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EFFECT OF CONDITIONING ON THE LONGEVITY OF LEAVES OF THE ITALIAN ARUM (*ARUM ITALICUM* MILL.) KEPT AT A LOW TEMPERATURE

Summary. Leaves of the Italian arum (*Arum italicum* Mill.) were conditioned and stored. The conditioning in aqueous solution of gibberellic acid at a concentration of 100 mg/dm³ lasted for 12 h. Use was made of Gibrescol 10 MG containing 10% gibberellic acid (GA₃). Next the leaves were placed in distilled water in a cold room where the temperature was +5°C and relative humidity was 90%. The control consisted of leaves placed in distilled water in room with a temperature 18-20°C. The reaction of the solutions was slightly acidic (pH ±5.0). The conditioning of not stored leaves of the Italian arum in gibberellic acid at a concentration of 100 mg/dm³ extended their post-harvest longevity by a week. The storage of conditioned and unconditioned leaves without a loss of ornamental qualities was only possible for a week. Two-week storage of leaves in a cold room was only possible after their previous conditioning in gibberellic acid. The conditioning of leaves in gibberellic acid inhibited chlorophyll degradation; as a result, their greenness index increased.

Key words: *Arum italicum*, vase life, gibberellic acid, storing

Introduction

In our times floristry can truly be regarded as a part of fine arts. Throughout the world florists want to offer customers newer and more beautiful compositions in which an indispensable element today is florists' 'greens'. The increasingly stringent requirements of customers make it necessary to search for new species in order to add variety to bouquets. One of them is the Italian arum, whose gorgeous, arrow-shaped, light-veined leaves can be a valuable element of modern flower arrangements (JANOWSKA and SCHROETER-ZAKRZEWSKA 2008). In choosing florists' green species, one should consider their post-harvest longevity to ensure bouquets a lasting ornamental quality and match the longevity of cut flowers. Another consideration should be their storage

capacity. It is the scarcity of information about the possibility of storing Italian arum leaves that prompted the present study.

Material and methods

Leaves of the Italian arum (*Arum italicum* Mill.) were conditioned and stored. Leaves selected for the experiment were mature, healthy and undamaged. The conditioning in aqueous solutions of gibberellic acid at a concentration of 100 mg/dm³ lasted for 12 h in a cold room where the temperature was +5°C and relative humidity was 90%. Use was made of Gibrescol 10 MG containing 10% gibberellic acid (GA₃). Next the leaves were placed in distilled water for 7 and 14 days in a cold room where the temperature was +5°C and relative humidity was 90%. The control consisted of leaves placed in distilled water in room with a temperature of 18-20°C. The reaction of the solutions was slightly acidic (pH about 5.0).

The post-harvest longevity of the leaves after storage was determined in a room with a temperature of 18-20°C, a 12-hour photoperiod, a luminescence light with a quantum irradiance intensity of 25 μmol/m²/s, and a relative air humidity of 70%. Throughout the experiment, water was changed every day.

Leaf longevity was defined in days. The loss of ornamental value was established as the moment when 30% of the leaf blade area had yellowed and/or wilted. When the experiment ended, an index of leaf greenness, correlated with chlorophyll content, was determined using a Chlorophyll Meter SPAD-502 (Minolta) apparatus (GREGORCZYK and RACZYŃSKA 1997, GREGORCZYK et AL. 1998). Initial index of leaf greenness was 67.4.

The experiment consisted of six combinations with three replicates, with five leaves in each. One combination (conditioning solution × length of storage) embraced 15 leaves.

The experiment results were subjected to two way analysis of variance using Duncan's test at the $\alpha = 0.05$ significance level.

Results

When comparing the post-harvest longevity of Italian arum leaves, it was found that this characteristic depended significantly on both, their conditioning in gibberellic acid and the length of storage in a cold room (Table 1). The leaves lasted significantly longer when conditioned in gibberellic acid at a concentration of 100 mg/dm³ prior to storage. Their longevity was extended by 3.6 days (30%), in comparison with unconditioned leaves. Irrespective of conditioning, the loss of ornamental value was the fastest in leaves stored in a cold room for 14 days. The conditioning of leaves not stored extended their post-harvest longevity by a week. A similar longevity was displayed by leaves kept for a week without conditioning or after conditioning in gibberellic acid, as well as those stored for two weeks after an earlier conditioning. In those cases their longevity was comparable with that of the control leaves. In leaves not conditioned in gibberellic acid after 2-week storage in a cold room, their longevity could be observed to have dropped by as much as 104.4% in comparison with the control not stored in a cold room.

Table 1. Effect of the period of storage and conditioning in gibberellic acid on the post-harvest longevity of the Italian arum leaves (days)

Tabela 1. Wpływ długości przechowywania i kondycjonowania w kwasie giberelinowym na pozbiorną trwałość liści obrazków włoskich (dni)

Storage (days)	Conditioning – GA ₃ concentration		Mean
	0 mg/dm ³	100 mg/dm ³	
0	13.9 b	20.1 c	17.0 c
7	14.9 b	14.4 b	14.6 b
14	6.8 a	12.0 b	9.4 a
Mean	11.9 a	15.5 b	

Means followed by the same letter do not differ significantly at $\alpha = 0.05$.

When comparing indices of leaf greenness, significant differences were observed depending on the conditioning in gibberellic acid and the time of storage at a low temperature (Table 2). The index was the highest in leaves which, irrespective of conditioning, were stored in the cold room for a week, and the lowest, in those stored for two weeks. Whatever the duration of storage, it was found that the conditioning of leaves in gibberellic acid inhibited chlorophyll degradation, as a result of which their greenness index was higher. When comparing interactions, the highest index was recorded in leaves not stored, but conditioned in gibberellic acid. A high greenness index was observed in leaves stored for a week in a cold room, whether or not conditioned in gibberellic acid. The conditioning of leaves in gibberellic acid inhibited chlorophyll degradation in plants stored for 14 days in a cold room. Unconditioned leaves stored for two weeks yellowed very rapidly and displayed greatly reduced longevity; hence their index of greenness was comparable with that of the control leaves, whose longevity, however, was much more prolonged.

Table 2. Effect of the period of storage and conditioning in gibberellic acid on the index of leaf greenness (SPAD) of the Italian arum leaves

Tabela 2. Wpływ długości przechowywania i kondycjonowania w kwasie giberelinowym na indeks zazielenienia (SPAD) liści obrazków włoskich

Storage (days)	Conditioning – GA ₃ concentration		Mean
	0 mg/dm ³	100 mg/dm ³	
0	25.5 a	48.4 d	37.0 b
7	43.2 c	42.0 c	42.6 c
14	25.1 a	36.5 b	30.8 a
Mean	31.3 a	42.3 b	

Means followed by the same letter do not differ significantly at $\alpha = 0.05$.

Initial index of leaf greenness: 67.4.

Discussion

In the experiment conducted, gibberellic acid proved effective in extending the longevity of *Arum italicum* leaves, both those only subjected to conditioning and those conditioned and then stored in a cold room at 5°C. While the longevity of the leaves stored was no better than that of the control ones, those leaves matched them in post-harvest longevity. This shows it to be possible to keep them wet in a cold room for a longer time. No differences were observed between the longevity of conditioned and unconditioned leaves taken out of a cold room after a week's storage, but the conditioned ones displayed improved longevity when kept wet for two weeks.

The effectiveness of gibberellic acid applied at different stages of distribution has been tested for both, cut flowers and 'cut greenery', with the information on how to proceed with cut flowers being much more plentiful. As follows from the latest studies, the conditioning of cut inflorescences of *Eustoma grandiflorum* 'Mariachi Grande White F₁' in aqueous solutions of gibberellic acid prolongs their post-harvest longevity (JANOWSKA and SCHROETER-ZAKRZEWSKA 2007). Also effective is the conditioning of shoots of *Astilbe* × *arendsii* 'Amethyst' in gibberellic acid at a concentration of 100 mg/dm³ and placing them in 8-hydroxyquinoline citrate at a concentration of 200 mg/dm³ with a 2% addition of saccharose (POGROSZEWSKA and SADKOWSKA 2006).

In the case of 'cut greenery', gibberellic acid has been found effective in extending the longevity of leaves of *Hosta* (RABIZA-ŚWIDER et AL. 2006), *Limonium latifolium* (JANOWSKA and SCHROETER-ZAKRZEWSKA 2010), *Hippeastrum* × *chmielii* (RABIZA-ŚWIDER and SKUTNIK 2006), *Calathea louisae* (PINTO et AL. 2007), *Spathiphyllum* (KOZIARA and SIKORA 2006), *Asparagus falcatus* applied at a concentration of 1.0 mmol/dm³ to soak shoots (SKUTNIK and RABIZA-ŚWIDER 2008), *Asparagus densiflorus* 'Myriocladus' when shoots are subjected to 24-h conditioning in a 0.25 mmol/dm³ solution of the acid, and *A. densiflorus* 'Meyerii' when shoots are soaked in a solution of GA₃ and conditioned for 24 h (SKUTNIK et AL. 2006). Besides, conditioning in a solution of gibberellic acid at a concentration of 0.25 mmol/dm³ improves the longevity of *Zantedeschia aethiopica* leaves stored in a cold room (WACHOWICZ et AL. 2007).

In the experiment conducted, the conditioning of leaves in gibberellic acid inhibited chlorophyll degradation, thus increasing the index of leaf greenness. Gibberellic acid impeded chlorophyll degradation in *A. italicum* leaves similarly as it took place in a research of JANOWSKA and SCHROETER-ZAKRZEWSKA (2008). In *Z. elliotiana* an extension of the longevity of leaves was due to the inhibiting effect of gibberellic acid on chlorophyll degradation, which helped the leaves preserve the green colour longer (JANOWSKA and JERZY 2003). In a study by SKUTNIK et AL. (2004) gibberellic acid hampered chlorophyll degradation in leaves of *Z. aethiopica* and *Z. elliotiana*, thus improving their post-harvest longevity.

The results of the experiment reported here encourage further attempts at extending the longevity of *A. italicum* leaves.

Conclusions

1. The conditioning of not stored leaves of the Italian arum in gibberellic acid at a concentration of 100 mg/dm³ extended their post-harvest longevity by a week.
2. The storage of conditioned and unconditioned leaves without a loss of ornamental qualities was only possible for a week.
3. Two-week storage of leaves in a cold room was only possible after their previous conditioning in gibberellic acid.
4. The conditioning of leaves in gibberellic acid inhibited chlorophyll degradation; as a result, their greenness index increased.

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WPLYW KONDYCJONOWANIA NA TRWAŁOŚĆ LIŚCI OBRAZKÓW WŁOSKICH (*ARUM ITALICUM* MILL.) PRZECHOWYWANYCH W NISKIEJ TEMPERATURZE

Streszczenie. Liście obrazków włoskich (*Arum italicum* Mill.) kondycjonowano i przechowywano. Kondycjonowanie, w wodnych roztworach kwasu giberelinowego o stężeniu 100 mg/dm³, trwało 12 h. Do kondycjonowania wykorzystano Gibrescol 10 MG zawierający 10% kwasu giberelinowego (GA₃). Następnie umieszczano liście w destylowanej wodzie i przenoszono do chłodni o temperaturze +5°C i wilgotności względnej 90%. Kontrolę stanowiły liście umieszczone w wodzie destylowanej w pomieszczeniu o temperaturze w zakresie 18-20°C. Odczyn roztworów był lekko kwaśny (pH około 5,0). Kondycjonowanie nieprzechowywanych liści obrazków włoskich w kwasie giberelinowym o stężeniu 100 mg/dm³ wydłużyło ich pozbiorną trwałość o tydzień. Przechowywanie liści kondycjonowanych i niekondycjonowanych bez utraty walorów ozdobnych było możliwe przez jeden tydzień. Dwutygodniowe przechowywanie liści w chłodni było możliwe tylko po wcześniejszym kondycjonowaniu ich w kwasie giberelinowym. Kondycjonowanie liści w kwasie giberelinowym hamowało degradację chlorofilu, dzięki czemu wzrastał indeks zazielenienia.

Słowa kluczowe: *Arum italicum*, trwałość, kwas giberelinowy, przechowywanie

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