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EFFECT OF PINCHING AND DAY LENGTH ON THE GROWTH AND FLOWERING OF *Ajania pacifica* (Nakai) Bremer et Humphries IN CONTROLLED CULTIVATION

Małgorzata Zalewska, Małgorzata Antkowiak
University of Technology and Life Sciences in Bydgoszcz

Abstract. *Ajania pacifica* has been gaining popularity as a pot plant. It is closely related to the chrysanthemum, and may become an interesting alternative for it, the more that the cultivation of both species can be carried out simultaneously. The aim of this study was to assess the growth and flowering of ajania as a result of pinching and the day length of pinched plants. The present research involved the use of *Ajania pacifica*, 'Silver and Gold' and 'Bea' 'Benetti' and 'Bengo' (of Bellania group). The first cultivation was made in the long-day glasshouse. Having been planted into pots, the plants of each cultivar were divided into groups: non-pinched and pinched once, and the last group: further divided into: allocated to immediate cultivation exposed to short day and those which, before the second stage of cultivation – plant darkening for the period of two weeks, were grown further under long-day conditions. Not all the cultivars reacted in the same way to pinching. In 'Bengo' the pinched plants formed buds and started flowering at a similar date as the non-pinched ones, in 'Benetti' and 'Bea' the delay was inconsiderable and in 'Silver and Gold' the buds appeared 5 to 12 days later. The plants growing longer under long-day conditions were higher, wider, with longer and wider corymbs, more inflorescences and their life was longer.

Key words: pot cultivation, photoperiod, pinching

INTRODUCTION

Ajania genus includes over 30 species. In that group we find both the plants with precious pharmacological properties, containing specific substances used in Chinese folk medicine as well as appreciated for their decorative qualities, used by breeders and horticulturists. An example of medicinal plant can be *Ajania fruticulosa* used in China

Corresponding author – Adres do korespondencji: Małgorzata Zalewska, Małgorzata Antkowiak, Department of Ornamental and Vegetable Plants, University of Technology and Life Sciences in Bydgoszcz, ul. Bernardyńska 6, 85-029 Bydgoszcz, e-mail: zalewska@utp.edu.pl, antkowiak@utp.edu.pl

to treat appendicitis, tuberculosis and emphysema. The substances contained in it inhibit the growth of fungi of *Candida* genus [Meng et al. 2001], they can be helpful in the treatment of nephrolithiasis, myocardial ischemia [Hao Li et al. 1999], and the alcohol extract has e.g. diastolic and diuretic properties [Adekenov et al. 1998, cit. Barnaulov et al. 1983].

Ajania pacifica formerly referred to as *Dendranthema pacificum*, and earlier *Chrysanthemum pacificum* has been gaining more and more interest in Poland. It represents *Asteraceae* family – the same one as chrysanthemums and it can become an interesting alternative to them. Their genetic closeness is seen from the studies of producing interspecific hybrids [Fukai et al. 2000, Roh and Ikeda 2003]. Undoubtedly the greatest popularity was won by 'Silver and Gold', grown both in the ground and under covers. In the ground it flowers in autumn and, as it is often the case that under Poland's climatic conditions, the inflorescences do not manage to flower at all. However, it does not disqualify the plants which are valued mostly for the original, silver-green, abundant foliage. Thanks to their closeness, ajania can be treated similarly as chrysanthemum and thus similar cultivation technology can be applied. The plant demonstrates a reaction to shortening day which mobilizes it to produce inflorescence buds. Here we can successfully apply controlled cultivation, which consists of shortening the length of the natural period of long days or the extension of the short day with artificial light, and also in maintaining the adequate temperature. In cultivation of this species retardants, limiting plant growth, are commonly recommended. It seems even more justifable to attract the interest of Polish chrysanthemum producers in launching the cultivation of ajania as well, especially since growing ajania is not difficult and breeders, crossing it with other species, produce interesting hybrids, e.g. with unusual inflorescences or flowering earlier.

The aim of this study was to assess the growth and flowering of four cultivars of *Ajania pacifica* as a result of pinching and as affected by the day length of the plants grown in pots in a glasshouse, using the controlled cultivation.

MATERIAL AND METHODS

The research was carried out in the glasshouses of the Department of Ornamental Plants and Vegetables of the University of Technology and Life Sciences in Bydgoszcz. In the experiment *Ajania pacifica* (Nakai) Bremer et Humphries, 'Silver and Gold' and 'Bea' 'Benetti' and 'Bengo' (representing Bellania group) were used.

The first research stage, covering the vegetative plant growth phase, was performed in the glasshouse starting from April 23, 2009, under 16-hour long-day conditions (by plant illumination; high pressure sodium lamps Electronic Ballast PLG-602, emitting light with intensity about 5000 lux). Cuttings provided by Kientzler Jungpflanzen (Kientzler GmbH & Co. KG) 3–4 cm long were rooted in the highmoor peat deacidified with perlite added (v:v 3:1) in plastic pallets, with the opening diameter of 3 cm, using the rooting agent A (containing 0.3% of indole-3-butyric acid). On May 29, after five weeks of growth, the plants were planted into pots 11 cm in diameter into the chrysanthemum – growing medium (manufacturer: 'Hollas' of Pasłęk) of pH 6.5. Then the

cuttings of each cultivar were divided into groups: non-pinched and pinched once and each of them further into: allocated to immediate growing exposed to short day as well as those which prior to darkening, for the period of two weeks were still grown exposed to long day. Having been planted into pots, they were left in the long-day glasshouse for further growth. Finally each experimental treatment included 12 plants (3 replications × 4 plants). A short (10-hour) photoperiod provided to the plants by darkening, used every day from 6^{00} p.m. to 8^{00} a.m., started the second cultivation stage. The average temperature of the air/substrate and relative air humidity were 21.8/20.5°C and 57.5%, respectively, under long-day conditions and 21.5/20.7°C and 52.5% under short-day conditions. Until the division into the treatments, the growth rate of cuttings and leaf formation were specified. The dates of the following were regularly recorded: the appearance of the inflorescence bud (when it was well visible with the naked eye), the beginning of flowering (when in half buds per plant there were visible the first tinted flowers), full bloom (when half of the inflorescences per plant was in full flower) and plant blossom shedding (when half of the inflorescences per plant lost decorative qualities). Mean dates concerning the above observations were defined based on the weighted mean. There was also determined the dynamics of growth until the first full bloom of plants in the treatment and the plant life based on the number of days from the beginning of flowering to blossom shedding. We also calculated the period of the cultivation period from planting into pots to the beginning of flowering and the percentage share of plants which bloomed. In the full bloom the plant height, from the top of the pot to the highest reaching inflorescence, the plant width, which was the mean value of the measurements in two widest places, and the length of corymb, from the lowest located pedicel of the inflorescence to its top as well as the width of the corymb, which also included the mean value of the measurements in two widest places, were also defined. Similarly the number of penducles of the corymb and inflorescences (which covered non-colored and colored buds) were determined. The results were statistically verified with the analysis of variance and the means were compared for each cultivar applying the Tukey test at the significance level of $\alpha = 0.05$. The calculations involved the use of FR-ANALWAR software based on Microsoft Excel.

RESULTS

The present research demonstrated that growth increment of ‘Silver and Gold’ cutting was slowest, averaging 0.6 cm per week. The others, ‘Bengo’, ‘Bea’ and ‘Benetti’ were growing at a similar rate and the average increment was 0.8 cm a week. The cultivar growing at the slowest rate formed the lowest number of leaves, while the fastest growing – the highest number of leaves. In all the cultivars most leaves appeared in the 6^{th} and 7^{th} week after plant cutting.

At the second cultivation stage the non-pinched plants in ‘Bengo’, ‘Bea’ and ‘Silver and Gold’, which were grown two weeks more under the conditions of long-day demonstrated a greater increment than those grown immediately exposed to short day. In pinched plants no such visible differences were observed. In ‘Benetti’ the plants from respective experimental treatments were growing at similar rate.

'Bea', 'Benetti' and 'Bengo' plants flowered in 100%, in each experimental treatment, irrespective of the period of long days before the short days as well as irrespective of the fact whether or not pinching was performed. 'Silver and Gold' showed an unfavourable reaction to pinching. In that plant cultivar the plants longer pinched, growing at long day, flowered only in 58% and grown shorter at long day – in 67%.

The flower buds appeared earliest in 'Bengo', then in 'Benetti' and 'Bea', and, finally, in 'Silver and Gold'. In all the cultivars, except for 'Silver and Gold' the microscopic development stage of the bud was very short: around two weeks, in pinched plants – on average 2 days longer than in the non-pinched ones, similarly as the plants the darkening of which started later. The buds, however, were developing at a similar rate in all the cultivars (the macroscopic development took about one month). In all the cultivars the additional two weeks of growth under long-day conditions delayed the appearance of the inflorescence bud, the beginning and abundance of flowering on average by the same number of days. Similarly the cultivation also got prolonged by two weeks. 'Bengo' plants reached abundance of flowering about 7 weeks after darkening, 'Benetti' and 'Bea' after 8 weeks and 'Silver and Gold' needed most time to abundance of flowering: 11 weeks (tab. 1 and 2).

Table 1. Inflorescence bud development stages in 'Bea', 'Benetti', 'Bengo' and 'Silver and Gold' cultivars depending on the treatment

Tabela 1. Etapy rozwoju pąka kwiatostanowego odmiany 'Bea', 'Benetti', 'Bengo' oraz 'Silver and Gold' w zależności od kombinacji

Cultivar Odmiana	Factor B Czynnik B	Flower bud visible (date) Pojawienie się pąka (data)			Beginning of flowering (date) Początek kwitnienia (data)			Full bloom (date) Pełnia kwitnienia (data)		
		factor A czynnik A		mean for B średnia dla B	factor A czynnik A		mean for B średnia dla B	factor A czynnik A		mean for B średnia dla B
		NP*	P		NP	P		NP	P	
Bea	L**	17.07.	19.07.	18.07.	19.08.	18.08.	19.08.	28.08.	27.08.	28.08.
	S	02.07.	03.07.	03.07.	03.08.	05.08.	04.08.	11.08.	13.08.	12.08.
	mean for A średnia dla A	10.07.	11.07.	-	11.08.	12.08.	-	20.08.	20.08.	-
Benetti	L	15.07.	19.07.	17.07.	13.08.	18.08.	16.08.	24.08.	25.08.	25.08.
	S	29.06.	01.07.	30.06.	02.08.	04.08.	03.08.	11.08.	12.08.	12.08.
	mean for A średnia dla A	07.07.	10.07.	-	08.08.	11.08.	-	18.08.	19.08.	-
Bengo	L	14.07.	16.07.	15.07.	10.08.	11.08.	11.08.	18.08.	18.08.	18.08.
	S	28.06.	29.06.	29.06.	25.07.	25.07.	25.07.	04.08.	03.08.	04.08.
	mean for A średnia dla A	06.07.	08.07.	-	02.08.	03.08.	-	11.08.	11.08.	-
Silver and Gold	L	02.08.	14.08.	08.08.	01.09.	17.09.	09.09.	11.09.	17.09.	14.09.
	S	24.07.	29.07.	24.07.	23.08.	03.09.	28.08.	31.08.	10.09.	05.09.
	mean for A średnia dla A	28.07.	06.08.	-	28.08.	10.09.	-	06.09.	14.09.	-

*NP – non-pinched plants, P – pinched plants

*NP – rośliny nieuszczykiwane, P – rośliny uszczykiwane

**L – plants growing 2 weeks more under long day, S – plants growing 2 weeks less under long day

**L – rośliny rosnące 2 tygodnie dłużej w warunkach dnia długiego, S – rośliny rosnące 2 tygodnie krócej w warunkach dnia długiego

The reactions of each cultivar to pinching varied. In 'Bengo' pinched plants produced buds and started flowering at a similar date as the non-pinched plants, in 'Benetti' and 'Bea' the delay was inconsiderable (1–5 days). Similarly, in the case of full bloom; in those cultivars there was observed no effect of pinching on the length of cultivation at permanent site (tab. 3). Only 'Silver and Gold' showed a very unfavourable reaction to that treatment. The buds of pinched plants appeared 5 to 12 days later. Similar relations concerned the beginning and full bloom as well as the period of cultivation. The pinched plants flowered from a few to a dozen or so days later than the non-pinched ones and their cultivation got prolonged by more than two weeks (tab. 1 and 2).

Table 2. Period of cultivation (days) of 'Bea', 'Benetti', 'Bengo' and 'Silver and Gold' cultivars depending on the treatment

Tabela 2. Okres trwania uprawy (dni) odmiany 'Bea', 'Benetti', 'Bengo' oraz 'Silver and Gold' w zależności od kombinacji

Cultivar Odmiana	Factor B Czynnik B	Factor A Czynnik A		Mean for B Średnia dla B
		NP*	P	
Bea	L**	81.5	80.7	81.1
	S	66.3	68.3	67.3
	mean for A średnia dla A	73.9	74.5	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = n.s. B =1.02 A/B = 1.44 B/A = 1.44	
Benetti	L	77.6	80.4	79.0
	S	65.4	67.0	66.2
	mean for A średnia dla A	71.5	73.7	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = n.s. B = 2.44 A/B = n.s. B/A = n.s.	
Bengo	L	73.33	73.5	73.5
	S	58.0	56.7	57.4
	mean for A średnia dla A	65.7	65.2	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = n.s. B = 1.15 A/B = n.s. B/A = n.s.	
Silver and Gold	L	94.9	111.2	103.0
	S	85.9	101.4	93.6
	mean for A średnia dla A	90.4	106.3	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = 5.45 B = 5.45 A/B = n.s. B/A = n.s.	

* and ** – see explanation for table 1
* i ** – patrz objaśnienie tabeli 1
n.s. – non-significant for p = 0.05, różnice nieistotne przy p = 0,05

Depending on the cultivar, the plants remained decorative for two, three weeks, and in the case of 'Silver and Gold' – even four weeks. In two cultivars pinching did not affect the plant life. In 'Benetti' it was two days longer in non-pinched plants and in 'Silver and Gold' – three days shorter. In 'Bea', 'Benetti' and 'Bengo' additional two weeks of growth in long day resulted in two-, three-day longer life and in 'Silver and Gold' – more than two-week longer life (tab. 3).

Table 3. Plant life (days) of 'Bea', 'Benetti', 'Bengo' and 'Silver and Gold' cultivars depending on the treatment

Tabela 3. Trwałość roślin (dni) odmiany 'Bea', 'Benetti', 'Bengo' oraz 'Silver and Gold' w zależności od kombinacji

Cultivar Odmiana	Factor B Czynnik B	Factor A Czynnik A		Mean for B Średnia dla B
		NP*	P	
Bea	L**	18.2	17.8	18.0
	S	15.8	16.3	16.0
	mean for A średnia dla A	17.0	17.0	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = n.s. B = 0.91 A/B = n.s. B/A = n.s.	
Benetti	L	21.7	19.6	20.6
	S	18.6	17.0	17.8
	mean for A średnia dla A	20.1	18.3	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = 1.70 B = 1.70 A/B = n.s. B/A = n.s.	
Bengo	L	19.0	18.7	18.8
	S	15.8	17.3	16.6
	mean for A średnia dla A	17.4	18.0	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = n.s. B = 0.84 A/B = 1.19 B/A = 1.19	
Silver and Gold	L	32.1	31.0	31.5
	S	10.8	18.2	14.5
	mean for A średnia dla A	21.4	24.6	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = 2.29 B = 2.29 A/B = 3.24 B/A = 3.24	

* and ** – see explanations for table 1

* i ** – patrz objaśnienie tabeli 1

n.s. – non-significant for p = 0.05, różnice nieistotne przy p = 0,05

Table 4. Corymb length and width, number of penducles and inflorescences in corymb of 'Bea', 'Benetti', 'Bengo' and 'Silver and Gold' cultivars depending on the treatment

Tabela 4. Długość i szerokość baldachogrona oraz liczba szypuł i kwiatostanów w baldachogronie odmiany 'Bea', 'Benetti', 'Bengo' oraz 'Silver and Gold' w zależności od kombinacji

Cultivar Odmiana	Factor B Czynnik B	Corymb Baldachogrono											
		length długość cm			width szerokość cm			number of penducles liczba szypuł			number of inflorescences liczba kwiatostanów		
		factor A czynnik A		mean for B średnia dla B	factor A czynnik A		mean for B średnia dla B	factor A czynnik A		mean for B średnia dla B	factor A czynnik A		mean for B średnia dla B
		NP*	P		NP	P		NP	P		NP	P	
Bea	L**	11.6	11.2	11.4	13.2	17.8	15.5	20.6	7.2	13.9	100.0	51.7	75.8
	S	9.0	9.9	9.5	10.9	16.3	13.6	15.6	9.8	12.7	68.5	64.3	66.4
	mean for A średnia dla A	10.3	10.6	-	12.1	17.0	-	18.1	8.5	-	84.3	58.0	-
	$LSD_{0.05}$ $NIR_{0,05}$	A = n.s. B = 0.74 A/B = n.s. B/A = n.s.			A = 0.62 B = 0.62 A/B = n.s. B/A = n.s.			A = 0.85 B = 0.85 A/B = 1.20 B/A = 1.20			A = 6.54 B = 6.54 A/B = 9.26 B/A = 9.26		
Benetti	L	17.7	16.7	17.2	24.2	23.3	23.7	16.3	11.6	13.9	81.2	71.3	76.2
	S	16.2	15.2	15.7	21.7	21.1	21.4	18.7	16.7	17.7	68.1	65.7	66.9
	mean for A średnia dla A	17.0	16.0	-	22.9	22.2	-	17.5	14.1	-	74.6	68.5	-
	$LSD_{0.05}$ $NIR_{0,05}$	A = 0.84 B = 0.84 A/B = n.s. B/A = n.s.			A = n.s. B = 1.85 A/B = n.s. B/A = n.s.			A = 1.35 B = 1.35 A/B = n.s. B/A = n.s.			A = n.s. B = n.s. A/B = n.s. B/A = n.s.		
Bengo	L	20.1	16.3	18.2	22.7	22.8	22.7	21.0	9.9	15.5	122.4	103.1	112.8
	S	14.7	13.3	14.0	18.1	19.8	19.0	24.6	13.2	18.9	99.7	87.2	93.4
	mean for A średnia dla A	17.4	14.8	-	20.4	21.3	-	22.8	11.6	-	111.1	95.1	-
	$LSD_{0.05}$ $NIR_{0,05}$	A = 0.51 B = 0.51 A/B = 0.72 B/A = 0.72			A = 0.83 B = 0.83 A/B = n.s. B/A = n.s.			A = 1.76 B = 1.76 A/B = n.s. B/A = n.s.			A = 7.34 B = 7.34 A/B = n.s. B/A = n.s.		
Silver and Gold	L	10.9	12.4	10.3	11.2	14.0	12.6	27.3	4.6	16.0	96.0	63.7	79.9
	S	9.8	11.2	10.5	10.7	11.2	11.0	16.5	4.8	10.7	98.5	56.7	77.6
	mean for A średnia dla A	10.3	11.8	-	10.9	12.6	-	21.9	4.7	-	97.2	60.2	-
	$LSD_{0.05}$ $NIR_{0,05}$	A = 0.75 B = n.s. A/B = n.s. B/A = n.s.			A = n.s. B = n.s. A/B = n.s. B/A = n.s.			A = 2.50 B = 2.50 A/B = 3.54 B/A = 3.54			A = 14.4 B = n.s. A/B = n.s. B/A = n.s.		

* and ** – see explanation for table 1

* i ** – patrz objaśnienie tabeli

n.s. – non-significant for p = 0.05, różnice nieistotne przy p = 0,05

Pinching had a significant effect on the length of corymb in all the cultivars, except for 'Bea'. In 'Bengo' the non-pinched plants produced corymb more than 2.5 cm longer, in 'Benetti' – 1 cm longer, while in 'Silver and Gold' the opposite reaction was noted; the pinched plants produced almost 1.5 cm longer corymbs than in the non-pinched

ones. In all the cultivars, except for 'Silver and Gold' additional two weeks of long days had a favourable effect on the length of corymb which was from almost 1.5 cm in 'Benetti' to more than 4 cm in 'Bengo'. Similarly, the plants growing longer in long day demonstrated wider inflorescences (in 'Bengo' by almost 4 cm, and in 'Bea' half less), while in 'Silver and Gold' no such relationship was observed. Irrespective of the duration of long days and plant pinching, the plants produced inflorescences similar in width. In 'Bea' and 'Bengo' the pinched plants produced corymbs significantly wider than the non-pinched plants (in 'Bea' almost 5 cm wider) but they were noted with a smaller number of penducles and inflorescences per corymb. In 'Benetti' pinching did not affect the number of inflorescences but more penducles per corymb were observed. In 'Silver and Gold' it limited the number of and inflorescences per corymb considerably; there were almost 80% fewer penducles and 40% fewer inflorescences (tab. 4, fig. 1).

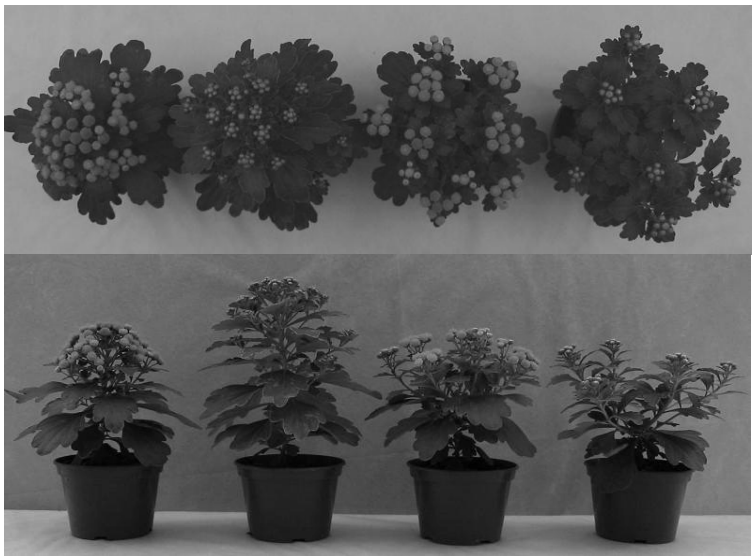

Fig. 1. Plants of 'Bea' cultivar (on left: non-pinched plants growing 2 weeks less under long day, non-pinched plants growing 2 weeks more under long day; pinched plants growing 2 weeks less under long day, pinched plants growing 2 weeks more under long day)

Rys. 1. Rośliny odmiany 'Bea' (od lewej: nieuszczykiwane – rosnące 2 tygodnie krócej w warunkach dnia długiego, nieuszczykiwane – rosnące 2 tygodnie dłużej w warunkach dnia długiego, uszczykiwane – rosnące 2 tygodnie krócej w warunkach dnia długiego, uszczykiwane – rosnące 2 tygodnie dłużej w warunkach dnia długiego)

Additional two weeks of growth in long day affected the height and width of plants of all the tested cultivars. Plants grown longer in long day were higher on average by more than 4 cm in 'Bengo', almost 3.5 cm in 'Bea', 2.5 cm in 'Silver and Gold' and 2 cm in 'Benetti'. As for the width, it was similar; the plants grown shorter in long day were narrower from over 1.5 cm in 'Bea' to almost 4 cm in 'Bengo'. 'Silver and Gold' was the only cultivar in which no significant difference in the plant width was reported.

Table 5. Height and width of plants of 'Bea', 'Benetti', 'Bengo' oraz 'Silver and Gold' cultivars depending on the treatment

Tabela 5. Wysokość i szerokość roślin odmiany 'Bea', 'Benetti', 'Bengo' oraz 'Silver and Gold' w zależności od kombinacji

Cultivar Odmiana	Factor B Czynik B	Height – Wysokość cm			Width – Szerokość cm		
		factor A czynnik A		mean for B średnia dla	factor A czynnik A		mean for B średnia dla
		NP*	P	B	NP	P	B
Bea	L**	19.0	15.2	17.1	20.7	19.6	20.1
	S	14.4	13.0	13.7	18.9	18.1	18.5
	mean for A średnia dla A	16.7	14.1	-	19.8	18.8	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = 1.45 B = 1.45 A/B = n.s. B/A = n.s.			A = 0.93 B = 0.93 A/B = n.s. B/A = n.s.	
Benetti	L	19.5	17.7	18.6	24.3	23.3	23.8
	S	17.4	16.1	16.8	21.7	21.3	21.5
	mean for A średnia dla A	18.5	16.9	-	23.0	22.3	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = 0.61 B = 0.6 A/B = n.s. B/A = n.s.			A = n.s B = 1.57 A/B = n.s. B/A = n.s.	
Bengo	L	23.2	18.2	20.7	22.8	23.1	22.9
	S	17.2	15.6	16.4	17.8	20.2	19.0
	mean for A średnia dla A	20.2	16.9	-	20.3	21.6	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = 0.58 B = 0.58 A/B = 0.82 B/A = 0.82			A = 0.82 B = 0.82 A/B = 1.16 B/A = 1.16	
Silver and Gold	L	19.2	16.1	17.7	15.8	17.8	16.8
	S	15.5	14.9	15.2	15.2	17.4	16.3
	mean for A średnia dla A	17.4	15.5	-	15.5	17.6	-
	$LSD_{0.05}$ $NIR_{0,05}$		A = 0.77 B = 0.77 A/B = 1.09 B/A = 1.09			A = 0.76 B = n.s. A/B = n.s B/A = n.s.	

* and ** – see expalnation for table 1

* i ** – patrz objaśnienie tabeli 1

n.s. – non-significant for p = 0.05, różnice nieistotne przy p = 0,05

In all the cultivars pinching limited the plant height. The greatest difference was observed in 'Bengo' (pinched plants were on average shorter more than 3 cm than the non-pinched ones) as well as in 'Bea' (by an average of more than 2.5 cm). The plant width increased in two cultivars 'Bengo' and 'Silver and Gold' (fig. 1, tab. 5).

DISCUSSION

Due to no information in the applicable literature on ajania, the present results have been referred to chrysanthemum only.

The present experiment showed that ajania is a plant of definitely lower rate of vegetative growth than chrysanthemums. Similar results were reported in the former experiment [Zalewska and Antkowiak 2009]. In the research performed by Zalewska [1986/87], the growth increment in chrysanthemums was on average 1.5 cm per week, while ajania cuttings – less than 1 cm. The slowest growing cultivar was 'Silver and Gold' the increment of which was only 0.5 cm per week. It also produced fewer leaves and, as it is commonly known, the leaves are the acceptor of the photoperiodic stimulus and in the plants dependent on the day length they determine the nature of flowering. According to Cockshull [1976], chrysanthemum flowering depends considerably on the number of leaves. Only after the adequate number of leaves is produced, the plants are becoming capable of flowering, which must have also been the reason of a considerable delay in flowering of that cultivar. 'Bengo' and 'Benetti' produced the highest number of leaves, they also started flowering first. They flowered in 100%, and their cultivation was shortest.

Pinching limits the plant height, increases their width and the number of branches [Rakesh et al. 2003, Beniwal et al. 2003]. This was confirmed by results of this study, although not all the cultivars of ajania responded to that treatment in the same way. In all of them it limited the height of plants but the width increased in two cultivars. In 'Bengo' the pinched plants produced buds and started flowering at a similar date as the non-pinched ones, in 'Benetti' and 'Bea' the delay was inconsiderable. Also the period of cultivation at a permanent site was similar. Pinching affected the plant quality also in a varied way. In 'Bengo' and 'Benetti' it limited the length of corymb, in 'Bea' and 'Bengo' it increased its width, accompanied by a decrease in the number of penducles and inflorescences per corymb. In 'Benetti' it did not affect the number of inflorescences but more penducles were observed per corymb. 'Silver and Gold' was the only one which showed a very unfavourable reaction to pinching. Even though the pinched plants produced longer corymbs than the non-pinched ones, at similar width, the treatment limited the number of penducles and inflorescences per corymb considerably. The pinched plants flowered from a few to a dozen or so days later than the non-pinched ones and their cultivation got prolonged by more than two weeks. It is clear that the reaction to pinching is cultivar-specific and the relationship should always be verified whenever the cultivation of new cultivars is launched.

In the experiment reported by Djurdjevac et al. [2000] the plants grown at the beginning of vegetation under long day (and then darkening) flowered about 30 days later than the ones which were grown right after rooting in short day. In the experiments reported by Strojny [1985] chrysanthemums grown longer in long day flowered later than the ones the darkening of which started earlier, proportionally to the period of long days. In the present experiment the same relationship was noted. In all the cultivars the additional two weeks of vegetative growth delayed flowering and thus made the cultivation period longer by the same number of days as the number of days the plants were growing longer under long day. Similar results were reported by Zakrzewski and Jerzy

in the experiment with chrysanthemums of Yaho group [2008]. The plants which were grown for two weeks under long day demonstrated a better quality than the ones grown in long day only for one day; they were higher, wider and produced more inflorescences. One shall add that, just like in the present experiment, the authors did not apply growth retardants. It turns out that a different period of long days before short days is then a perfect way to modify growth not only in chrysanthemum but also ajania. Similar results are reported as a result of treating the plants with interchangeable photoperiod. Jerzy [2003], applying a 5-day break in darkening of spray chrysanthemum cultivars under covers obtained wider plants, with a greater number of buds and inflorescences in blossom. The quality enhancement was also accompanied by a delay in flowering, in autumn cultivation on average by as many says as the number of days in the break in plant darkening. In summer cultivation the delay was greater since the maximum air temperature over their cultivation period was higher and the day during break in darkening was longer. An unfavourable effect of excessively high temperature can be observed especially over full summer when the air temperature exceeds admissible 26°C [Jerzy and Borkowska 2002]. One can therefore assume that at a later start of the cultivation of ajania, and thus possibly higher air temperature in the glasshouse, the delay in flowering would be even greater. Due to prolonged cultivation (caused by longer vegetative growth in long day) it seems most favourable to start it in early-spring months. Despite the two-week delay in plant flowering, their higher quality justifies such procedure. Besides, the additional two weeks of cultivation in long day gave similar results, as supplementary assimilation illumination. According to Machin [1997], the application of illumination supplementing poor daylight results in, among others, producing long-living plants after harvest. The results of the resent research show that the plants growing longer in long day also maintain a longer decorative life.

It seems that two cultivars of *Ajania pacifica* of the four used in the experiments, 'Bea' and 'Silver and Gold', are specially noteworthy. They could increase the offer of ornamental plants since they are decorative, not only in full bloom but also when the bud is still closed (as the so-called cut foliage).

CONCLUSIONS

1. Not all the *Ajania pacifica* cultivars reacted to pinching in the same way. In 'Bengo' the pinched plants started flowering at a similar date as the non-pinched ones, in 'Benetti' and 'Bea' – only slightly later, while in 'Silver and Gold' the delay in flowering was even up to a dozen or so days.

2. The plants growing longer under long day were higher, wider, with longer and wider corymbs, more inflorescences and at the same time their life was longer.

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WPŁYW USZCZYKIWANIA ORAZ DŁUGOŚCI DNIA NA WZROST I KWITNIENIE AJANII SPOKOJNEJ (*Ajania pacifica* (Nakai) Bremer et Humphries) W UPRAWIE STEROWANEJ

Streszczenie. Ajania staje się coraz bardziej popularna jako roślina doniczkowa. Jest bliską krewną chryzantemy i może stać się dla niej interesującą alternatywą tym bardziej, że uprawę obu gatunków można prowadzić jednocześnie. Celem pracy była ocena wpływu uszczykiwania oraz długości dnia na wzrost i kwitnienie roślin. W badaniach wykorzysta-

no ajanię spokojną odmiany ‘Silver and Gold’ oraz ‘Bea’, ‘Benetti’ i ‘Bengo’ (z grupy Bellania). Pierwszy etap uprawy przeprowadzono w szklarni dnia długiego. Po posadzeniu do doniczek każdą odmianę podzielono na grupy: nieuszczykiwane i uszczknięte jednorazowo, a te na kolejne – przeznaczone od razu do uprawy przy dniu krótkim oraz takie, które przed drugim etapem uprawy (zaciemnianiem roślin, przez okres dwóch tygodni) uprawiano dalej w warunkach dnia długiego. Nie wszystkie odmiany w jednakowy sposób reagowały na zabieg uszczykiwania. U ‘Bengo’ rośliny uszczknięte wytworzyły pąki i rozpoczęły kwitnienie w podobnym terminie co nieuszczykiwane, u ‘Benetti’ i ‘Bea’ opóźnienie było niewielkie, a u ‘Silver and Gold’ pąki pojawiły się od 5 do 12 dni później. Rośliny rosnące dłużej w warunkach dnia długiego były wyższe, szersze, miały dłuższe i szersze baldachogrona, więcej kwiatostanów, dłużej zachowywały trwałość.

Słowa kluczowe: uprawa doniczkowa, fotoperiod, uszczykiwanie

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