Research Reports

Propagation of *Vinca minor* by Single-node Cuttings[1]

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Abstract

Stems of three *Vinca minor* L. cultivars ('Bowles Variety', 'Dart's Blue', and 'Sterling Silver') were collected on four dates (January, April, July, and October) and prepared as single-node cuttings, either from the distal 10 cm (4 in) of the stem or from the section of the stem just proximal to that. The cuttings were treated with mixtures of indolebutyric acid (IBA) and naphthaleneacetic acid (NAA) in 50% ethanol at concentrations of 0, 1000 + 500, 2000 + 1000, or 3000 + 1500 ppm (0, 0.1 + 0.05, 0.2 + 0.1, or 0.3 + 0.15%) (IBA + NAA). They were then placed under intermittent mist for rooting. Highest rooting percentages occurred with the 1000 + 500 ppm IBA + NAA treatment. For cuttings taken in October, the proximal cuttings rooted at somewhat higher percentages than the distal cuttings (85 vs. 77%) but at other times, stem position had little effect on rooting. Optimum time of year for rooting varied with cultivar but all cultivars rooted well in October.

Index words: periwinkle, auxin, indolebutyric acid, naphthaleneacetic acid, adventitious rooting.

Significance to the Nursery Industry

Vinca minor is in demand as a flowering ground cover, particularly in shady areas. This research shows that *Vinca minor* can be rooted efficiently as single-node softwood or hardwood cuttings, although rooting success varies at different times of the year, depending upon the cultivar. Over all three cultivars evaluated ('Bowles Variety', 'Dart's Blue', and 'Sterling Silver'), the highest rooting percentage occurred with cuttings taken in October. Rooting percentages and root numbers were generally increased with a quick dip of IBA + NAA at 1000 + 500 ppm (0.1 + 0.05%) but higher concentrations tended to reduce rooting percentages.

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Introduction

Vinca minor L., also known as periwinkle, is a prostrate, evergreen perennial with long, trailing shoots and shorter, erect fertile shoots bearing lilac-blue to blue-violet flowers in early spring. It has lustrous medium to dark green leaves and makes an excellent ground cover for shady areas, USDA hardiness zones 4 to 8 (2). The cultivar 'Bowles Variety' (syn. 'Bowlesii', 'LaGrave') has relatively large, azure-blue flowers and a growth habit that is more compact than the species (2). 'Sterling Silver' has variegated leaves and pale, violet-blue flowers. 'Dart's Blue' is similar to 'Bowles Variety' but with resistance to canker (2). Commercial propagation of *V. minor* is generally by softwood cuttings. Multiple node cuttings have been recommended due to the tendency to root at the nodes (3). However, the use of shorter single-node cuttings would increase the number of propagules available from the stock plant, make cuttings easier to handle, and increase the efficiency of propagation space (5). The objective of this study was to evaluate rooting of three cultivars of *V. minor*

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by single-node cuttings. The influences of timing, cultivar, cutting stem position, and auxin treatment were investigated.

Materials and Methods

Stem cutting material of *V. minor* 'Bowles Variety', 'Dart's Blue', and 'Sterling Silver', consisting of terminal sections approximately 25 cm in length, were collected from container-grown stock plants at Hanover Farms, Inc., Fine Ground Covers, Rockville, VA, on four dates: January 25, April 21, July 15, and October 7, 2001. The stock plants were maintained in 3.8 liter (3 gal) containers on outdoor beds shaded by pine trees. They had been top-dressed the previous fall with 18N–2.6P–10K (Osmocote 18–6–12, The Scotts Company, Marysville, OH), 70 g (2.5 oz) per container. The collected stem sections were placed in polyethylene bags and stored overnight at 4C (40F). The following day, the collected stems were taken to the Virginia Tech, Hampton Roads Agricultural Research and Extension Center, Virginia Beach, VA, for rooting experiments. The initial cutting material was cut into single-node cuttings, with those from the distal 10 cm (3.9 in) portion of the stems identified separately from cuttings taken proximal to them. In January, both distal and proximal portions of the stems were hardwood material. In April, all of the cutting material was predominantly softwood. For stems collected in July, the distal portion of the material was predominantly softwood, transitioning to semi-hardwood, and the proximal portion was predominantly semi-hardwood. In October, the distal portions were semi-hardwood, and proximal portions of the stem were transitioning to hardwood. The node portion of the cuttings was treated for 5 sec with reagent grade IBA + NAA combinations of 0, 1000 + 500 ppm (0.1 + 0.05%), 2000 + 1000 ppm (0.2 + 0.1%), or 3000 + 1500 ppm (0.3 + 0.15%) in 50% ethanol. After the auxin treatments, cuttings were allowed to dry for 15 minutes before inserting each node into 25.4 × 50.8 cm (10 × 20 in) plastic flats filled with propagation substrate (MetroMix 360, The Scotts Co., Marysville, OH), 48 cuttings per flat. The flats were placed on raised benches in a glass greenhouse under intermittent mist operated daily for 5 sec every 5 min during daylight hours. Cuttings were maintained at day/night temperatures of 27 ± 4C (80 ± 7F)/20 ± 4C (68 ± 7F). Natural photoperiods were utilized which, in Virginia Beach at the beginning of the experiments in January, April, July, and October, 2001, were (hrs:min) 10:11, 13:22, 14:26, and 11:05, respectively (Virginia State Climatology Office). A natural light intensity was also provided, reduced by approximately 50% with a greenhouse shading for the duration of the experimental period from July through October.

The experimental design utilized for each of the four cutting collection dates was a randomized complete block with a factorial arrangement of treatments consisting of three cultivars × four auxin concentrations × two cutting stem locations (distal vs. proximal) × five replications. A replication (block) consisted of two flats (96 cuttings) within which all treatments were randomized, with 4 cuttings per treatment per block. After seven weeks the cuttings were harvested and percent rooting, number of primary roots ≥ 1mm (0.04 in) in length, and individual root lengths were recorded. All data except rooting percentages were based on the actual number of cuttings that rooted. Analysis of variance using the SAS General Linear Model procedure was carried out to evaluate treatment effects and interactions following arcsin transformation of percentage data. When appropriate, mean separations were performed by LSD, P ≤ 0.05, and trend responses to auxin levels were determined by single degree of freedom orthogonal contrasts. Means separations and trend significance results for transformed percentage data are presented with the original means.

Results and Discussion

For cuttings taken in January, there was a significant cultivar by auxin concentration interaction for rooting percentage (Table 1). 'Bowles Variety' had a rooting percentage of 80% with the 1000 + 500 ppm (0.1 + 0.05%) IBA + NAA treatment but rooting percentages decreased to 50% with higher auxin concentrations. 'Dart's Blue' rooted at 75 to 80% for all three auxin concentrations applied, as opposed to 43% for the zero auxin treatments. 'Sterling Silver' rooted poorly at all auxin concentrations in January, with rooting percentages increasing (non-significantly) from 18 to 40% as auxin levels increased from 0 to 3000 + 1500 ppm (0.3 + 0.15%) IBA + NAA. There were no interactions for root numbers or root lengths but, over all cultivars, increasing auxin concentrations resulted in a linear increase in the number of roots, and a corresponding decrease in root lengths for the cuttings that rooted (Table 2). This decrease in root lengths with increased auxin levels has been observed with other species as well and it has been speculated to result from competition among developing roots for finite quantities of nutrients and/or carbohydrates (1, 4).

Although no cultivar by auxin concentration interaction occurred for cuttings taken in April, both cultivar and auxin concentration independently affected percent rooting, root numbers and root lengths. 'Sterling Silver' was significantly higher in rooting percentages than the other two cvs., in addition to having the highest numbers of roots and mean root lengths on cuttings that rooted (Table 2). Over all cultivars, the highest rooting percentage (68%) was obtained with 1000 + 500 ppm (IBA + NAA), and there was again a linear increase in root numbers along with a decrease in root lengths with increasing auxin concentration for cuttings that rooted.

In July, there was a cutting position by auxin level interaction effect for both rooting percentage and for root numbers on cuttings that rooted. For distal cuttings, there was a linear decrease in rooting percentage (68 to 50%) with increasing auxin concentration, but for proximal cuttings there was a quadratic response, with the highest rooting percentage (83%)

Table 1. Interaction effects of auxin concentrations and *Vinca minor* cultivars on mean rooting percentages of cuttings taken in January, 2001.

IBA + NAA conc. (ppm)	Rooting percentage		
	'Bowles Variety'	'Dart's Blue'	'Sterling Silver'
0	20c[z]	43b	18
1000 + 500	80a	75a	28
2000 + 1000	53b	80a	33
3000 + 1500	50b	75a	40
Significance[y]	Q 0.0001	Q 0.009	NS

[z]Mean separation within cultivar columns by LSD, P ≤ 0.05; n = 10.
[y]Significant quadratic (Q) response at the indicated probability level. NS = non-significant.

Table 2. Main effects of cultivar, auxin concentration, and cutting stem position on rooting percentages (%), mean root numbers (RN), and mean root lengths (RL) on single-node cuttings of *Vinca minor* taken in January, April, July, and October, 2001.

	January				April				July				October			
Parameter evaluated	**%**	**RN**	**RL**	**n[y]**	**%**	**RN**	**RL**	**n**	**%**	**RN**	**RL**	**n**	**%**	**RN**	**RL**	**n**
Cultivar																
'Bowles Variety'	51b[z]	2.0	27	36	33b	2.9b	51b	28	49c	3.9b	50	39	84	3.1b	73	40
'Dart's Blue'	68a	2.2	27	39	28b	2.7b	53b	29	60b	5.1b	55	38	81	2.7b	64	39
'Sterling Silver'	29c	2.3	23	30	89a	4.9a	63a	40	71a	7.4a	55	40	79	4.4a	66	40
		NS	NS								NS		NS		NS	
IBA + NAA (ppm)																
0	26b	1.7b	29a	22	40c	1.5b	61a	21	60b	2.0b	70a	30	89a	2.3b	76a	30
1000 + 500	61a	2.2ab	29a	26	68a	3.9a	60a	29	73a	6.9a	53b	29	92a	3.5a	70ab	30
2000 + 1000	55a	2.2ab	26ab	28	54b	3.9a	57a	26	53b	7.1a	46bc	28	77b	3.7a	60b	29
3000 + 1500	55a	2.5a	21b	29	38c	5.2a	47b	21	54b	6.1a	44c	30	67b	4.1a	64b	30
Significance[x]	Q0.0010	L0.008	L0.004		Q0.001	L0.0001	L0.01		C0.01	Q0.0001	L0.0001		L0.0001	L0.0007	L0.01	
Stem position																
Distal	49	2.0	27	52	48	3.4	59	46	56	4.6b	47b	57	77a	3.4	65	59
Proximal	50	2.3	24	53	52	4.0	55	51	64	6.3a	59a	60	85b	3.4	70	60
	NS	NS	NS		NS	NS	NS		NS					NS	NS	

[z]Mean separation within columns for a parameter evaluated by LSD, P ≤ 0.05. For rooting percentages: n = 40 for cultivar, 30 for auxin, and 60 for position.

[y]n is provided for mean root numbers and mean root lengths because the number of cuttings that rooted varied among parameters evaluated.

[x]Significant linear (L), quadratic (Q) or cubic (C) response at the indicated probability value; NS = non-significant.

occurring at 1000 + 500 ppm IBA + NAA (data not shown). Combined over both distal and proximal cuttings, there was a cubic response to auxin concentrations, with highest rooting percentages occurring at 1000 + 500 ppm (IBA + NAA) (73%, Table 2). With root numbers, both the distal and proximal cuttings had a quadratic response to auxin but, for distal cuttings, the largest number of roots (6.0) occurred with 2000 + 1000 ppm IBA + NAA while, for proximal cuttings, more roots (8.5) occurred with 1000 + 500 ppm IBA + NAA on cuttings that rooted (data not shown). Cultivar had a significant effect on both rooting percentages and root numbers on cuttings that rooted, with 'Sterling Silver' again being highest in both these parameters in July (Table 2). Auxin concentration and cutting position also affected root lengths in July. Root lengths decreased with increasing auxin concentration, and proximal cuttings had longer roots and more roots than distal cuttings over all cultivars (Table 2).

In October, all cultivars rooted equally well at about 80%, although 'Sterling Silver' had more roots per cutting than the other two cultivars (Table 2). Generally, auxin did not improve rooting percentages in October and, with concentrations over 1000 + 500 ppm IBA + NAA, there was a decrease in rooting percentages, although increased auxin levels again resulted in an increase in root numbers along with a decrease in root lengths on cuttings that rooted (Table 2). Proximal cuttings had higher rooting percentages than distal cuttings over all cultivars but cutting position had no effect on root numbers or lengths in October (Table 2).

In summary, the effect of time of year on rooting of single-node *V. minor* cuttings varied with the cultivar. Over all cultivars, best rooting percentages occurred when cuttings were taken in October. Generally, rooting percentages over all cultivars was improved with 1000 + 500 ppm IBA + NAA, but not with higher auxin concentrations. However, root numbers on rooted cuttings increased with increasing auxin concentrations but with a corresponding decrease in root lengths.

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