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Ethephon Suppresses Flowering and Improves the Aesthetic Value of Purple Passion Plant (*Gynura aurantiaca*)[1]

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Abstract

Gynura aurantiaca is a colorful foliage plant with velvety purple hairs that cover the green leaves and stems. However, its malodorous flowers and tendency towards a leggy appearance have been key limitations to its production and use for interiorscaping. This study was undertaken to determine if plant growth regulators could suppress its flowering and excessive growth, while improving its overall quality. A-Rest (ancymidol), B-Nine (daminozide), Bonzi (paclobutrazol), Cycocel (chlormequat chloride), and Florel (ethephon) were applied as foliar sprays in two applications in March at a two-week interval. Florel completely inhibited flowering but A-Rest, B-Nine, Bonzi, and Cycocel were ineffective in suppressing flowering. Florel-treated plants also produced more lateral shoots resulting in a compact and dense bush-like appearance, which improved and prolonged the aesthetic value of *Gynura* as a container-grown or hanging-basket interior plant. Whereas, plants treated by A-Rest, B-Nine, Bonzi, or Cycocel exhibited little improvement in their appearance compared to the control; some treatments were even detrimental. Regardless of application concentrations, subsequent growth of plants after pruning or rooting of cuttings was not affected by previous treatments of growth regulators.

Index words: flowering, growth regulators, tropical ornamental foliage plants.

Growth regulators used in this study: A-Rest (ancymidol), ? -cyclopropyl-? -(4-methoxy-phenyl)-5-pyrimidine methanol; B-Nine SP (daminozide), butanedioic acid mono (2,2-dimethylhydrazide); Bonzi (paclobutrazol), ? -(4-chlorophenyl)methyl-? -(1,1-dimethylethy)-1*H*-1,2,4-triazole-1-ethanol; Cycocel (chlormequat chloride), (2-chlorethy) trimethylethanaminium chloride; Florel (ethephon), (2-chloroethyl) phosphonic acid.

Species used in this study: *Gynura aurantiaca* (Blume) DC. (purple passion plant).

Significance to the Nursery Industry

Gaudy and malodorous flowers in spring and summer coupled with an over-grown leggy appearance have been key limitations in the production and interior use of purple passion plant (*Gynura aurantiaca*). Florel (ethephon) at 250 to 1,000 ppm applied twice in March at a two-week interval not only suppressed flowering but also enhanced lateral shoot growth and produced more compact plants, thereby greatly improving aesthetic appearance as either hanging-basket or container-grown plants. However, foliar applications of A-Rest, B-Nine, Bonzi, or Cycocel either did not improve the plant's ornamental value or were detrimental. No residual effects were observed on subsequent growth after pruning of or rooting of cuttings from plants that were previously treated by growth regulators.

Introduction

The genus *Gynura* belongs to the family Compositae, comprises more than 50 species of perennial herbs and subshrubs, and is native to tropical regions of Africa and Asia (5). Among the cultivated species, *G. aurantiaca* is particularly favored as an ornamental foliage plant because its leaves are generously covered with numerous tiny, vivid purple hairs that give the plant a rich, colorful glow. Thus, *G. aurantiaca* is commonly known as purple passion or purple velvet plant. Purple passion is easily grown from cuttings and commonly used as a hanging-basket or containerized plant. In addition, the plant's unusual coloring often makes it well suited for adding a bright note to combination planters.

Generally, scented flowers can be a bonus with most plants, but the yellowish flowers of purple passion have a scent that is obnoxious or malodorous enough to be offensive. Additionally, they grow very fast under appropriate light conditions if watered properly and fertilized regularly. As a result, purple passion plants can acquire a leggy appearance (1).

To make this plant more aesthetically pleasing, flowering must be inhibited and the long creeping growth must be controlled. Since gibberellins promote floral initiation and stem elongation (4, 9), applications of antigibberellin growth regulators might be a solution to both problems (7). Ethephon, an ethylene-releasing chemical that has been used to induce lateral branching and flower bud abortion (2, 8, 11), may also improve the commercial value of this plant.

The objectives of this study were to determine (a) if commercial plant growth regulators could be used to inhibit flowering and promote lateral shoot growth, resulting in more compact and higher quality plants and (b) if subsequent rooting capacity and plant growth and flowering would be affected by the growth regulator treatments.

Materials and Methods

Plant materials and plant growth conditions. Single node cuttings, 4 to 5 cm (1.6 to 2.0 in) in length, of purple passion [*G. aurantiaca* (Blume) DC.] were rooted in 72-cell trays using Vergro Container Mix A (Verlite Co., Tampa, FL), which is comprised of Canadian peat, vermiculite, and perlite (3:1:1 by vol), on October 28, 1998. Uniform rooted cuttings were transplanted singly into 15-cm (6 in) pots containing the same

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substrate mentioned above on November 18, 1998. Potted plants were grown in a shaded glasshouse under a maximum light level of 284 µmol/m²/s (1,500 ft candles), a temperature range of 16 to 28C (60 to 82F), and a relative humidity of 60 to 90%. Plants were watered one or two times per week depending on temperature. One week after potting, 5 g (0.18 oz) of a controlled-release fertilizer 18N–2.6P–10K (Osmocote 18–6–12, The Scotts Co., Marysville, OH) was applied to the substrate surface of each container. On February 19, 1999, plants were cut to a single stem about 12 cm (4.7 in) from the surface of the substrate leaving three nodes. Three lateral shoots emerged from the stem four days after pruning.

Growth regulators and their applications. On March 8, 1999, 160 uniform plants, each with three shoots from 6 to 10 cm (2.3 to 4 in) long, were selected. Solutions of ancymidol (A-Rest, SePRO Co., Carmel, IN) at concentrations of 25, 75, and 150 ppm; daminozide (B-Nine SP, Uniroyal Chemical Co., Middlebury, CT) at 1,250, 2,500, and 5,000 ppm; paclobutrazol (Bonzi, Uniroyal Chemical Co.) at 15, 50, and 100 ppm; chlormequat chloride (Cycocel, Olympic Horticultural Products, Mainland, PA) at 500, 1,000, and 2,000 ppm; and ethephon (Florel, Monterey Lawn and Garden Products, Fresno, CA) at 250, 500, and 1,000 ppm were prepared on March 9 using deionized water. The solutions, along with a deionized water as a control, were immediately foliar sprayed until runoff, approximating 25 ml (0.85 oz) per plant. A second spray was applied two weeks later. The experiment was arranged in a completely randomized design with 10 replications.

Data collection. Flower buds appeared in early April, and plants bloomed fully from mid-April to mid-May. On May 28, 1999, total shoot numbers (TSN) per plant, number of internodes per shoot, flower or bud numbers per plant, and the largest leaf lengths and widths were recorded. Average internode length (AIL) was calculated by dividing the shoot length by the number of internodes. Overall plant quality (OPQ) was determined based on a scale of 1–5 where 1 = very poor; 2 = poor, unsalable; 3 = fair, maybe salable if bud and flower occurrence is not a concern; 4 = good quality, no buds or flowers with compact look; and 5 = excellent quality, no buds or flowers with compact growth and a deep purple color.

Post treatment evaluation. After the preceding data were recorded, one or two stems per container were cut on June 1 into single-node leaf cuttings and rooted in 10 cm (4 in) pots containing the aforementioned substrate. The experiment was also arranged in a completely randomized design with 10 replications. Root numbers and individual root lengths per cutting were measured on June 25. Total root length per cutting was calculated by summing up the lengths of individual

Table 1. Effect of foliar sprays of A-Rest, B-Nine, Bonzi, Cycocel, and Florel on the production of flowers and flower buds of purple passion. Plants were treated on March 9 and 23, 1999. Data were taken on May 28, 1999.

Growth regulator	Concentration (ppm)	Bud no. per plant	Flower no. per plant	Bud and flower no. per plant
Control[z]	0	12.98	15.99	28.97
A-Rest	25	28.5*[y]	15.4	43.9*
	75	21.5*	27.8*	49.3*
	150	9.0*	6.4*	15.4*
Significance[x]		L***	L***Q***	L***Q***
B-Nine	1250	33.0*	15.8	48.8*
	2500	23.0*	27.8*	50.8*
	5000	33.0*	15.0	48.0*
Significance		L*Q***	L**Q***	NS
Bonzi	15	23.2*	35.0*	58.2*
	50	40.0*	7.5*	47.5*
	100	25.3*	6.5*	31.8
Significance		Q***	L***Q***	L***
Cycocel	500	35.0*	38.3*	73.3*
	1000	47.6*	27.0*	74.6*
	2000	12.8	4.7*	17.5*
Significance		L***Q***	L***	L***Q***
Florel	250	0*	0*	0*
	500	0*	0*	0*
	1000	0*	0*	0*
Significance		NS	NS	NS

[z]Deionized water as control.

[y]Asterisk (*) following means within columns indicates significance from the control (0 ppm) at the 0.05 level with Dunnett's test.

[x]Regression response non-significant (NS), linear (L), or quadratic (Q) at the 0.05 (*), 0.01 (**), or 0.001 (***) level; control (0 ppm) was excluded in the analysis.

roots. Root numbers and total root length were used to determine if rooting capacity was altered by the application of growth regulators.

Plants were allowed to continue growing in the shaded glasshouse for testing subsequent growth and also for monitoring possible bud or flower appearance in Florel-treated plants. After four months, plants were pinched and fertilized with 5 g (0.18 oz) of the controlled-release fertilizer mentioned previously. Plants grew in the shaded glasshouse until June 2000 to determine if the previous year's application of the growth regulators would affect subsequent growth and flowering.

Data analysis. Effects of growth regulators on flowering and growth characteristics were determined by analysis of variances according to the general linear model procedures of the Statistical Analysis System (SAS Institute, Inc., 1992, Cary, NC). Responses of flower buds, flower numbers, total shoot numbers, average stem lengths, average internode lengths, the largest leaf lengths and widths, and root numbers and lengths to the application concentrations of each growth regulator, excluding the control were analyzed by regression using the PROC REG procedure (SAS Institute, Inc.). Dunnett's test at P ? 0.05 was used to compare the means of flowering and growth parameters resulted from each concentration treatment of the growth regulators to the means of the control (6).

Results and Discussion

Effects of growth regulators on plant flowering and growth characteristics. Florel completely suppressed flowering of purple passion at the three concentrations used whereas applications of A-Rest, B-Nine, Bonzi, and Cycocel, regardless of treatment concentrations, did not completely inhibit flowering (Table 1). Flower buds or flower numbers or both changed significantly in either linear, quadratic or both linear and quadratic fashions according to the rates of A-Rest, B-Nine, Bonzi, or Cycocel except total bud and flower numbers of B-Nine treated plants that exhibited no significant application rate responses. Application of A-Rest, B-Nine, Bonzi, and Cycocel actually significantly increased total bud and flower numbers compared to the control with the exception of A-Rest, Bonzi, and Cycocel at 150, 100, and 2,000 ppm, respectively, that resulted in total bud and flower numbers either equal to or significantly less than those of the control.

Plant growth characteristics were also significantly affected by the application of growth regulators (Table 2). Florel-

Table 2. Total shoot numbers (TSN), average stem length (ASL), average internode length (AIL), the largest leaf length (LLL) and width (LLW), and overall plant quality (OPQ) of purple passion after foliar spraying of A-Rest, B-Nine, Bonzi, Cycocel, and Florel at different concentrations. Plants were treated on March 9 and 23, 1999. Data were taken on May 28, 1999.

Growth regulator	Concentration (ppm)	TSN	ASL (cm)	AIL (cm)	LLL (cm)	LLW (cm)	OPQ[z]
Control[y]	0	6.5	48.3	3.4	11.2	6.9	3.4
A-Rest	25	4.8*[x]	7.6*	1.2*	9.0*	5.2*	2.2*
	75	5.2	6.9*	0.9*	8.9*	5.5*	2.1*
	150	3.0*	6.3*	0.7*	7.0*	4.3*	1.8*
Significance[w]		L***Q**	L**	L**	L***Q*	L***Q**	L*
B-Nine	1250	6.5	35.2*	3.3	10.9	7.0	3.0
	2500	6.4	21.8*	3.4	11.1	6.4	3.6
	5000	6.5	16.2*	2.0*	9.2*	5.3*	3.0
Significance		NS	L***Q***	L***	L**	L***	Q***
Bonzi	15	7.0	24.9*	2.6*	11.5	6.9	3.0
	50	7.0	6.5*	0.9*	8.0*	4.9*	2.2*
	100	6.4	6.8*	0.8*	8.0*	5.0*	1.8*
Significance		NS	L***Q***	L***Q***	L***Q***	L***Q**	L***Q*
Cycocel	500	7.8	39.9*	3.5	11.1	6.3	3.4
	1000	7.5	34.9*	3.7	10.4	6.0	3.2
	2000	6.5	44.4	3.7	10.6	6.0	3.4
Significance		L*	Q*	NS	NS	NS	NS
Florel	250	9.4*	30.0*	2.8*	11.3	6.5	4.8*
	500	9.8*	29.5*	2.6*	10.5	6.3	4.8*
	1000	8.9*	24.1*	2.0*	11.0	6.4	4.8*
Significance		NS	L***	L***	NS	NS	NS

[z]OPQ where 1 = very poor; 2 = poor, unsalable; 3 = fair, maybe salable if bud and flower occurrence was not a concern; 4 = good quality, no buds or flowers and compact look; and 5 = excellent quality, no buds or flowers, compact look, and deep purple color.

[y]Deionized water as control.

[x]Asterisk (*) following means within columns indicates significance from the control (0 ppm) at the 0.05 level with Dunnett's test.

[w]Regression response non-significant (NS), linear (L), or quadratic (Q) at the 0.05 (*), 0.01 (**), or 0.001 (***) level; control (0 ppm) was excluded in the analysis.

treated plants produced significantly more lateral shoots and shorter stems and internodes with no reduction in leaf sizes compared to the control. There was no rate-dependent response to total stem numbers; however, average stem and internode lengths decreased linearly with the increased rates of Florel application. As a result, Florel application not only stopped flowering of purple passion but also improved its aesthetic value.

Total shoot numbers, average stem and internode lengths, and leaf sizes decreased either linearly, quadratically, or both linearly and quadratically to the rates of A-Rest application. As a result, A-Rest treated plants had significantly fewer shoots, shorter stems and internodes, and smaller leaves than the control; plants were all unmarketable. Plants sprayed with B-Nine exhibited comparable numbers of lateral shoots to the control plants. However, average stem lengths decreased both linearly and quadratically to the application rates. Additionally, average internode lengths and the largest leaf lengths and widths decreased linearly to B-Nine rates. Regardless of application rates, however, overall quality of B-Nine treated plants was rated at 3 or above, suggesting that the plants could be salable if the existence of buds or flowers was not a concern. Bonzi application did not significantly change shoot numbers compared to the control. Plants had significantly shorter stems and internode lengths. Leaf sizes became smaller than the control when sprayed at concentrations of 50 and 100 ppm. Plants with an overall quality rating of 3 were those treated by Bonzi at a rate of 15 ppm only. Cycocel applications did not result in significant difference in growth characteristics compared to the control with the exception of treatments at 500 and 1,000 ppm where average stem length significantly reduced. Thus, overall quality ratings of Cycocel-treated plants did not significantly differ from those of the control.

Effects of growth regulator treatments on subsequent plant rooting, growth, and flowering. Growth regulator application has been shown to inhibit plant growth from several weeks to several years in both herbaceous and woody ornamental plants (3, 10). Since purple passion is propagated primarily through stem cuttings, whether or not rooting capacity was altered by growth regulator treatments was tested. Results showed that root numbers and lengths produced from cuttings derived from plants previously treated with either growth regulators at all tested concentrations ranged from 4 to 6 and 14 to 18 cm (5.5 to 7.1 in), respectively, which were not significantly different from those of the control plants (data not shown). Florel-treated plants did not flower during the prolonged growth. In addition, all plants, no matter what growth regulators at which treated concentrations, after cutting back, grew well and flowered in spring 2000, suggesting that the applied growth regulators had no residual effects on plant growth and development (data not shown).

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