GIBBERELLIC ACID INDUCED FLOWERING OF CONTAINERIZED *CENTAUREA MONTANA* L.

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Abstract

The effect of gibberellic acid-3 (GA) spray applications on flowering of *Centaurea montana* L. was studied to determine if GA could substitute for long-day promotion of stem elongation and flowering. Sprays of 25 or 100 µg GA/ml were applied 3 (monthly), 5 (biweekly) or 9 (weekly) times between 7 February and 4 April 1985. No stem elongation or flowering occurred when plants were untreated. Both rates of GA, at all application intervals, promoted stem elongation and flowering. Flowering was most rapid with 5 or 9 applications of 100 µg GA/ml. Nine applications of either GA rate and 5 applications of 100 µg GA/ml caused undesirable changes in leaf morphology and stem weakness; these effects were absent in other treatments.

1. Introduction

Commercial production of herbaceous perennials has increased to meet the demand for "new" landscape and garden plants. Normal flowering season of many perennials does not coincide with the March to May spring sales season in the United States. Methods are needed for producing flowering containerized perennials to increase consumer interest and product recognition. Flowering techniques, involving vernalization, photoperiod, and growing temperature treatments, are available for some perennials (Lopes and Weiler, 1977; Shedron and Weiler, 1982a; 1982b; 1982c; 1982d) but are lacking for most species.

Flowering of *Centaurea montana* L. (Mountain Bluet, Perennial Bachelor's Button) is promoted by long days (Cox, 1985). Containerized plants can be flowered in the greenhouse during late winter and spring in about 60-70 days from transplanting with 4 or 6 hr night-lighting. Plants with no night-lighting during this period will assume a rosette form and will not flower until early summer. Many long-day, rosette-forming plants can be induced to flower under short photoperiods using GA (Wittwer and Bukovac, 1958). As another approach to flowering *C. montana*, this study sought to determine if GA could substitute for long-day promotion of stem elongation and flowering.

2. Materials and methods

Seeds were sown in #3 vermiculite on 7 January 1985 and placed under intermittent mist to germinate. On 28 January, seedlings were transplanted to 12-cm plastic pots of sphagnum peat moss and perlite medium, 1:1 (v/v). Medium was amended on a m^{-3} basis with 3 kg dolomitic limestone, 4.7 kg single superphosphate, 2.5 kg Esmigran (micronutrient fertilizer) and 21 g chelated iron. Plants were fertilized at every watering with soluble 20N-8.8P-16.6K at 200 ppm N. The experiment was conducted in a double-layer polyethylene greenhouse maintained as closely as possible to 21°/18°C day/night temperature. Natural daylength increased from about 10 hr 30 min to 13 hr 30 min during the experiment.

Beginning 7 February plants were untreated or received either 25 or 100 µg GA/ml spray applications at 3 (monthly), 5 (biweekly), or 9 (weekly) intervals. A commercial GA (gibberellic acid-3) preparation, Pro-Gibb 3.91% liquid concentrate, and deionized water were used to prepare GA solutions; no wetting agent was used. At each application enough solution was applied to thoroughly wet all upper leaf surfaces but avoiding the point of runoff and contact with the growing medium. There were five single plant replicates per treatment arrayed in a completely randomized design.

Growth and flowering data were collected as flower buds became visible and at anthesis of the first inflorescence. The experiment was terminated 100 days after transplanting. Data were subjected to analysis of variance and partitioning of degrees of freedom.

3. Results

GA treatment successfully stimulated stem elongation and flowering of all replicate plants regardless of concentration or number of applications (table 1). Stem elongation and flower bud formation did not occur on untreated plants and they were still in rosette-form at the end of the experiment. Five or 9 applications of 100 µg GA/ml resulted in earlier flowering compared to all other treatments, but in these 2 treatments and with 9 applications of 25 µg GA/ml stems were weak and leaves were abnormally long and narrow. Leaf morphology and stem growth were normal with 3 applications of either rate and 5 applications of 25 µg GA/ml. GA rate had no effect on plant height or basal shoot number. At 25 µg GA/ml flowering was not affected by number of applications, however with 100 µg GA/ml flowering was more rapid as the number of applications increased. Plant height and basal shoot number were not affected by number of applications at either GA rate.

4. Discussion

The results of this experiment show that GA can substitute for long photoperiods in promoting stem elongation and flowering of *C. montana*. Although a direct comparison cannot be made between this experiment and earlier night-lighting work of the author (Cox, 1985) because sowing and transplanting dates were about 3 wk earlier in the night-lighting study, about the same number of days were required for flowering with 5 or 9 applications of 100 µg GA/ml as with 4 or 6 hr of night-lighting. It was noted, however, that 5 or 9 applications of 100 µg GA/ml caused undesirable growth effects similar to those previously observed with other plants treated with multiple GA applications (Mastalerz, 1977). With the exception of 9 applications of 25 µg GA/ml, these effects did not occur in the other GA treatments, thus reductions in GA rate and/or frequency of application resulted in normal growth with about a 15 day delay in flowering. Future research should investigate the minimum GA concentration and number of applications required to cause flowering and evaluate the landscape performance of *C. montana* flowered with GA.

References

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Table 1. Effect of night-lighting on flowering of containerized *Centaurea montana*.

GA rate (μg/ml)	Number of applications	Days, transplant to visible flower bud	Days, transplant to anthesis first inflor.	Plant height at anthesis (cm)	No. of basal shoots
0	-	-	-	-	-
25	3	76	84	53.7	4.8
	5	77	84	61.3	4.4
	9	73	81	64.9	4.4
100	3	73	81	57.7	6.2
	5	59	67	55.2	4.2
	9	61	69	55.7	4.0
GA rate					
25 vs. 100, 3 appl.		ns	ns	ns	ns
25 vs. 100, 5 appl.		**	**	ns	ns
25 vs. 100, 9 appl.		**	**	ns	ns
Number of applications					
25 μg/ml		ns	ns	ns	ns
100 μg/ml		L*Q**	L*Q*	ns	ns

Significant F-values: 1% (**) or 5% (*), linear (L) or quadratic (Q)