Propagation of Wilga, *Geijera parviflora*

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Successful propagation of *Geijera parviflora* from seed and juvenile cuttings was achieved. Seed dormancy was overcome by removing the hard seed coat (testa). Both naked embryos and embryos with endosperm intact, germinated readily at 20C with a 12 h photoperiod. No seed with any part of the testa intact germinated. Naked embryos placed on crushed testa failed to germinate, indicating a chemical inhibition. Cuttings harvested from nodes 1 to 12 showed reduced rooting potential at higher nodes, with 100% strike at nodes 1 and 2 to 0% strike at node 12. Cuttings from branches between nodes 1 to 12 also showed reduced rooting potential to those from the main stem. Hypocotyl cuttings formed roots within 20 days. Hypocotyl cuttings treated with IBA 500 ppm, had a greater total root length than cuttings with no treatment. Semi-hardwood cuttings harvested from mature trees in late autumn were unsuccessful.

INTRODUCTION

Geijera parviflora (Lindley), is a small tree in the Rutaceae family commonly known as wilga in Australia, and Australian willow in the U.S.A. The species is typically found in arid shrubland and woodland communities of eastern Australia (Allen, 1992; Harden, 1991), and is classified as endangered in Victoria (Allen, 1992). This species has a low water requirement which may prove it suitable for use as a street tree (Meakin-Poor, 1984). In the past, Wilga has been used as a fodder supplement in periods of drought (Cunningham et al., 1992). While recognised as having potential application in both horticultural and agricultural situations (Costermans, 1983; Cremer, 1990; Elliot and Jones, 1986), *G. parviflora* has a seed dormancy which restricts its use (Allen, 1992). Preliminary trials indicated that germination is possible, but that it is typically slow and erratic with a low percentage success. Coumarin, a known germination inhibitor found in the embryo coverings of many seeds (Bewley and Black, 1994), is reported to be present in the leaves (Lahey and McLeod, 1967) and fruits (Dreyer and Lee, 1971; Chen and Joullie, 1984) of *G. parviflora*. It may be that a period of leaching is required to remove inhibitors from the seed. This would be consistent with observations of germination in the species natural habitat where prolific germination has occurred following high summer rainfall with follow-up autumn rains (Allen, 1992). Propagation by cuttings is also reported to be difficult (Wrigley and Fagg, 1988).

The aims of this research were to develop methods of propagation for *G. parviflora* through: (1) Developing a technique to overcome or remove the reported seed dormancy and; (2) Asexual propagation by cuttings.

EXPERIMENTAL PROCESS, RESULTS AND DISCUSSION

Part 1—Seed Propagation.

Stage 1: Preliminary Germination Trials and Viability Tests. A technique for embryo extraction was developed. This involved removal of the testa by fracturing it with controlled pressure. Each seed was placed in a micrometer, which allowed pressure to be applied gradually. Once fractured, the testa fell away from the embryo and endosperm. The endosperm was then removed by making an incision at the point of attachment (Fig. 1), and then soaking in deionised water. At this stage some embryos "floated out". If embryos did not float out, gentle pressure was applied with the finger tip to the radicle end of the embryo (opposite end to location of cut), forcing the embryo out of the endosperm. Naked embryos germinated readily on moist filter paper in a lit cabinet (12-h photoperiod) at 20C.

Stage 2: Nicking and Leaching Trials. The aim of this stage was to determine the effects of nicking and leaching, and combinations of both, on germination. Leaching treatments aimed to remove germination inhibitors from the embryo coverings. Seeds were held in a micrometer and using a small engraving tool, an incision was made in the testa at either the radicle or cotyledon end (Fig. 1). Several treatments involved complete removal of the testa, but left the endosperm intact. Leaching was achieved by placing seeds in gauze material which were then placed in water with constant oxygenation. Water was replaced weekly. No seed with any part of the testa intact germinated, but a large percentage of seeds with testa completely removed did (Table 1). This indicated that the dormancy is imposed by the testa and not the endosperm. Leaching treatments did not appear to have any significant effect on germination.

Table 1. Germination in nicking and leaching trials.

Treatment	Percentage germination
2-week leaching period, nicked at the cotyledon end.	0
2-week leaching period, nicked at the radicle end.	0
2-week leaching period, no nick.	0
2-week leaching period, testa removed, endosperm intact.	50
1-week leaching period, nicked at the cotyledon end.	0
1-week leaching period, nicked at the radicle end.	0
1-week leaching period, no nick.	0
1-week leaching period, testa removed, endosperm intact.	30
1-day (19 h) leaching period, nicked at the cotyledon end.	0
1-day (19 h) leaching period, nicked at the radicle end.	0
1-day (19 h) leaching period, no nick.	0
1-day (19 h) leaching period, testa removed, endosperm intact.	45
No Treatment.	0
Nicked at cotyledon end, no leaching.	0
Nicked at radicle end, no leaching.	0
Testa removed, endosperm intact, no leaching.	60
Testa removed, incision made at point of attachment on endosperm, no leaching.	27

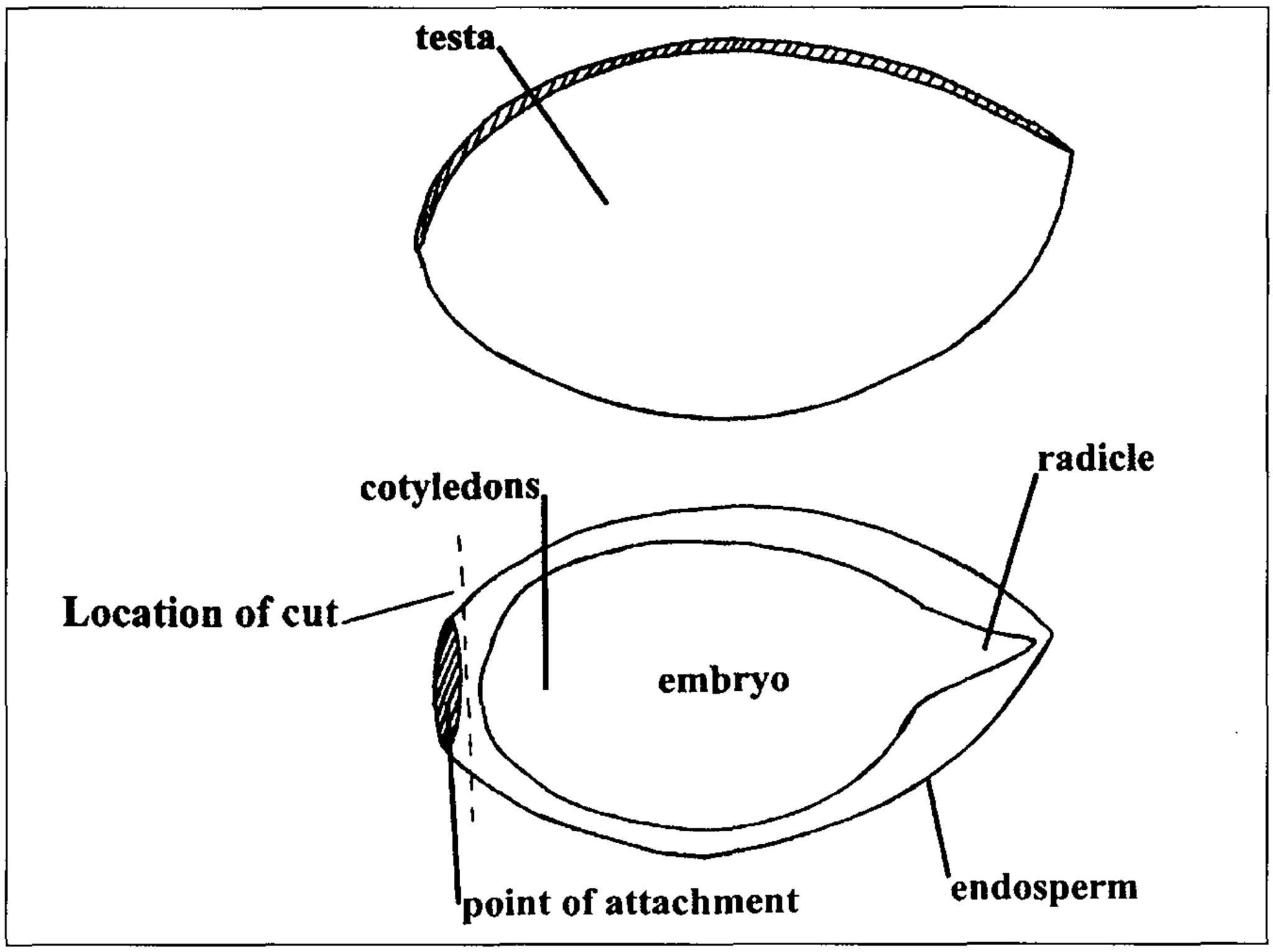

Figure 1. Seed morphology of *Geijera parviflora.*

Stage 3: Seedling Production. Seedling numbers were built up to provide a source of cutting material for use in Stage 6.

Stage 4: Investigation into the Possible Inhibitory Effects of the Testa on Germination. This trial aimed to determine whether the apparent dormancy imposed by the testa is due to chemicals contained within it, or due simply to the physical restriction of the hard coat (or a combination of both). Naked embryos were placed on crushed testa and crushed endosperm. Embryos with endosperm intact were placed on crushed testa only. Naked embryos on crushed testa failed to germinate, indicating a chemical inhibition. Naked embryos placed on crushed endosperm germinated, but radicle extension was small when compared with embryos that had endosperm left intact. This could be due to the importance of the endosperm as a food reserve for the germinating embryo.

PART 2—ASEXUAL PROPAGATION

Stage 5: Mature Growth Cutting Trials. Cuttings using mature growth harvested in late autumn and placed in a fog house with bottom heat, were unsuccessful. Within 2 weeks, cuttings in all treatments had desiccated.

Stage 6: Juvenile Cutting Trials.

Hypocotyl cuttings. During Stage 3, seedling numbers were built up to provide a source of juvenile cutting material. Forty seedlings were harvested using a sharp knife at the surface of the media. Four treatments were used with 10 cuttings in each. These were; IBA 500 ppm for 5 sec, IBA 500 ppm for 1 min, methylated spirits

for 5 sec, and no treatment. All but one cutting formed roots. Total root length was greater in cuttings treated with IBA 500 ppm than other treatments, indicating earlier root initiation and therefore a response to applied IBA (Fig. 2).

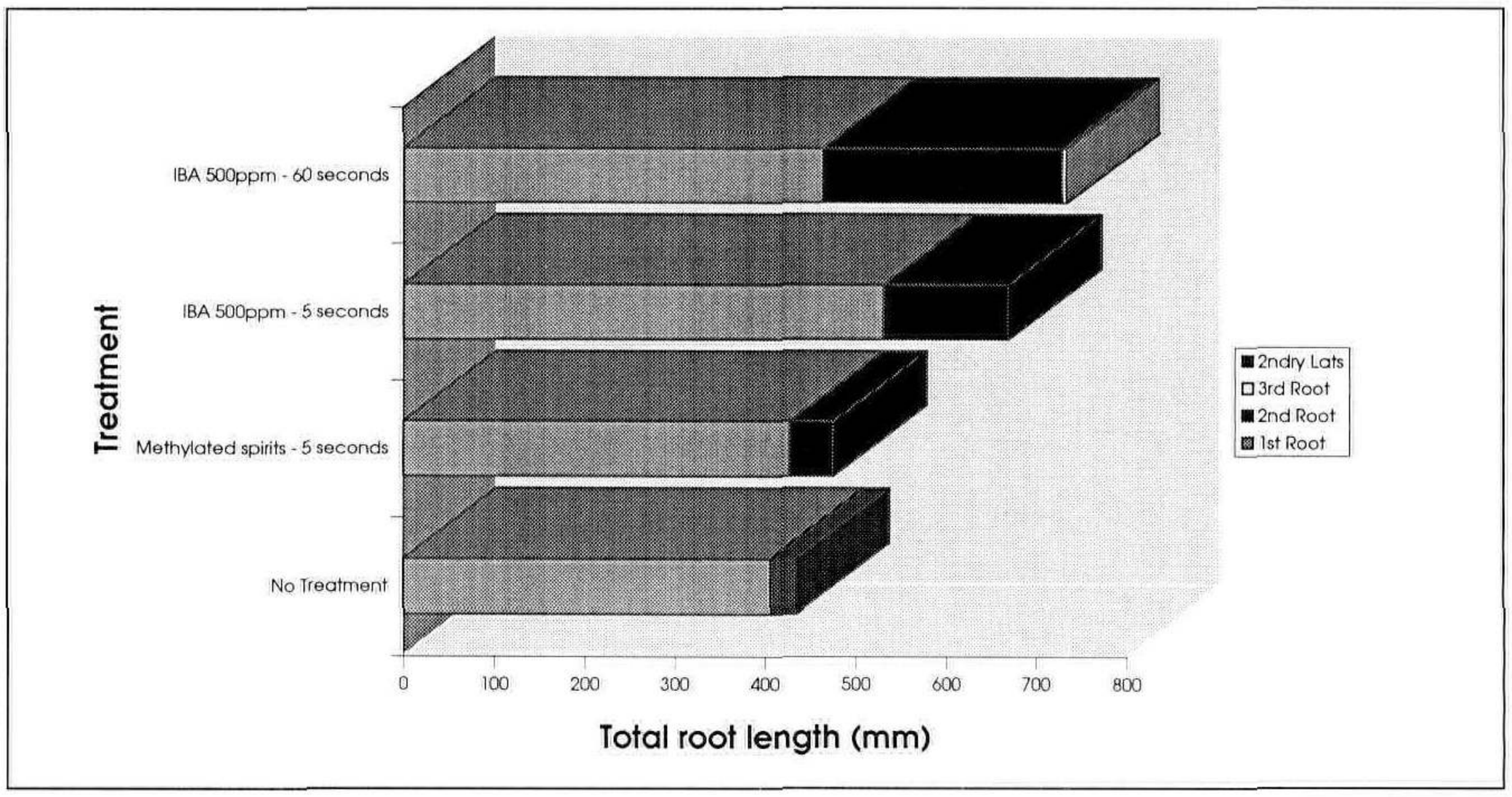

Figure 2. Total root length (mm) of hypocotyl cuttings.

Relationship between node height and relative rooting potential. Young plants grown on from trials in Stage 1 were used as a source of cutting material. Due to the low numbers of seedlings and variation between seedlings, treatments had very low numbers of replicates. Although the trend is for reduced rooting potential with higher nodes (Fig. 3), insufficient replication make these results inconclusive.

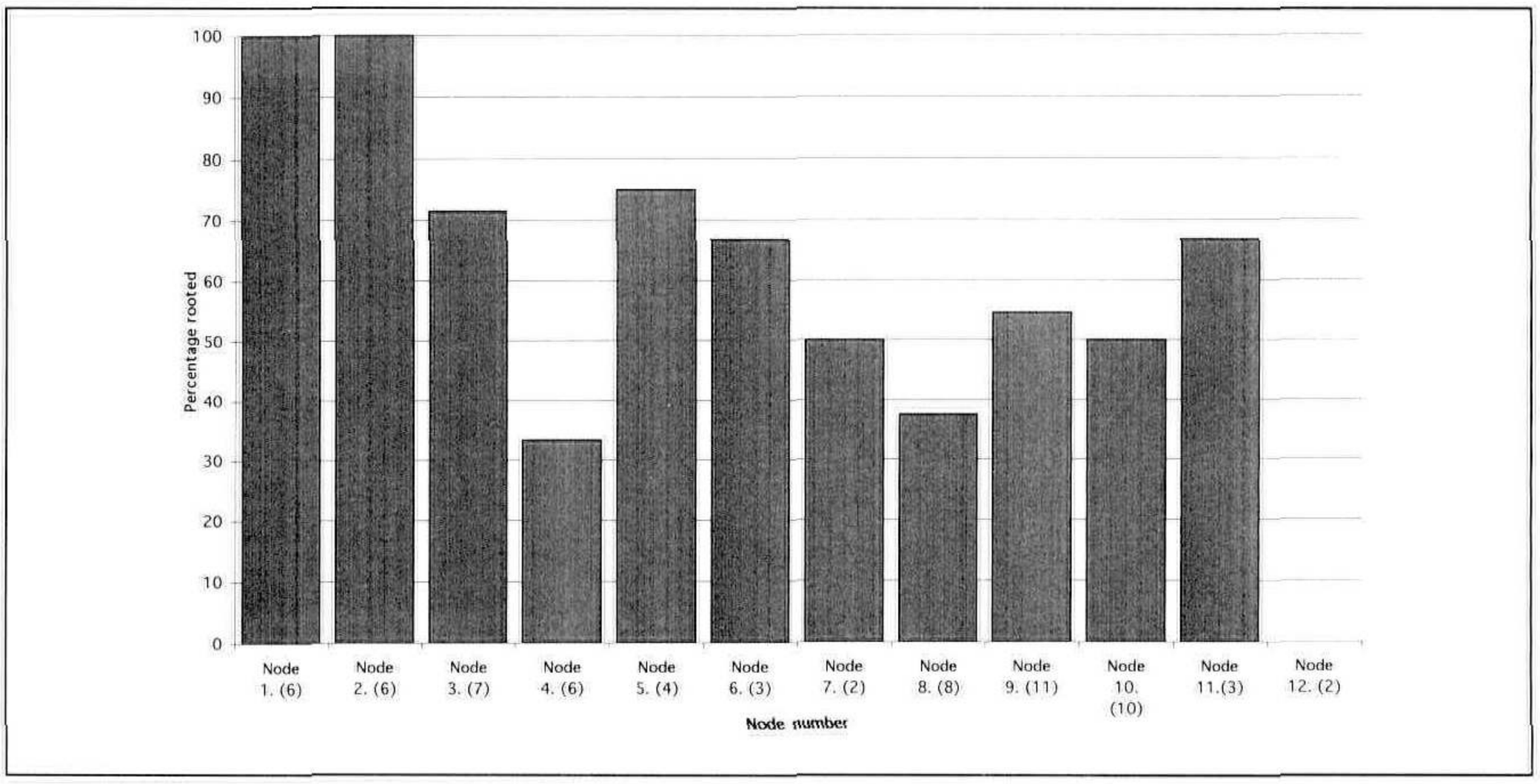

Figure 3. Percentages of juvenile cuttings to form roots in relation to node number. The number in brackets ( ) represents number of cuttings.

CONCLUSION

Trials have demonstrated that propagation of *G. parviflora* by seed is possible, and that the techniques involved, i.e. testa removal, while initially slow, are viable in a production nursery situation.

The mechanism for dormancy appears to be located in the testa, and is likely to be due in part to a chemical inhibition. Although leaching treatments trialed were unsuccessful in removing the inhibitor, longer leaching periods should be trialed.

While the trend in vegetative propagation trials was reduced rooting potential with increasing node number, low numbers of replicates make these findings inconclusive. Success achieved in juvenile cutting trials demonstrate that asexual propagation is possible and the species may be suited to micropropagation techniques where rapid propagation of large numbers is desired. Clonal propagation of mature trees, for desired form or other characteristics, warrants further research.

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