Pink Polka-Dot Plant (*Hypoestes phyllostachya*) Response to Growth Retardants[1]

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Abstract

Pink polka-dot plant, *Hypoestes phyllostachya* Bak., was treated with one or two foliar spray applications of Bonzi (paclobutrazol) (25, 50, or 100 ppm), Cycocel (chlormequat chloride) (3500 ppm) or B-Nine (daminozide) (3500 ppm) to suppress shoot elongation. One or two applications of 3500 ppm Cycocel (chlormequat chloride) retarded shoot elongation, resulting in consistently mounded plants. Bonzi (paclobutrazol) and B-Nine (daminozide) also suppressed shoot elongation but to a lesser degree, and plants were not uniform.

Index words: growth retardant

Growth regulators used in this study: Bonzi (paclobutrazol), β-[(4-chlorophenyl)methyl]-α-(1,1-dimethylethyl)-1*H*-1,2,4,-triazole-1-ethanol; B-Nine (daminozide), butanedioic acid mono (2,2-dimethylhydrazide); Cycocel (chlormequat chloride), 2-chloro-*N*,*N*,*N*-trimethylethanaminium chloride.

Species used in this study: pink polka-dot plant (*Hypoestes phyllostachya* Bak. 'Pink Splash')

Significance to the Nursery Industry

The application of chemical growth retardants to bedding plants may improve their appearance by producing uniformly compact plants. *Hypoestes*, or pink polka-dot plant, has outstanding foliage for the bedding plant border, but the non-uniform growth habit detracts from its usefulness. In this study, 3500 ppm of Cycocel (chlormequat chloride) applied once or twice 14 days apart produced uniform *Hypoestes* plants that were 58% shorter than untreated controls, concentrating foliage color and potentially increasing the plant's effectiveness in the border. Plants treated with Bonzi (paclobutrazol) or B-Nine (daminozide) were 10% and 46% shorter, respectively, than the control. However, these plants also exhibited a non-uniform branching habit.

Introduction

Pink polka-dot plant, *Hypoestes phyllostachya* Bak., though usually considered an indoor plant, has the potential to be a popular annual addition to the herbaceous garden border. *Hypoestes*, a member of the tropical Acanthaceae family, has the uncommon characteristic of dark green foliage mottled with bright pink, red or white spots (13, 15). The plant is easily grown from seed or cuttings and forms an irregularly branched mound 30 to 60 cm (12 to 24 in) in height. It prefers moist, well-drained soil and full sun, but will also grow in partial shade, where it becomes more open in habit (15). Pinching of *Hypoestes* during production is suggested to decrease height and encourage branching (15). Despite pinching, the plant has an unkempt appearance due to excessive and irregular shoot elongation, reducing the effect of the unusual foliage in the border. By controlling shoot elongation or plant height, a more compact habit may be achieved, concentrating color and potentially improving the foliage effect.

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Chemical growth retardants are commonly applied to bedding plants to suppress shoot or internode elongation, thereby producing compact plants and extending marketability (9). Plant heights were controlled with foliar spray applications of Bonzi (paclobutrazol) at 75 or 150 ppm on chrysanthemum (2), at 20 or 40 ppm on geranium (7), at 250 to 2000 ppm on marigold (9) and at 20, 40, or 80 ppm on various other flowering annuals (4). A foliar spray of Cycocel (chlormequat chloride) has retarded shoot elongation of dianthus at 1500, 3000 or 6000 ppm (10), geranium at 1500 ppm (7) and many other ornamental plants at rates from 500 to 3000 ppm (5). Plant height of selected members of the Acanthaceae family, such as *Sanchezia* and *Strobilanthes*, has been suppressed by the use of Cycocel (chlormequat chloride) at 1500 ppm, but *Pseuderantheumu* did not respond to Cycocel (chlormequat chloride) (14). Internode elongation of *Hypoestes* also has been reported to be suppressed by application of Cycocel (chlormequat chloride) at 1500 ppm (2). B-Nine (daminozide) sprays retarded stem elongation of lisianthus when applied at 2500, 5000 or 7500 ppm (16), chrysanthemum when applied twice at 5000 ppm (2) and several herbaceous and woody species at rates ranging from 1000 to 10,000 ppm (5). Rates of B-Nine (daminozide) from 2500 to 5000 ppm are recommended for height control of bedding plants (6). The objective of this experiment was to determine if shoot elongation of *Hypoestes* could be suppressed with one or two applications of the chemical growth retardants Bonzi (paclobutrazol), B-Nine (daminozide) and Cycocel (chlormequat chloride).

Materials and Methods

Seeds of *Hypoestes phyllostachya* 'Pink Splash' were sown on December 11, 1987, in flats of Pro-Mix BX (Premier Brands, Inc., New Rochelle, NY) drenched with benomyl fungicide. Flats were placed under intermittent mist (10 sec/5 min) in a double layer polyethylene greenhouse with minimum day/night temperatures of 21°C (70°F)/16°C (60°F). Seedlings with fully emerged cotyledons were removed from

mist on January 8, 1988, and transplanted 11 days later to 10 cm (4 in) pots of growth medium drenched with benomyl. Plants were fertilized weekly with 200 ppm N from 20N-4.3P-16.6K (20-10-20) Peter's Peatlite Special (W.R. Grace Co., Fogelsville, PA). Foliar spray treatments were applied to a point just before runoff on February 23, 1988, and consisted of one or two applications of Bonzi (paclobutrazol) at 25, 50 or 100 ppm, Cycocel (chlormequat chloride) at 3500 ppm or B-Nine (daminozide) at 3500 ppm. The second spray treatment was made 2 weeks after the initial application. A pinched treatment and an untreated control were included for comparison. Buffer-X was added as a surfactant at 0.2% to all spray solutions. Plants were about 4 cm (1.6 in) tall with about three basal branches when treated. The terminal shoot of plants given the pinched treatment was removed immediately prior to growth regulator application, leaving 3-cm (1.2 in) tall plants with one set of true leaves; basal branches were not pinched. Treatments were completely randomized with nine single-plant replicates. Plant height was measured at 2-week intervals beginning 2 weeks after initial application until experiment termination at week 12. Final data consisted of shoot dry weights and the numbers of primary and secondary side branches. A visual estimate of plant quality based on uniformity of plant shape and plant height relative to pot size and observations of foliage color were made at the termination of the experiment using untreated controls as the standards for comparison. Rate responses were determined by regression analysis, and an LSD was included for treatment comparisons.

Results and Discussion

One and two applications of 3500 ppm Cycocel (chlormequat chloride) were most effective in suppressing shoot elongation of the three plant growth regulators tested (Table 1). Armitage and Carlson (1) also found Cycocel (chlormequat chloride) to be effective in suppressing shoot elongation of *Hypoestes*. Beginning at week 4 and continuing throughout the experimental period, plant height was suppressed with one or two applications of Cycocel (chlormequat chloride); maximum suppression occurred at week 8 with heights about 70% less than the control plants. Shoot dry weights and numbers of primary and secondary side branches were less than the control with one or two applications of Cycocel (chlormequat chloride) (Table 2). Foliage of plants treated with Cycocel (chlormequat chloride) appeared darker green than that of control plants. This effect has been noted in other plants treated with this chemical (5). Plants also were compact with no vegetative shoot elongation above the consistently mounded foliage, making them potentially more attractive to the consumers.

Although one or two applications of 3500 ppm B-Nine (daminozide) suppressed plant height beginning at week 4 and continuing throughout the experimental period, effects began to dissipate after week 8. At week 6, plant height was suppressed a maximum of 52% and 41% with one and two applications of B-Nine (daminozide), respectively. Shoot dry weights and the numbers of primary and secondary side branches of plants treated with one or two applications of

Table 1. Plant height of *Hypoestes phyllostachya* as affected by pinching or 3 plant growth regulators applied once or twice.

Treatment	Conc. (ppm)	Appl. no.	Plant height (cm) Weeks after initial treatment applied 2	4	6	8	12
Bonzi	25	1	4.6	6.1	11.1	19.8	46.3
	50	1	4.9	5.6	8.7	15.0	36.9
	100	1	4.7 NS[z]	5.1 Q	7.0 Q	10.5 Q	28.8 L
	25	2	5.5	7.1	13.6	23.1	47.9
	50	2	5.1	5.6	8.2	13.3	31.6
	100	2	4.6 L	5.4 L	7.1 Q	11.2 Q	30.9 C
B-Nine	3500	1	4.7	5.3	9.0	17.3	40.4
	3500	2	4.6	5.2	10.9	21.4	45.9
Cycocel	3500	1	4.7	5.0	6.5	8.8	22.6
	3500	2	4.1	4.4	5.7	7.6	22.0
Pinched	—		5.5	7.3	15.5	25.2	47.9
Control	—		6.2	8.8	18.6	29.0	53.3
LSD[y]			1.3	1.9	4.3	5.7	5.1
Significance[x]							
Paclobutrazol							
Appl. no.			NS	NS	NS	NS	NS
Rate			NS	*	*	*	*
Appl. no.* rate			NS	NS	NS	NS	NS
Daminozide							
Appl. no.			NS	NS	NS	NS	*
Chlormequat chloride							
Appl. no.			NS	NS	NS	NS	NS

[z]Significance of regression analysis at P = 0.05: L = linear; Q = quadratic; C = cubic; NS = not significant; control included in regression.

[y]Mean separation within columns by a protected Fisher's least significant test, P = 0.05; LSD used for comparisons among growth regulators.

[x]Significance at the 5% level indicated by an asterisk (*).

Table 2. Branching and shoot dry weight of *Hypoestes phyllostachya* as affected by pinching or 3 plant growth regulators, 12 weeks after treating.

Treatment	Conc. (ppm)	Appl. no.	Side branches		Shoot dry weight (g)
			Primary	Secondary	
Bonzi	25	1	22.2	31.9	9.77
	50	1	19.6	43.2	9.38
	100	1	17.8 L[z]	32.1 C	7.56 L
	25	2	21.8	34.3	10.27
	50	2	17.2	43.1	9.17
	100	2	20.8 Q	40.1 NS	7.91 L
B-Nine	3500	1	23.6	64.0	10.51
	3500	2	23.2	64.1	11.04
Cycocel	3500	1	14.7	38.3	7.59
	3500	2	15.9	34.6	7.17
Pinched		—	23.3	52.7	12.20
Control			22.9	76.5	11.49
LSD[y]			4.0	16.8	2.53
Significance[x]					
Paclobutrazol					
Appl. no.			NS	NS	NS
Rate			*	NS	NS
Appl. no.* rate			NS	NS	NS
Daminozide					
Appl. no.			NS	NS	NS
Chlormequat chloride					
Appl. no.			NS	NS	NS

[z]Significance of regression analysis at P = 0.05: L = linear; Q = quadratic; C = cubic; NS = not significant; control included in regression.
[y]Mean separation within columns by a protected Fisher's least significant test, P = 0.05; LSD used for comparisons among growth regulators.
[x]Significance at the 5% level indicated by an asterisk (*).

B-Nine (daminozide) were not different from those of control plants. Observed foliage color of plants treated with B-Nine (daminozide) did not differ from that of control plants. Also, despite suppression of plant height, some vegetative shoots continued to elongate, resulting in non-uniform plants. Quality of plants treated with B-Nine (daminozide) was not improved compared to control plants.

From week 4 until experiment termination, plant height was suppressed by each concentration of Bonzi (paclobutrazol) except two applications of 25 ppm at week 4. Also beginning at week 4, as concentration of one or two applications of Bonzi (paclobutrazol) increased, plant height decreased. Of the tested concentrations of Bonzi (paclobutrazol), the highest rate (100 ppm) produced the shortest plants, however, treatments with Cycocel (chlormequat chloride) were more effective. Only plants treated with one or two applications of Bonzi (paclobutrazol) at 100 ppm decreased shoot dry weight. One application of Bonzi (paclobutrazol) at 100 ppm or two applications at 50 ppm produced fewer primary side branches than control plants. One or two applications of each concentration of Bonzi (paclobutrazol) resulted in fewer secondary side branches. Leaf color of Bonzi (paclobutrazol) treated plants appeared similar to that of control plants. Though overall plant height was suppressed, elongation of some vegetative shoots was not consistently controlled, and plants developed an irregular shape.

Pinching was not effective in controlling plant height, although a slight decrease was noted at week 12. Shoot dry weights and numbers of primary side branches of pinched plants did not differ from those of control plants, however, numbers of secondary side branches were less. Foliar color and plant quality of pinched and control plants were similar.

The inconsistent control of some vegetative shoots by Bonzi (paclobutrazol) and B-Nine (daminozide) may be attributed to the development and elongation of basal shoots after spray applications of these retardants. Since Bonzi (paclobutrazol) is translocated acropetally through the xylem from the roots or stem, suppression of basal shoots would not be expected (3, 12).

One and two applications of identical rates of Bonzi (paclobutrazol), B-Nine (daminozide) or Cycocel (chlormequat chloride) produced consistently similar results throughout the experimental period. These results are surprising but not unique. For example, a single application of Arest (ancymidol) or Cycocel (chlormequat chloride) hastened flowering and suppressed height of geranium to a similar degree as sequential applications of the same concentrations (11). Gilbertz (8) suggested that greater height control from a given concentration of growth retardant may be attained by an earlier application since less foliage on younger plants would allow more complete coverage of stems.

Cycocel (chlormequat chloride) uniformly suppressed height of *Hypoestes* and was more persistent throughout the experimental period than other tested growth retardants. Although one or two applications of B-Nine (daminozide) at 3500 ppm were effective up to 8 weeks after application, plant quality was not improved relative to control plants. Armitage and Carlson (1) reported *Hypoestes* as being less responsive to B-Nine (daminozide) applied once at 5000 ppm than to Cycocel (chlormequat chloride). Though Bonzi (paclobutrazol) also suppressed plant height, uniformity was not achieved. However, it is important to note that as concentration of Bonzi (paclobutrazol) increased, plant height decreased, therefore, concentrations above those tested in

this experiment may also produce compact, uniform *Hypoestes*.

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Chemical Promotion of Axillary Shoot Development of Geranium Stock Plants[1]

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Abstract

Foliar applications of Promalin (BA + GA_{4+7}), Pro-Shear (BA), Accel (PBA) or Florel (ethephon) were evaluated for their capacity to increase cutting production of geranium stock plants. After a first harvest of cuttings, the number of terminal cuttings was increased 19% by a single application of Promalin (BA + GA_{4+7}) or Accel (PBA) and 93% with Florel (ethephon) application when compared to an untreated control. However, after a second harvest of cuttings following a second application of the foliar spray treatments, numbers of terminal cuttings did not differ among chemical treatments and single-node cuttings increased 60–73% with the application of Promalin (BA + GA_{4+7}) when compared to the control.

Index words: chemical branching agent, cytokinin, axillary shoot development, stock plants, BA, Pro-Shear, Promalin, BA + GA_{4+7}, Accel, PBA, Florel, ethephon

Growth regulators used in this study: Pro-Shear (BA), *N*-(phenylmethyl)-1*H*-purin-6-amine; Accel (PBA), *N*-(phenylmethyl)-9-(tetrahydro-2*H*-pyran-2-yl)-9*H*-purin-6-amine; Promalin (BA + GA_{4+7}), *N*-(phenylmethyl)-1*H*-purin-6-amine (BA) + (1α,2β,4aα,4bβ,10β)-2,4a,7-trihydroxy-1-methyl-8-methylenegibb-3-ene-1,10-dicarboxylic acid (GA_{4+7}); Florel (ethephon), (2-chloroethyl)phosphonic acid.

Species used in this study: geranium (*Pelargonium* × *hortorum* L.H. Bailey 'Hollywood Star').

Significance to the Nursery Industry

The maintenance of geranium stock plants as a source of vegetatively propagated cultivars requires a continual investment in space and labor. Greater efficiency is possible if the number of cuttings per plant is increased, thus reducing the total number of stock plants maintained. Florel (ethephon) is labeled as a branching compound for use on geranium stock plants, however in our research, calipers of terminal cuttings were less than those of control plants. Two applications of Promalin (BA + GA_{4+7}) at either 75 or 150 ppm increased production of single-node cuttings, without reducing the number or caliper of the terminal cuttings. The use of Promalin (BA + GA_{4+7}) is a viable alternative to the industry standard, Florel (ethephon), for increasing the total number of marketable geranium plants produced from single-node cuttings.

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Introduction

Although many types of geraniums are produced from seed, some cultivars continue to be propagated from cuttings