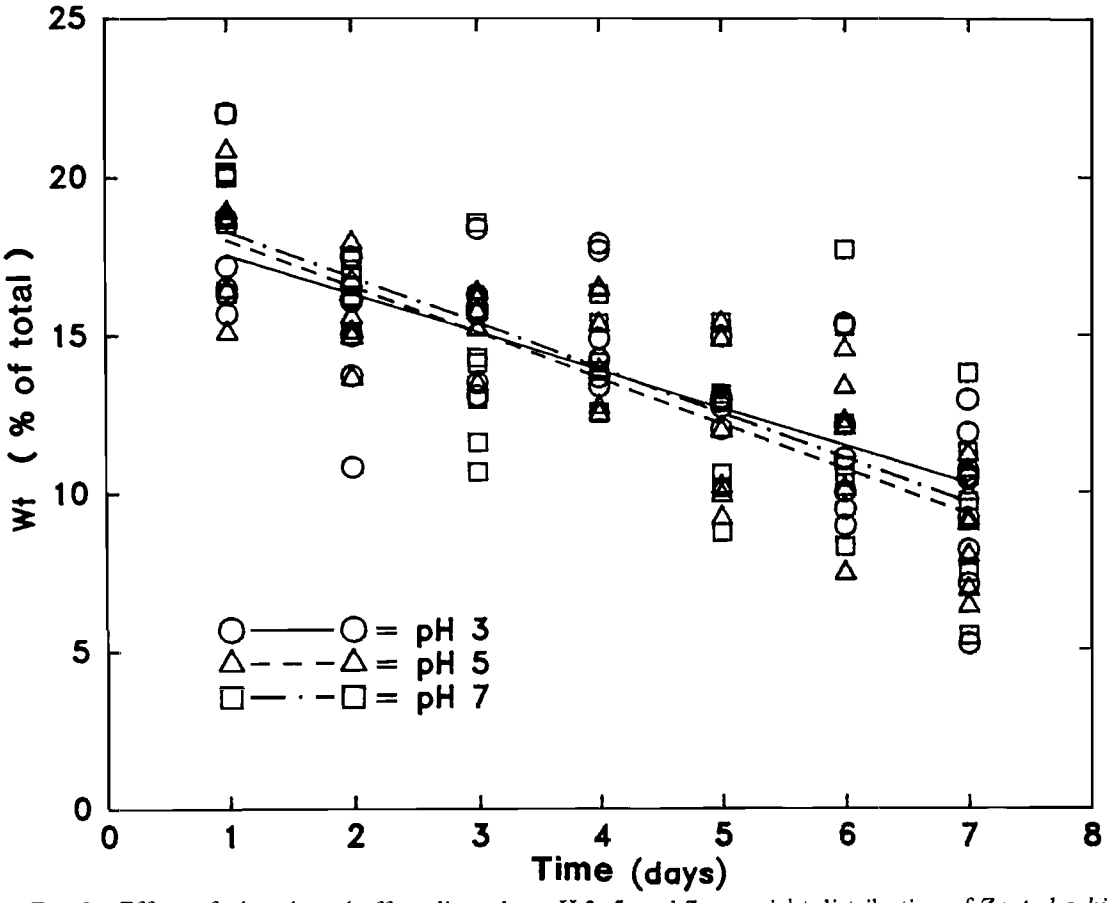

Fig. 2. Effect of phosphate buffer adjusted to pH 3, 5, and 7 on weight distribution of *Zantedeschia aethiopica* spathes. Spathes placed at pH 3 ($y = 18.746 - 1.209x$), pH 5 ($y = 19.464x$) or pH ($y = 19.724 - 1.438x$) did not show any appreciable differences.

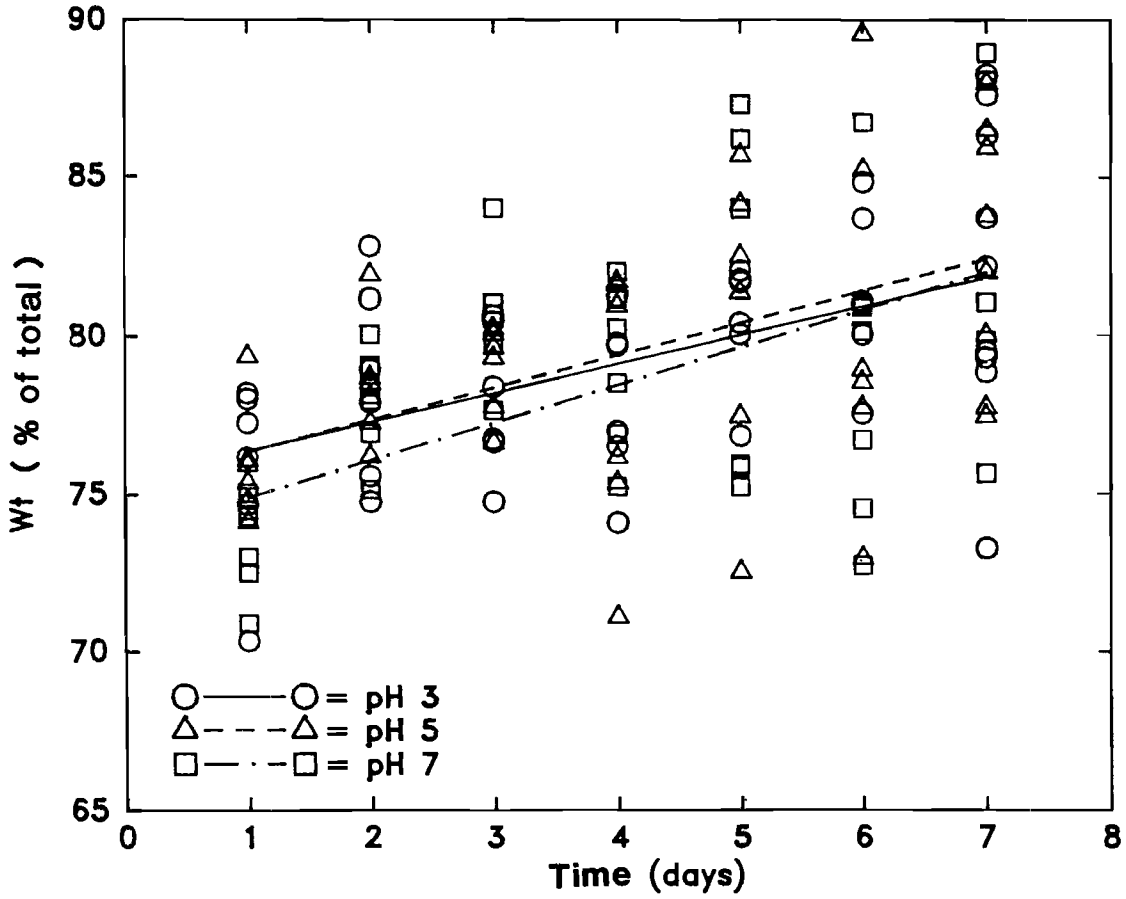

Fig. 3. Effect of phosphate buffer adjusted to pH 3, 5, 7 on weight increase of *Zantedeschia aethiopica* scapes. pH 3 (y = 75.482 + 0.904x), pH 5 (y = 75.370x + 1.004x) or pH (y = 73.728 + 1.178x).

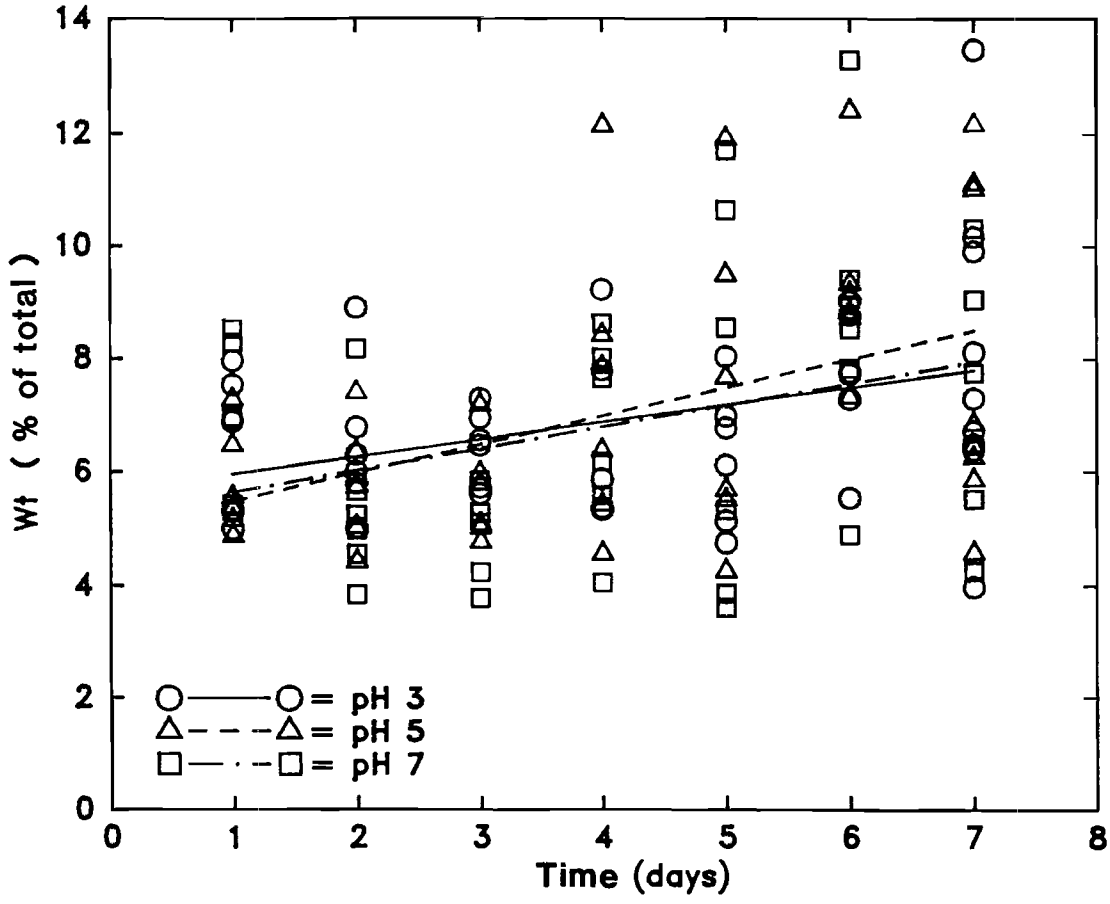

Fig. 4. Effect of phosphate buffer adjusted to pH 3, 5, and 7 on weight distrubution of *Zantedeschia aethiopica* spadices. pH 3 (y = 5.655 + 0.306x), pH 5 (y = 1.00x), pH 7 (y = 5.260 + 0.385x).

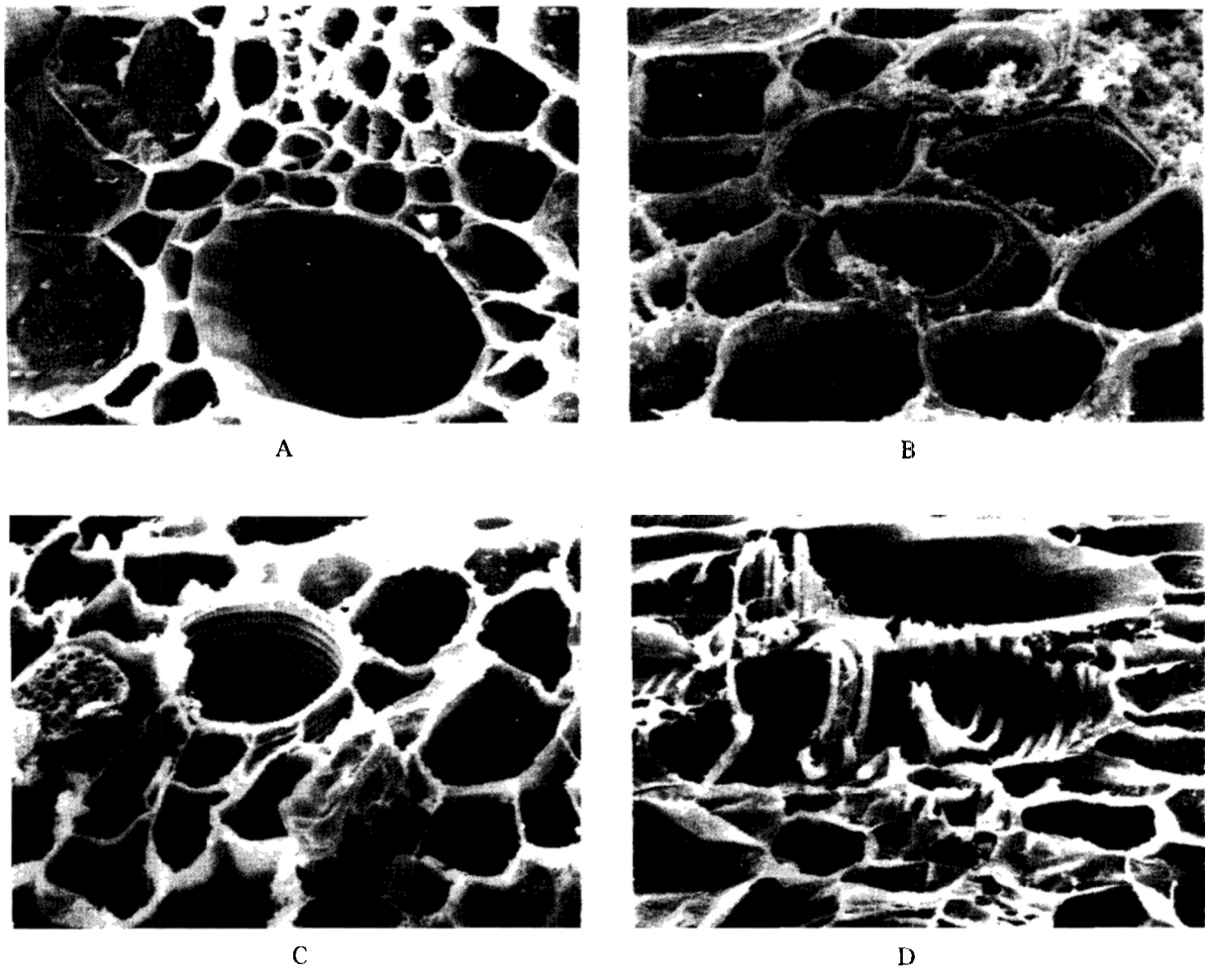

Fig. 5. SEM photomicrograph of *Zantedeschia aethiopica* water conducting tissue.

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)