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Propagation of *Comptonia peregrina* L. from stem cuttings

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***Abstract*. *Comptonia peregrina* is a desirable native ornamental plant for challenging landscapes, but it cannot be produced using conventional softwood stem cuttings. We demonstrate that *C. peregrina* can be successfully propagated using young shoots (6 to 8 cm in length) recently emerged from rhizomes taken as cuttings. Although significantly more cuttings rooted using intermittent mist (99%) than propagation dome (70%), cuttings under propagation domes had greater shoot counts. Due to the drier and warmer conditions under propagation domes, cutting shoot tips were killed, which relieved apical dominance and stimulated lateral budbreak. Cuttings rooted under propagation domes produced plants having greater height, width, and size after 90 d than cuttings rooted under intermittent mist. Treatment of cuttings with talc-based rooting hormone at 3000 and 8000 ppm indole-3-butyric acid (IBA) significantly improved rooting percentage and shoot count over untreated cuttings. Cuttings treated with 8000 ppm IBA produced the most roots. Container plants grown from cuttings and pruned to 7 cm in height produced twice as many shoots as unpruned plants. Using cuttings taken from young shoots (6 to 8 cm) produced from rhizomes, 3000 or 8000 ppm IBA, and intermittent mist nursery growers can achieve rooting percentages for *C. peregrina* above the 80% benchmark preferred for commercial plant production.**

Comptonia peregrina L. is a highly sought ornamental plant because it is native to the northeastern United States, adaptable to challenging landscape situations, and has appealing habit and foliage, which is aromatic (Hightshoe, 1988; Lubell, 2013). Current nursery propagation of *C. peregrina* by rhizome division is not meeting consumer demand for this plant. *C. peregrina* is difficult to propagate from seed due to germination inhibitors present in the seedcoat (Del Tredici and Torrey, 1976), and seeds produce variable-quality plants. Deciduous shrubs are typically propagated from softwood cuttings taken at the end of June when shoots begin to harden off (Hartmann et al., 2002). However, this method has not been successful for *C. peregrina* (Dirr and Heuser, 1987). Cultivars developed for *C. peregrina* would require vegetative propagation. This can be accomplished using rhizome division, but this method is slow, requires significant investment in stock plants, and produces less uniform liner plants compared with cuttings. Dirr and Heuser (1987) suggested that young shoots ≤8 cm in length taken as cuttings without an attached rhizome segment will root using 3000 ppm IBA in talc and intermittent mist, but no information on rooting outcome was provided. We evaluated the impact of increasing concentration of rooting hormone on propagation success of recently elongated shoot cuttings (6 to 8 cm long) harvested off of rhizomes of *C. peregrina*, henceforth referred to as young shoots. An additional objective of this study was to compare propagation success of young shoot cuttings of *C. peregrina* rooted under intermittent mist and propagation dome.

Materials and Methods

Rhizome preparation. This study was conducted two times using dormant *C. peregrina* plants that had received adequate cold chilling to break dormancy. For the first replication of this study, rhizomes were dug on 1 Nov. 2016, prepared in flats (as described below), and placed in a cooler with set points of 3 °C ± 2 °C. For the second replication of this study rhizomes received natural outdoor chilling conditions and were dug on 3 Apr. 2017, prepared in flats, and placed directly into a greenhouse with set points described below. *C. peregrina* plants were dug from University of Connecticut properties in Mansfield, CT. Rhizomes were cut into 10 to 15 cm long pieces with diameters that ranged from 0.5 to 1 cm. After preparation, rhizomes were planted horizontally in 21.5-L plastic flats (11 × 36 × 53 cm) filled with medium composed of four parts aged pine bark (Fafard, Agawam, MA), two parts Canadian sphagnum peatmoss (Fafard), and one part sand. Flats were watered in by hand to settle the medium and top-dressed with 1 cm of horticultural-grade vermiculite (Whittemore Co., Lawrence, MA). Flats were set in a greenhouse with set points of 23 °C ± 2 °C day and 16 °C ± 2 °C night temperatures for forcing on 22 Feb. 2017 (first replication) and 3 Apr. 2017 (second replication). Five flats were prepared for each replication of this study. Flats were irrigated as needed and once shoots started to emerge a soluble fertilizer (Peters 10N–4.3P–16.6K Fertilizer, Scotts, Marysville, OH) solution with 100 ppm N was provided every 7 d.

Cutting study. Cuttings were taken on 16 Mar. 2017 for replication one of this study and 16 May 2017 for replication two, when shoots had reached 6 to 8 cm in length (Fig. 1). To prepare cuttings shoots were cut at the medium surface above and not including the rhizome. Cuttings were dipped in talc containing 0, 1000, 3000, or 8000 mg/kg IBA [Hormodin #1, #2, or #3, respectively (OHP, Mainland, PA)] and inserted into 50 round cell propagation sheets (54 × 26 × 6; Dillen-ITML HC-Companies, Middlefield, OH) filled with medium composed of one part Canadian sphagnum peatmoss (Fafard) and one part horticultural-grade vermiculite (Fafard). An experimental unit consisted of a five-cell row of the propagation sheet with five cuttings (one cutting per cell). Flats were covered with a clear propagation dome (54 × 28 × 6; Curtis Wagner Plastics, Houston, TX) and placed in a greenhouse with set points as described or left uncovered and placed under intermittent mist that provided 10 s of mist every 8 min. Flats were provided 50% shade using woven polypropylene cloth.

Fig. 1. (**A**) Young shoots of *Comptonia peregrina* growing from rhizomes and (**B**) prepared as cuttings.

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Experimental design. The experimental design was a split-plot with propagation system as the fixed main plot (one replication). Within each main plot, there was a randomized complete block design with 20 blocks for replication one of this study and 15 blocks for replication two (35 blocks combined between replicate experiments, 280 experimental units × 5 cuttings per experimental unit = 1400 total cuttings). After 60 d, cuttings were harvested and experimental units were evaluated for percentages of rooted cuttings. Root count (the number of roots longer than 0.5 cm) and shoot count (the number of new shoots) for the rooted cuttings (Fig. 2) in an experimental unit were averaged to obtain a value for each unit.

Post-propagation growth. To evaluate the effect of propagation system on subsequent plant growth, 160 rooted cuttings from replication 1 (one randomly selected cutting per hormone treatment per block per main plot) were potted into 160-mL containers using the same medium described for the flats of rhizomes. Plants were grown in a greenhouse with set points as described, and after 30 d, plants were transplanted to 307-mL containers using the same medium and plant height (measured from the potting medium surface to the apex of the foliage) and width (measured twice, at right angles to each measurement) were recorded. Plant size was calculated by multiplying height × width 1 × width 2. On 7 July 2017, 18 d after transplanting, 48 uniform plants were selected, and half the plants were pruned to a height of 7 cm; the remaining plants were left unpruned. Plants in the greenhouse were arranged as a randomized complete block design with 24 blocks each with one pruned and one unpruned plant. Plants were irrigated as needed and provided a soluble fertilizer (Peters 10N–4.3P–16.6K Fertilizer, Scotts) at 100 ppm N every 7 d. On 29 Aug. 2017 the number of shoots per plant was recorded.

Data analysis. Data were subjected to analysis of variance (PROC MIXED) and mean separation with Tukey's honestly significant difference test ($P \leq 0.05$) using SAS (version 9.4 for Windows; SAS Institute, Cary, NC). There was no significant difference between replications of this study, so the data were combined for statistical analysis. The interaction was not significant.

Results and Discussion

C. peregrina shoot emergence from rhizomes was first observed ≈12 d after forcing in the greenhouse. The first roots on young shoot cuttings of *C. peregrina* were observed ≈21 d after sticking. Significantly more *C. peregrina* cuttings rooted under intermittent mist than under propagation domes, and cuttings under intermittent mist produced more roots (Table 1). Rooting success of nearly 99% was achieved for *C. peregrina* using intermittent mist. This success rate surpasses the current benchmark of 80% rooting necessary for a plant to be considered a viable commercial nursery crop (Lubell and Griffith Gardener, 2017). Cuttings of *C. peregrina* rooted under a propagation dome had greater shoot counts than cuttings rooted under intermittent mist. Compared with intermittent mist, conditions under propagation domes were drier and warmer, which killed the shoot tips of most cuttings under propagation domes. This relieved apical dominance and stimulated lateral budbreak, resulting in significantly more shoots on propagation dome cuttings than intermittent mist cuttings. Cuttings rooted under the propagation dome produced plants having greater height, width, and size after 90 d than cuttings rooted under the intermittent mist. Pruned plants of *C. peregrina* (Fig. 3) produced significantly more shoots (8.6) than unpruned plants (4.7; P = 0.0124).

Increasing hormone concentration benefitted rooting of *C. peregrina* (Table 1). Cuttings treated with 3000 or 8000 ppm IBA had the greatest rooting percentage, which exceeded 85%. *C. peregrina* cuttings treated with 8000 ppm IBA produced more roots than all the other hormone treatments. IBA at 3000 and 8000 ppm resulted in cuttings with greater shoot counts than the no hormone control. Similarly, for the eastern U.S. native shrubs *Ceanothus americanus, Corylus cornuta, Viburnum acerifolium*, and *Viburnum lantanoides,* increasing hormone concentration improved rooting success of softwood stem cuttings (Cartabiano and Lubell, 2013; Lubell and Griffith Gardner, 2017).

C. peregrina can be propagated at nearly 100% rooting when cuttings are taken from young shoots (6 to 8 cm long) produced from rhizomes (Fig. 1) using 3000 or 8000 ppm IBA and intermittent mist. Although not studied, evidence from the propagation domes indicates that pinching cuttings immediately after rooting could be beneficial to increase shoot development and produce larger plants. The results of this study were found for shoots produced from rhizomes;

Fig. 2. A rooted cutting of *Comptonia peregrina* at (**A**) 30 d after sticking and (**B**) 60 d after sticking.

Table 1. Rooting percentage, root count, and shoot count, for cuttings of sweetfern treated with talc-based indole-3-butyric acid (IBA) at 0, 1000, 3000, or 8000 ppm, and rooted under intermittent mist or propagation dome, and plant height, width and size for 90-d-old plants.

Main effects	Rooting percentage (%)	Root count[z]	Shoot county	Plant height (cm)	Plant width (cm)[x]	Plant size (1000 cm^3)[w]
Propagation system						
Intermittent mist	98.6 av	9.0 a	1.9 b	20.1 b	16.5 b	6.75 b
Propagation dome	69.4 b	5.6 b	2.9 a	23.0 a	20.3 a	11.33 a
n	70	70	70	80	80	80
IBA (ppm)						
0	79.4 b	5.6 c	2.1 b	21.1 a	17.8 a	8.24 a
1000	80.6 b	7.1 b	2.4 ab	21.9 a	18.5 a	9.05 a
3000	89.1 a	7.5 b	2.6 a	21.4 a	17.4 a	8.60 a
8000	86.9 a	9.0 a	2.5 a	21.9 a	19.8 a	10.26 a
n	35	35	35	40	40	40

[z]Root count is the number of roots longer than 0.5 cm.
[y]Shoot count is the number of shoots longer than 0.5 cm.
[x]Plant width was measured twice, at right angles to each measurement, and averaged.
[w]Plant size was the product of height and two perpendicular widths.
[v]Mean separation within column, within main effect, indicated by different letters, by Tukey's honestly significant difference test at $P \leq 0.05$.

Fig. 3. Pruned plants of *Comptonia peregrina* in 307-L containers at 150 d after sticking as cuttings.

however, this technique can be successfully applied to shoots produced from aboveground stems on *C. peregrina* plants in containers or the landscape based on a limited trial that we conducted (data not shown). Nursery growers should have no problems expanding their production of *C. peregrina* using our method for young shoot cuttings. After shoot cuttings were taken from rhizomes for this study, the rhizomes regenerated a second flush of shoots, which could have been made into additional cuttings. Using flats of rhizomes nursery growers may be able to obtain multiple rounds of cuttings thereby improving their propagation efficiency of *C. peregrina*. Producers of *C. peregrina* should consider conducting a late spring to early summer prune to help develop fuller liner plants.

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