Within-Shoot Variation in Propagating Stem Cuttings of Two *Eucalyptus globulus* Interspecific Hybrids

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INTRODUCTION

Interspecific hybrids of *Eucalyptus grandis* Hill ex Maid, propagated by stem cuttings, are planted widely in the tropics and subtropics, especially on sites which are marginal for the pure species. In Mediterranean regions, interspecific hybrids of *E. globulus* Labill. could become equally prominent on analogous sites where, for example, the pure species suffers from excessive winter cold or summer drought.

Clones of the hybrids *E. viminalis* × *E. globulus* (VG) and *E. cypellocarpa* × *E. globulus* (YG) were each multiplied from a seedling by stem cuttings. Within-shoot variation in the initial survival and rooting ability of the hybrid cuttings was investigated, and compared to that in *E. globulus*.

MATERIALS AND METHODS

Hybrid seed was created by controlled pollination in the Stora CELBI breeding programme. The pollen parent was *E. globulus* Labill. from the Portuguese landrace, while the seed parents were of unknown provenance.

The juvenile shoot morphology of the hybrids was intermediate between that of the parent species. Leaves were narrowly lanceolate (VG) or ovate (YG), and in both hybrids the leaves were opposite, sessile to slightly petiolate, and nonglaucous. In both, the stem was also square in cross-section and nonwinged close to the apex, otherwise rounded. The VG stem bearing mature leaves tended to be relatively thin and stiff while the YG stem was more like that of *E. globulus*.

Mother plants were grown in 10-litre pots in a double-skin plastic greenhouse. Minimum night temperatures were 10 to 15C and day temperatures were 25 to 35C. The plants were harvested for cuttings every 2 to 4 weeks when principal shoot length was up to 20 to 30 cm. Shoots less than 15 cm long were left on the mother plants to facilitate renewed growth, maintaining a globular crown on a low woody framework. Cuttings were prepared from harvested shoots (including first order laterals) at least 10 to 12 cm long.

The cuttings were set in a glasshouse in a peat and perlite mixture (2 : 1, v/v) (containing 3 kg m^{-3} of slow-release fertiliser 15N : 10P : 12K), and kept well wetted with intermittent mist. Temperatures were 15 to 20C at night and 20 to 30C during the day, minimum relative humidity was 85% to 90%, while shade of 85% was provided on clear days. Cuttings harvested in January and February received supplementary light in the glasshouse, extending day length to 16 to 18 h.

Trials Conducted.

1) ***Contiguous One-node Cuttings.*** The shoot apex and immature leaves (less than 75% full-size) were removed from harvested shoots and four contiguous one-node cuttings were then prepared

from each, starting from the distal node (node 1). The stem of the distal node was relatively thin but internode length and trimmed leaf area (approximately 33% of entire area) were similar at all node positions. The cuttings were set in February (VG) and May (YG).

2) ***Decapitation.*** Entire apical cuttings consisted of two leafy nodes (lower leaves fullsize, upper leaves at least 75% full size) which were trimmed to approximately 33% of their entire area, the internode below and the apical region of the shoot above (apex and immature leaves). Cuttings of both clones were set in January, either entire, or decapitated by removing the apex and immature leaves less than 75% full size.
3) ***The Length of the Cutting Stem.*** Entire cuttings (as in 2 above) were set in February in both clones, retaining either one or two internodes below the lowermost leaf pair. Cutting lengths were 8 to 10 cm and 12 to 15 cm respectively, and the longer cuttings were thicker and woodier at the base.

Each trial consisted of one harvest of cuttings from each clone (80 to 120 cuttings per treatment per clone in randomised blocks). Cuttings were lifted after 35 to 40 days and the following variables were recorded: survival (%), rooting (%) of survivors (if there was any mortality), and roots per rooted cutting. Cuttings were "dead" if they had no surviving stem below the level of the substrate or no remaining foliar area. Original percentages are cited but were angular-transformed before analysis of variance.

RESULTS

1) **Contiguous One-node Cuttings.** Table 1 shows that, in both hybrids, node position had no effect on survival. Rooting (%) of survivors was highest in subdistal (node 2) cuttings, while the more basal cuttings had much lower rooting ability.

Table 1. Survival (%), rooted (%) of survivors [root (%) survivor] and roots per rooted cutting (roots/rooted cutting) of one-node cuttings of two *Eucalyptus globulus* hybrids. Node 1 is the distal node, node 2 subdistal, etc.

	Node				
Hybrid	1	2	3	4	F
E. viminalis × *E. globulus*					
Survival (%)	92	95	95	86	NS
Root (%) survivor	39	51	24	17	5.5^{++}
Roots/rooted cutting	1.7	1.9	1.2	1.2	2.7 NS
E. cypellocarpa × *E. globulus*					
Survival (%)	100	100	100	100	NS
Root (%) survival	42	50	24	14	7.2^{**}
Roots/rooted cutting	1.8	1.9	1.8	2.3	1.2 NS

$^{++}P < 0.025$
$^{**}P < 0.01$
NS = not significant

2) Decapitation. Decapitation slightly increased survival in the YG hybrid but not in the VG hybrid, and had no effect on rooting ability in either hybrid (Table 2).

Table 2. Survival (%), rooted (%) of survivors, and roots per rooted cutting, of cuttings of two *Eucalyptus globulus* hybrids, either left entire or decapitated.

Hybrid	Entire	Decapitated	F
E. viminalis × *E. globulus*			
Survival (%)	100	100	NS
Root (%) survival	72	75	NS
Roots/rooted cutting	2.5	2.0	2.0 NS
E. cypellocarpa × *E. globulus*			
Survival (%)	92	97	2.9^{++}
Root (%) survival	91	90	NS
Roots/rooted cutting	2.6	3.0	2.4 NS

$^{++}$P <0.1. NS = not significant

3) The Length of the Cutting Stem. The results were similar in the two hybrids (Table 3). Survival was uniformly high, but cuttings with a longer stem had slightly lower rooting ability than cuttings of standard form.

Table 3. Survival (%), rooted (%) of survivors and roots per rooted cutting of two *Eucalyptus globulus* hybrids, in which either 1 or 2 internodes were retained below the lowermost leaves.

Hybrid	1	2	F
E. viminalis × *E. globulus*			
Survival (%)	99	99	NS
Root (%) survival	87	74	6.1^{**}
Roots/rooted cutting	2.3	2.1	0.9 NS
E. cypellocarpa × *E. globulus*			
Survival (%)	97	99	NS
Root (%) survival	93	87	2.1 NS
Roots/rooted cutting	3.0	2.4	7.2^{++}

**P < 0.1 and
$^{++}$p < 0.025.
NS = not significant

DISCUSSION

Within-shoot variation in the initial survival and rooting of stem cuttings was similar in two *E. globulus* interspecific hybrids. In both, the rooting ability of one-node cuttings was concentrated close to the apex of the shoot (Table 1). Decapitation of entire apical cuttings (leaving the cutting with only newly mature leaves) had no effect on rooting (Table 2). And in apical cuttings with the same leaf complement, a relatively long stem slightly reduced rooting (Table 3). In both hybrids, the moderate to low rooting of one-node cuttings (Table 1) indicates that only one (larger) cutting should be prepared per shoot.

The survival of cuttings was consistently high in both hybrids. Their leaves were nonglaucous, hence easy to wet, and physically tougher than those of *E. globulus*. However, in the YG hybrid, mortality was slightly higher in entire than in decapitated cuttings (Table 2), as was found in *E. globulus* (Wilson, 1993).

The characteristics of the hybrid cuttings, considered together, were slightly different from those of *E. globulus*. In contiguous one-node cuttings, rooting was highest in subdistal cuttings in the hybrids (Table 1) but in the distal cutting in *E. globulus* (Wilson, 1993), suggesting that the newly matured leaf and the maturing leaf, in the hybrids and *E. globulus* respectively, had a particularly positive effect on rooting. Thus, decapitation of entire apical cuttings (removal of the shoot apex and immature leaves) tended to reduce rooting in *E. globulus* (Wilson, 1993) but was not prejudicial in the hybrids (Table 2). However, in both the hybrids and in *E. globulus*, the decline in rooting towards the base of the shoot was rapid (Table 1; Wilson, 1993).

In conclusion, similar propagation techniques for the hybrid and *E. globulus* cuttings should be appropriate, although there may be some differences in (for example) the appropriate form of cuttings or their resilience in the propagation environment.

LITERATURE CITED

Wilson, P.J. 1993. Propagation characteristics of *Eucalyptus globulus* Labill. ssp. *globulus* stem cuttings in relation to their original position in the parent shoot. J. Hort. Sci. 68:715-724.