

Development of Screening Trials to Rank *Pinus radiata* Genotypes for Resistance to Defoliation by Monterey Pine Aphid (*Essigella californica*)

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Abstract

The Monterey pine aphid (*Essigella californica*) is a recent arrival in Australia, having first been detected in 1998. It quickly spread throughout the national radiata pine (*Pinus radiata* D. Don) plantation estate, causing seasonal defoliation and compromising tree growth in many areas. Selection of resistant radiata pine for deployment commenced in 2002, based on heritable defoliation in mature progeny trials. Further development of the breeding program requires efficient methods for screening later generation germplasm.

Glasshouse and nursery-based screening trials, involving infestation of potted radiata pine plants with aphids, were used to develop guidelines for operational scale screening of defoliation resistance. Three types of plant material were tested: physiologically aged clonal cuttings (10 to 30 years); 1-year-old clones derived from somatic embryogenesis; and 1-year-old seedling families. All of the plant types examined supported dramatic increases in aphid populations under suitable environmental conditions. Variability between plants within clones and between clones was high. For example, over a period of 28 days, one m tall aged cuttings infested with 30 aphids yielded between 26 and 3,804 aphids (mean 584). Significant and repeatable differences in aphid population counts among different radiata pine genotypes and families were obtained using trial durations of 18 to 35 days.

Treatment options, including environmental conditions, initial infestation levels, and replication requirements, were examined. Specific attention needs to be paid to managing peak aphid production levels by infestation level and experiment duration in order to minimize alate initiation.

Glasshouse screening results were tested by counting aphids on 1-year-old clonal cuttings in the field, and on 1-year-old stool beds. Both showed good correlation with glasshouse trial results ($r=0.45$ and 0.93). Damage to foliage and eventual loss of foliage, was observed where aphid counts were high, suggesting that identification and deployment of genetic material which does not support rapid aphid population buildup is likely to result in reduced defoliation and reduced growth losses in plantations due to *Essigella* activity.

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