Propagation of *Taxodium mucronatum* from Softwood Cuttings

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Abstract
Mexican bald cypress (*Taxodium mucronatum* Ten.) is propagated from seed, but procedures have not been reported for the propagation of this ornamental tree by stem cuttings. This study evaluated the use of softwood cuttings to propagate Mexican bald cypress. Softwood cuttings were collected on 16 October 1998 and 1999 from Las Cruces and Los Lunas, New Mexico, treated with either 3000 or 8000 ppm of indole-3-butyric acid (IBA) and held under intermittent mist in a greenhouse for 13 weeks. In 1998, cuttings sampled from one of two Los Lunas trees showed 48% and 82% rooting when treated with IBA at 3000 or 8000 ppm, respectively. Root number and average root length were 9 and 3 times greater, respectively, with 8000 ppm IBA than with 3000 ppm IBA. More 1998 cuttings rooted (65%) than 1999 cuttings (10%) when means were combined over IBA treatments. Results indicate that efficient propagation of Mexican bald cypress by cuttings depends on exogenous IBA and selection of stock plants amenable to root formation.

Introduction
Mexican bald cypress or Montezuma cypress (*Taxodium mucronatum* Ten.) is a deciduous conifer that was distributed across the northern hemisphere but is now limited to Mexico, southern Texas and Guatemala. The plant may be a geographical form of the common bald cypress (*Taxodium distichum* L.) (Harper, 1902), but Debreczy and Rácz (1998) reported that trees of Mexican bald cypress are more compact, have smaller cones (0.6 to 1 inch diameter) with pointed scales and shorter leaves (0.2 to 0.5 inch long) than its northern relative, the bald cypress. Additionally, St. Hilaire (2001) reported that Mexican bald cypress lacks the distinctive root collar swellings (pneumatophores) that are characteristic of *T. distichum*.

Mexican bald cypress typically may be propagated from seed (St. Hilaire, 2001), but asexual propagation techniques are not well established. Softwood cuttings have been used to propagate *T. distichum* (Moore, 1970), but there are no reports of whether softwood cuttings may be used to propagate *T. mucronatum*. In view of the declining range of the plant, initial and the lack of clonal propagation-related data, the objective of this research was to evaluate whether softwood cuttings could be used to propagate Mexican bald cypress.

Terminal softwood cuttings were collected on 16 October 1998 and 1999. Cuttings were selected from the lower branches of an 11-year-old tree at New Mexico State University's Fabian Garcia Science Center in Las Cruces (lat. 32° 16' 48" N; long. 106° 45' 18" W), from all branches of a 2-year-old tree at an arboretum in Los Lunas, New Mexico (lat. 34° 48' 18" N; long. 106° 43' 42" W), and from all branches of a 2-year-old tree in the display landscape of a nursery in Los Lunas. Plants of *T. mucronatum* grow rapidly. The 11-year-old tree was 12 m tall (≈50 main branches), and the 2-year-old trees had reached 2 m (≈ 15 main branches). This facilitated the collection of at least 30 terminal cuttings per tree in each of the two years. All trees were irrigated as necessary, but not fertilized. In addition, all trees originated as seedlings from two adjacent, open-pollinated, trees in a stand located in the Gila National Forest. Cuttings were collected at sunrise at the Los Lunas locations and late morning at the Las Cruces site. Harvested cuttings from all provenances were misted immediately, sealed in opaque plastic bags, and kept on ice. Cuttings selected from the Los Lunas locations were transported (H"2 hours) to Las Cruces. Both collections were stored at 10 C overnight in a refrigerator. In the early morning of 17 October 1998 and 1999, the cuttings were removed randomly from the bags and their basal ends recut to obtain terminal cuttings that were 15 cm long. Basal diameter of cuttings ranged from 3 to 5 mm. The basal 1.5 cm on opposite ends of the cutting was wounded by scraping off the epidermis and phloem with a razor blade. The wounded area was coated with talc containing 3000 or 8000 $mg \cdot kg^{-1}$ IBA (Hormodin® #2 or #3, E. C. Geiger, Harleysville, PA.). The basal cutting ends then were inserted 5 cm deep into 10-cm tall × 35-cm wide × 50-cm deep plastic flats (Dyna-flat™, A. H. Hummert, Earth City, Mo.) containing 1:1 coarse perlite : peat moss by volume. Holes were drilled on the bottom surfaces of the flats to facilitate drainage. There were 30 cuttings in each of five flats. A single cutting was the experimental unit. In each of two years, the experiment was completely randomized with three tree sources, two levels of IBA, and 25 replications for each source x IBA combination.

Flats were placed in a propagation bench (30% shade) and misted with tap water 6 sec every 6 min from 0800 to 1800 HR. Daily minimum/maximum temperatures of the air within the mist bench were 15 ± 2/35 ± 5 C in 1998-1999 and 13 ± 3/35 ±4 C in 1999-2000. Midday photosynthetically active radiation averaged 326 ± 126 $\mu mol \cdot m^{-2} \cdot s^{-1}$ in 1998-1999, and 280 ± 84 $\mu mol \cdot m^{-2} \cdot s^{-1}$ in 1999-2000.

Cuttings were destructively harvested after 13 weeks (14 January 1999 and 2000). Adventitious roots that protruded more than 2 mm from the sides of each cutting were counted, and their lengths were measured. The root lengths on each

were analyzed to test whether the year of propagation affected rooting performance.

Results and Discussion

In both years, cuttings that rooted were from the 2-year old tree in the display landscape of the Los Lunas nursery. Within each year, the level of IBA did not affect rooting percentage, but more 1998 cuttings rooted (average of 65%) than 1999 cuttings (average of 10%) (Table 1). Cuttings selected in 1999 may not have rooted successfully because they were one year older than those selected in 1998. This is consistent with a report by Moore (1970) that has shown the age of the stock plant influences rooting of its northern relative, *T. distichum*.

For cuttings propagated in 1998, root number and mean root length were 9 and 3 times greater, respectively, with 8000 ppm IBA than with 3000 ppm IBA (Table 1). In addition, root dry weights were 15 times higher in cuttings treated with IBA at 8000 ppm than in cuttings treated with IBA at 3000 ppm (Table 1), thus indicating that the higher level of IBA was more effective in promoting adventitious rooting. Environmental conditions were similar and cuttings were selected on the same date for both repetitions of the experiment. Yet, the level of IBA did not affect root number, mean root length and root dry weight of cuttings selected in 1999 (Table 1). Although several factors affect root formation in stem cuttings (St. Hilaire and Fierro, 2000), these results suggest that the inconsistency in rooting Mexican bald cypress from year to year may be related to the age of the stock plants.

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Literature Review

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Table 1. Percentage rooting, number of primary roots, mean root length, and root dry weight of cuttings taken from a 2-year-old tree of Mexican bald cypress in the display landscape of a nursery in Los Lunas, New Mexico. Cuttings were collected on 17 October 1998 and 1999, treated with IBA at 3000 or 8000 ppm, and propagated for 13 weeks.

IBA	Rooting (%)		No. of primary roots		Mean root length (mm)		Root dry wt. (mg)	
(ppm)	1998	1999	1998	1999	1998	1999	1998	1999
3000	48[z] a	4 a	1 a	0.04 a	6 a	0.22 a	4 a	0[y] a
8000	82 a	16 a	9 b	0.24 a	18 b	1.28 a	59 b	0.2 a

[z]Means within columns were separated by $LSD_{0.05}$. Each value is the mean of 25 values.
[y]Weight was too low to detect.