Chemical Removal of Premature, Unwanted Azalea Buds[1]

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Abstract

Spray applications of 4.2% Off-Shoot-0 (a mixture of methyl ester of fatty acids C_6, C_8, C_{10}, and C_{12}) effectively destroyed flower bud scales and flower parts on the azalea (*Rhododendron simsii* Plachon.) cultivars 'Prize' and 'Kingfisher'. The addition of ethephon to Off-Shoot-0 did not increase the destruction of bud scales and flower parts. Dikegulac-sodium and oxathiin alone or in combination with ethephon did not significantly destroy scales or flower parts. Destructive chemical pinching agents such as dimethyl dodecylamine and n-undecanol usually were as effective as Off-Shoot-0 in killing bud scales but not flower parts. Cultivars differed slightly in their response to chemicals designed to destroy unwanted flower buds.

Index words: *Rhododendron* cv., growth regulators, chemical pinching agents, chemical pruning, growth inhibitors

Introduction

Unwanted, random, premature budding of azalea cultivars is an undesirable physiological problem caused by incomplete pinching and environmental conditions. Mechanical pinching or shearing, usually used to increase branching, often removes these unwanted flower buds if they are located in the shearing area, however, it is more likely that they are located in areas not subject to shearing. Chemical methods to remove unwanted buds have not been considered. Nondestructive chemical pinching agents such as cytokinins (7), oxathiin (4) and dikegulac (2, 5, 7) may retard flower bud, but do not prevent bud development. Destructive chemical pinching agents such as fatty acids (1, 7, 8, 9) or alcohols (7) have the potential to destroy these buds but plants may be injured. Ethephon has been shown to pinch azaleas (6, 7) and is used to induce abscission of plant parts (6). Unpublished preliminary research by the authors indicated that ethephon might destroy flower parts. The authors also noted that ethephon often increased the activity of other growth regulators.

The purpose of the present study was to evaluate various growth regulators alone and in combination with ethephon for their effectiveness in destroying azalea flower buds.

Materials and Methods

Liners of the azalea cultivars 'Prize' and 'Kingfisher' were planted in 15 cm (6 in) pots and grown in a 1:1:1 (by vol) sand, sphagnum peat moss, and pinebark medium amended with 2.8 kg (6.1 lb) dolomitic limestone, 0.7 kg (1.5 lb) Micromax (a minor element additive manufactured by Sierra Chemical Co., Milpitas, Calif.), 1.0 kg (2.2 lb) gypsum, and 0.5 kg (1.1 lb) AquaGro (a wetting agent manufactured by Aquatrols Inc., Pennsauken, N.J.) per m^3 (1.3 yd^3). Plants were grown in a greenhouse at 21°C (70°F) minimum night temperature and approximately 990 u mol s^{-1} m^2 (5,000 ft.c) maximum daily radiation. Every two weeks the plants were fertilized with water soluble 25.0N-4.4P-8.3K (25-10-10) fertilizer (2 g per liter or 2½ lb per 100 gal) by filling the headspace of the pot. Approximately 8 weeks after transplanting, two applications of 3,000 ppm chlormequat (2-chloro-N,N,N-trimethylethan ammonimum chloride) were applied at one-week intervals (February 12 and 19) to stimulate flower bud formation. Six weeks after the last treatment, the flower buds were examined macroscopically to determine the presence of flower parts (petals, anthers, stigma and styles) prior to the application of chemicals being investigated to destroy the flower bud. These chemicals included: dimethyl dodecylamine caprylate, n-decanol, Off-Shoot-0 (mixture of C_6 to C_{12} methyl ester of fatty acids), oxathiin (2,3-dihydro-5, 6-diphenyl-1, 4-oxathiin), and dikegulac sodium (sodium salt of 2,3:4, 6-bis-0-(1-methylethylidene-L-xyol-2 hexulofuransonic acid. Chemicals were applied alone and in combination with 0.24 or 0.48% (at a full rate) ethephon (Table 1). The rate or concentration of the chemicals applied was determined from previous investigations and published research (2, 3, 4, 6, 9) that demonstrated effective concentrations for chemical pinching of azaleas. Chemicals were sprayed on the plant with a low pressure, high volume sprayer to apply 11.5 to 13.8 ml of solution per plant. Treatments were carried out on April 9 in a fan and pad cooled greenhouse with a temperature set point of 27°C (80°F). An experimental unit consisted of 3 plants per treatment for 'Prize' plants and 1 plant per treatment for 'Kingfisher' plants. 'Prize' treatments were replicated 4 times and 'Kingfisher' treatments twice using a randomized complete block design for both cultivars.

Two weeks after the treatments were applied, five randomly selected buds were removed from each plant and examined macroscopically to determine the condition of the bud scales and flower parts (petals, anthers, stigmas and styles). Discolored, brown or black scales and flower parts were considered dead.

Results and Discussion

A small amount of unexplained scale destruction was noted on both cultivars (Table 1). The non-destructive chemical pinching agents, dikegulac-sodium and oxathiin, with the addition of 0.24% ethephon did not significantly destroy the scales of either cultivar. The addition of 0.48% ethephon did increase scale destruction with dikegulac-sodium and

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Table 1. Effect of various growth regulator sprays on the percentage of dead scales and flower parts of 'Prize' and 'Kingfisher' azalea plants.

Treatment	Scales		Flower parts	
	'Prize'	'Kingfisher'	'Prize'	'Kingfisher'
Check (no treatment)	10a[z]	10a	0a	20abc
Single sprays				
Ethephon 0.48%	38bc	70abc	0a	0a
Dimethyl dodecylamine caprylate 0.50%	90e	90bc	48bc	70cd
N-undecanol 2.5%	85e	40abc	44bc	30a–d
Off-Shoot-0 4.2%	97e	100c	80d	70cd
Dikegulac-sodium 0.5%	13a	25ab	0a	25a–d
Oxathiin 1.0%	16ab	8a	3a	0a
Combined with 0.24% Ethephon				
Dimethyl dodecylamine caprylate 0.25%	83e	38abc	10a	10ab
N-undecanol 1.25%	46c	50abc	5a	60bcd
Off-Shoot-0 0.21%	96e	80bc	64cd	80d
Dikegulac-sodium 0.25%	10a	30ab	0a	0a
Oxathiin 0.5%	26abc	60abc	0a	0a
Combined with 0.48% Ethephon				
Dimethyl dodecylamine caprylate 0.5%	75e	90abc	31b	30a–d
N-undecanol 2.5%	97e	90bc	49bc	70cd
Off-Shoot-0 4.2%	98e	80bc	71d	70cd
Dikegulac-sodium 0.5%	50cd	32ab	5a	30a–d
Oxathiin 1.0%	72de	40abc	7a	20bcd

[z]Means in columns for cultivar followed by the same letter(s) are not significantly different according to Duncan's multiple range test at the 5% level.

oxathiin on 'Prize' plants. Generally, Off-Shoot-0 with and without ethephon caused the highest percentage of scale death of both 'Prize' and 'Kingfisher' buds. Ethephon alone increased scale death of 'Prize' buds. With one exception, dimethyl dodecylamine caprylate, Off-Shoot-0 and n-undecanol with and without ethephon effectively destroyed the scales of 'Prize' buds. Sprays of 0.5% dimethyl dodecylamine, 4.2% Off-Shoot-0, 2.1% Off-Shoot-0 plus 0.24% ethephon, 2.5% n-undecanol plus 0.48% ethephon, and 4.2% Off-Shoot-0 plus 0.48% ethephon destroyed the scales on 'Kingfisher' buds. The slight difference in the cultivars may be due to azalea bud morphology (8). Buds protected with immature leaves, dense trichomes and overlapping bud scales are less likely to be destroyed by a chemical spray.

The flower parts of 'Prize' buds were not damaged by dikegulac-sodium and oxathiin with and without ethephon (Table 1). Combinations of 0.24% ethephon and 0.25% dimethyl dodecylamine caprylate or 1.25% n-undecanol also caused little injury to flower parts. Once again the response of 'Kingfisher' buds to the chemicals was not as clear as with 'Prize' buds (Table 1). Sprays of 0.5% dimethyl dodecylamine caprylate, 4.2% Off-Shoot-0, 2.1% Off-Shoot-0 plus 0.24% ethephon, 2.5% n-undecanol plus 0.48% ethephon, and 4.2% Off-Shoot-0 plus 0.48% ethephon caused significant death of flower parts.

The percentage of flower buds with necrotic flower parts following Off-Shoot-0 (64 to 80%) was high enough to consider it an effective method of removing unwanted flower buds. Flower part death is usually a better indicator of bud destruction, however, scale death often causes abortion or disease loss. A high percentage of scale death was associated with Off-Shoot-0 treatment. The addition of ethephon to Off-Shoot-0 did not increase scale or flower part death. Plants in this study eventually produced shoots that were used for cuttings. Following shearing after cutting removal, plants were budded, subject to cold treatment and flowered in the spring. Flowering was normal.

Significance to the Industry

This work demonstrates an efficient and effective method, 4.2% Off-Shoot-0 sprays, to remove unwanted premature azalea buds. This information is useful in the selection of a chemical pinching agent (use a destructive one such as Off-Shoot-0 if premature buds are present) and to remove buds that are not removed by mechanical pinching or shearing. Off-Shoot-0 treatment could also facilitate bud removal at pinching with a more efficient chemical pinching agent, on stock plants prior to propagation and on budded cuttings during propagation (there is a disease risk with its use at this stage). A concentration of 4.2% Off-Shoot-0 was effective in this study. Different concentrations (higher and lower) may be warranted depending on cultivar, growth condition and environment.

(*Ed. Note:* This paper reports the results of research only, and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this research paper, be certain of their registration by appropriate state and/or federal authorities.)

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Growth Response of Selected Container-grown Bedding Plants to Paclobutrazol, Uniconizole, and Daminozide[1]

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Abstract

A study was conducted to compare the growth-retarding effects of paclobutrazol (Bonzi), uniconizole (XE-1019, Sumagic), and daminozide (B-Nine) on container-grown bedding plants. Seedlings of *Begonia semperflorens* 'Olympia', 'Scarletta', and 'Vodka', *Catharanthus roseus* 'Little Bright Eye', *Impatiens sultani* 'Blitz Orange', and *Zinnia elegans* 'Yellow Marvel' were treated with a paclobutrazol spray at 0.15, 0.3 or 0.45 mg ai/plant, or a drench of 0.15 mg ai/pot. Uniconizole was applied as a spray at 0.025, 0.05, or 0.075 mg ai/plant, or a drench of 0.025 mg ai/pot. The daminozide was applied only as a 5000 ppm spray. Paclobutrazol and uniconizole were very effective in controlling the height of begonia, catharanthus (vinca), and impatiens at relatively low rates compared to daminozide. The height of zinnia was controlled by daminozide, but not by the other compounds at the rates tested.

Index words: Growth regulators, growth retardants

Species used in this study: begonia (*Begonia semperflorens*), vinca (*Catharanthus roseus*), impatiens (*Impatiens sultani*), zinna (*Zinnia elegans*)

Growth regulators used in this study: (±)-(R*,R*)-β-((4-chlorophenyl)methyl)-α-(1,1-dimethylethyl)-1*H*-1,2,4-triazole-1-ethanol, Bonzi, paclobutrazol; (E)-(p-chlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)-1-penten-3-ol, Sumagic, uniconizole; butanedioic acid mono(2,2-dimethylhydrazide), B-Nine, daminozide

Introduction

Compact container-grown bedding plants are highly desirable because they are more attractive, easier to handle and transport without damage, and tend to have a longer period of marketability than leggy, poorly-conformed plants. Growth control can be achieved with the use of chemical growth retardants. Currently, daminozide (B-Nine) is the growth retardant most frequently used on bedding plants. Recent studies (1, 2, 3, 4, 5) have shown two new gibberellin biosynthesis inhibitors, paclobutrazol (Bonzi) and uniconizole (Sumagic), to be very effective growth retardants on a wide range of plants. Bonzi is currently labeled for poinsettia, and the EPA has recently approved an expanded label including bedding plants. Sumagic does not have a label as this paper is being written, but labelling is expected in the near future. The objective of this study was to evaluate the effects of paclobutrazol and uniconizole on several container-grown bedding plants, and to compare the growth-retarding activity with that of daminozide (B-Nine).

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Materials and Methods

On April 2, 1987, recently-transplanted seedlings of begonias 'Olympia', 'Scarletta', and 'Vodka', and vinca 'Little Bright Eye' were obtained from a wholesale nursery. These plants were growing in 15.3 cm dia × 12.7 cm deep (6 × 5 in) plastic containers in a pine bark:peat medium (19:1 by vol). The vinca had been fertilized at the nursery with Lebanon 18N-1.7P-8.3K (18-4-10) (6 g/container). The begonias were fertilized with Osmocote 18N-2.6P-9.9K (18-6-12) (6 g/container). On April 21, 1987, additional seedlings of zinnia 'Yellow Marvel' and impatiens 'Blitz Orange' were transplanted into 15.3 cm × 12.7 cm (6 × 5 in) containers of pine bark:composted sewage sludge:sand (4:2:1 by vol) and fertilized with Osmocote 18N-2.6P-9.9K (18-6-12) (6 g/container). Treatments were applied to the begonias and vinca on April 23, 1987. The vincas were 5 to 10 cm (2 to 4 in) tall, with 6 to 10 fully-expanded leaves. The begonias had a spread of 10 to 15 cm (4 to 6 in). Treatments were applied to the impatiens on May 4, 1987, when they were 5 to 10 cm (2 to 4 in) high. The weather when all treatments were applied was overcast, with the temperature in the greenhouse 16 to 18°C (60.8 to 64.4°F). All treatments were applied on the basis of amount of active ingredient per plant. Paclobutrazol treatments were applied at rates of 0.15, 0.3, and 0.45 mg/plant with sprays of 30, 60, and 90 ppm resp (5 ml/plant), based on a label rate of