

STUDY ON REFRIGERATED STORAGE OF *Nephrolepis* FRONDS

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A B S T R A C T

FronDS of *Nephrolepis exaltata* 'Bostoniensis' exhibited a longer vase life than those of 'Golden Boston'. For these cultivars their vase life remained rather stable when previously kept for 18 and 12 days in wet storage, respectively. FronDS of 'Bostoniensis' dry stored in polypropylene (PP) sleeves continued to show a longer vase life than those kept in polyethylene (PE). Storage in PP sleeves for 18 days did not affect a subsequent frond vase life but it started to decline when fronds were previously held in PE just for 3 days. Hence, the storage of fronds in PP sleeves has been suggested to prolong their vase life.

Key words: wet/dry storage, *Nephrolepis exaltata* 'Bostoniensis' and 'Golden Boston', vase life

INTRODUCTION

Cut foliage constitutes an important part of florist industry. A large number of plants can be potentially used for this purpose, provided they can be produced and handled economically and their leaves possess suitable postharvest characteristics. Ferns are highly valued as florist greens due to the elegant symmetry

of their fronds and lush green foliage. *Nephrolepis* is an important fern whose fronds are commercially used for flower arrangements. To ensure the availability of the greens for a longer duration, refrigerated storage holds considerable significance (Nowak and Rudnicki, 1990; Bhattacharjee, 1999; Singh et al., 2001). However, very little information is available on the storage

behaviour of fern fronds (Stamps, 1983; Stamps and Nell, 1983). Stamps and Chase (1984) reported that the storage of leatherleaf fern fronds at 4.5°C for one month did not affect their subsequent vase life. The present study was conducted on both the wet and dry storage using the fronds of two cultivars of *Nephrolepis exaltata* viz.: 'Bostoniensis' and 'Golden Boston'

MATERIAL AND METHODS

Forty cm long mature fronds of *Nephrolepis exaltata* 'Bostoniensis' and 'Golden Boston' were harvested in the morning and immediately put in clean water. The pinnae from the lower third of the frond were removed. Thereafter, the lower portions of the fronds were re-cut in water to obtain a uniform length of 30 cm and to remove the surface blockages. The fronds were made into bunches of three stems each, tied loosely with rubber band at the base, and pre-cooled for 6 hours at 4±0.5°C in 250 ml conical glass flasks containing distilled water. Study on wet storage was conducted with both cultivars whereas for dry storage only 'Bostoniensis' was used. For wet storage, the stems were placed into conical flasks (100 ml capacity) and kept in a cool chamber (4±0.5°C; 80-85% RH) for 3-45 days with 5-6 cm basal portions dipped in water. Storage periods examined are given in Table 1. For dry storage, a bunch of three stems was sealed in a sleeve of nonvented polypropylene (PP) or low density polyethylene (PE) of

100-gauge thickness. The sleeves were stored in a cool chamber (4±0.5°C; 80-85% RH) for 3-30 days (Tab. 2). The bunches of fronds were weighed both before and after storage and an increase/decrease in fresh weight was calculated in %.

After storage, the basal 2 cm portions of the fronds were re-cut and then, to determine their vase life, the fronds were put into 100 ml conical flasks containing distilled water and kept in an air-conditioned laboratory at 23±2°C, 65-70% RH and 16 hour illumination (1000 Lux intensity) provided by 40W fluorescent tubes. Freshly harvested fronds kept in flasks with distilled water served as the control. Data presented are the mean for three replications, each of three fronds. The results were statistically evaluated by an analysis of variance. The significance of differences between means was evaluated by Duncan's multiple range test at P=0.05. Observations were recorded for the vase life (till the pinnae started to wilt), total water absorbed/bunch and per cent increase/decrease in fresh weight.

RESULTS AND DISCUSSION

Wet storage. Results presented in Table 1 show that the vase life of 'Bostoniensis' fronds did not show any appreciable decrease for 18 days of the preceding wet storage. Thereafter, in spite of its gradual decline, their vase life was still acceptable (16 days) even after 30 days of storage, but after being stored for 36 days the fronds could

Table 1. Effect of wet storage on vase life, per cent increase in fresh weight and water absorption by fronds of *Neprolepis sexaltata* 'Bostoniensis' and 'Golden Boston'

Storage duration [days]	Vase life [days]		Per cent increase in fresh weight		Total water absorbed [ml]	
	'Bostoniensis'	'Golden Boston'	'Bostoniensis'	'Golden Boston'	'Bostoniensis'	'Golden Boston'
0	22.33abe*	16.00c	-	-	17.00ab	24.33ab
3	21.67abe	16.33c	2.21de	1.76e	18.00ab	25.00b
6	23.67ae	14.33ac	3.16abc	1.58e	18.33a	23.67ab
9	26.33e	14.56ac	3.98a	2.02de	29.67f	25.33b
12	19.67abc	14.00ac	4.02a	2.32cde	24.67c	25.67b
15	21.33ab	11.89abc	3.96a	2.74bcd	22.67c	23.67ab
18	18.00bcd	10.45abd	3.46ab	2.85a-d	23.00c	21.67a-c
21	16.67cd	10.56abd	3.95a	2.98abc	18.67a	18.00cd
24	13.33dfg	11.11ab	1.89e	3.27ab	17.67ab	18.67cd
27	15.00cdg	8.89bde	3.14abc	3.32ab	17.33ab	17.00d
30	16.00cd	8.45bde	3.02bcd	3.18abc	17.00ab	20.33a-d
33	11.00fg	8.33bdef	3.52ab	3.53ab	16.00ab	23.67ab
36	9.33fh	6.11defg	3.10abcd	3.63ab	12.00bd	20.33a-d
39	9.00fh	5.00efg	2.28cde	3.74a	10.67d	20.67a-d
42	5.67h	3.67fg	2.76bcd	4.64f	5.33e	11.67e
45	4.00i	2.67g	3.04bcd	4.77f	2.33e	7.00e

*Means followed by the same letter do not differ significantly at P=0.05 according to Duncan's multiple range t-test

be kept in a vase only for 9.33 days. After 45 days of wet storage, the vase life dropped just to 4 days. The fronds of 'Golden Boston' showed a shorter vase life than those of 'Bostoniensis', as its initial duration was 16 and 22.33 days for both cultivars, respectively. The vase life of 'Golden Boston' fronds remained rather stable up to 12 days of the preceding storage and thereafter it showed a slight decline until being stored for 24 days. After 27 days in storage, the vase life dropped below 10 days and at the end of the experiment it lasted only for 2.67

days. Fronds stored wet exhibited shorter vase life than those kept under dry conditions (Tab. 1 and 2). Goszczyńska and Rudnicki (1988) reported that wet stored carnations showed a high metabolic rate. Due to their high water uptake and a slow bud development, a 20% increase in fresh weight was observed during wet storage of those flowers (Goszczyńska et al., 1982). Carnations stored in water had a 25-30% higher respiration rate than those kept dry (Hardenburg et al., 1969). In the present study, fronds of both fern cultivars also exhibited an increase in

Table 2. Effect of dry storage on vase life, per cent decrease in fresh weight and water absorption by fronds of *Nephrolepis exaltata* 'Bostoniensis'

Storage duration [day]	Vase life [day]		Per cent decrease in fresh weight		Total water absorbed [ml]	
	PP sleeves	PE sleeves	PP sleeves	PE sleeves	PP sleeves	PE sleeves
0	20.33abc*	20.33e	-	-	18.00ab	18.67abd
3	21.00ab	14.33ab	1.83d	2.17e	20.00af	19.00ab
6	21.00ab	15.45a	3.48c	3.59d	19.00a	18.00bcd
9	21.67a	15.33ab	4.65b	5.99a	15.00b	16.33c
12	20.33abc	15.00ab	3.20cd	5.17cd	16.00bc	21.00a
15	19.56abc	13.67abc	3.93e	5.32bc	26.33g	21.00a
18	18.00abc	12.00bcd	5.38ab	5.84ab	19.00a	20.00ab
21	16.33bc	9.00cd	5.65ab	7.61f	16.00bc	16.00c
24	17.33abc	8.45d	5.75ab	6.21a	22.67de	16.67cd
27	17.00abc	9.33cd	9.70f	14.68g	24.00d	12.00e
30	15.67c	9.00cd	13.19g	19.06h	21.33ef	10.00e

*For explanations see Table 1

fresh weight in wet storage, apparently due to the continuous absorption of water, but a gain in weight did not significantly differ for both cultivars. The cut fronds of 'Bostoniensis' showed a higher water absorption for 33 days, whereas those of 'Golden Boston' for 39 days. But though the fronds of the former continued to exhibit a longer vase life up to the 33rd day of storage, for the latter 6 days it decreased below 10 days. It may indicate that factors other than the water regime are also involved in determining a vase life. Stamps and Nell (1986) found in leatherleaf fern fronds no correlation between water uptake and vase life. In the present study, both cultivars apparently showed inherent variations in their vase life and response to wet storage. It can thus be inferred that 'Bostoniensis' fronds could be wet stored for up to 33 days and those of 'Golden Boston' for 24 days, with their vase life beyond 10 days.

Dry storage. Fronds of 'Bostoniensis' exhibited a slight but continuous decrease in their vase life after dry storage (Tab. 2). A significantly longer vase life was recorded for fronds stored in PP sleeves than for those in PE, e.g. after 18 days of storage it lasted for 18 and 12 days, respectively. Even after the fronds were stored for 30 days in PP sleeves, their vase life reached 15.67 days as compared to 9 days for those kept in PE. According to Kumar (2001), polypropylene has a tendency to maintain a higher level of CO₂ with a low O₂ content inside, thereby creating a suitable environment for storage. High CO₂ and low O₂ in the storage atmosphere have already been suggested to enhance the storage ability of many cut flowers (Goszczyńska and Rudnicki, 1988; Singh et al., 2001). In general, a loss of fresh weight increased the longer the fronds were kept in storage, but for fronds in PP sleeves such a loss

was significantly lower than for those held in PE. It could be due to higher CO₂ levels inside the PP sleeves, which might lead to the closure of stomata, thereby limiting water loss (Kumar, 2001). Fronds stored in PP sleeves maintained more or less constant water absorption throughout whereas for those kept in PE water absorption decreased after 27 days of storage.

Therefore, one can conclude that 'Bostoniensis' fronds could be stored at 4±0.5°C in PP sleeves (100 gauge thick) for up to 30 days but in PE only for 18 days, to maintain their subsequent vase life more than 10 days.

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BADANIA NAD PRZECHOWYWANIEM W CHŁODNI LIŚCI PAPROCI *Nephrolepis*

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S T R E S Z C Z E N I E

Liście paproci *Nephrolepis exaltata* odmiany ‘Bostoniensis’ wykazały dłuższą trwałość wazonie po wyjęciu z chłodni niż ‘Golden Boston’. U obu tych odmian stwierdzono w miarę stabilną trwałość, po uprzednim przetrzymywaniu w chłodni z końcami łodyg umieszczonymi w wodzie, odpowiednio przez 18 i 12 dni.

W przypadku przechowywania liści w chłodni “na sucho” bez wody, umieszczono je w rękawach z polipropylenu (PP) lub polietylenu (PE). Do tych badań użyto tylko odmiany ‘Bostoniensis’, która wykazała stabilną trwałość wazonie po uprzednim przetrzymywaniu w rękawie PP przez 18 dni. Stąd taki sposób przechowywania w chłodni liści tej odmiany paproci może być zalecany, w przeciwieństwie do rękawów PE, w których już trzydniowe przetrzymanie liści wyraźnie obniżało ich trwałość wazonie.

Słowa kluczowe: przechowywanie na sucho i mokro, *Nephrolepis exaltata* ‘Bostoniensis’ i ‘Golden Boston’, trwałość wazonie