Seed germination of weeds from New Zealand native plant communities

S.A. Miller and R.F. Henzell

Horticultural and Food Research Institute of New Zealand, Ruakura, Hamilton, New Zealand

Introduction

Introduced weeds which self propagate in the wild can pose a threat to natural vegetation and re-vegetation schemes. Highly effective dispersal mechanisms by seed (e.g., old man's beard *Clematis vitalba*, tree privet *Ligustrum lucidum*), and/or re-growth of vegetative fragments (e.g., Japanese honeysuckle *Lonicera japonica*, mistflower *Ageratina riparia*, wandering Jew *Tradescantia fluminensis*, spartina *Spartina* sp) aid in the rapid spread of these weeds. Control by conventional spraying methods is often unacceptable, particularly in urban areas, because of public concerns related to spray drift. Spraying can also lead to creation of open spaces in the canopy, which then become invaded by further weeds, probably at the expense of native colonisers. A better understanding of the interactions between weed seeds/seedlings, native plants and the environment may assist in the formulation of more effective control strategies. This paper reports preliminary findings into the environmental conditions required for the germination of the seeds of eight weed species which commonly invade New Zealand native forest. A technique, previously used to study allelopathic effects of grasses (Ray and Richardson, 1993), was investigated as a means of screening weeds for their effects on germination and growth of native plants.

Materials and Methods

Germination tests

Seeds of eight common invasive weeds and four native plants (Table 1) were freshly harvested for use in these studies. Preparation and storage of seed varied according to species, but in general, seed was stored at 4°C before use. Germination was tested under two different light regimes - either total darkness (zero light for 24 h/day) or a 16 h light and 8 h dark, cycle. Germination tests were carried out on damp filter paper in petri dishes. The number of petri dishes used for each species was determined by size of the seed. Either 20 large seeds or 25 small seeds was the maximum number that could be positioned on each dish without overcrowding. There were 60-100 seeds tested for each weed species, and 50 of each native plant. All seeds were incubated at 15°C for up to 9 weeks before assessment.

Allelopathic technique

Preliminary experiments were carried out using seeds of climbing dock (*Rumex sagittatus*). Seeds were sown onto a square of fine mesh, which was then supported on polystyrene beads and floated on 250 ml of nutrient solution in a 500 ml plastic pot. There were 25 seeds/mesh; they were germinated at 15°C for three weeks, and the amount of root growth through the mesh then visually assessed.

Results and Discussion

Exposure to light had a positive effect on Japanese honeysuckle *Lonicera japonica*, but had no effect on any of the other weed species used (Table 1). Because germination rates of some of the weeds used were very low, it is suggested that factors other than light might be involved. Germination of *Ligustrum lucidum* and *L. sinense* is inhibited for example, unless the seed is excised from the fruit (Burrows and Kohen, 1986). While every care was taken in this study to extract the seed cleanly, it is possible that remnants of the fruit may have been left on the seed, thus reducing germination. Interactions of light with temperature or other factors, such as variable seed age or endogenous gibberellins, may also be important for germination of some species, e.g., *Solanum mauritianum* (Campbell and van Staden, 1994).

The germination requirements of New Zealand native plants were reviewed about ten years ago (Fountain and Outred, 1991) and results presented in this study were consistent with that work. Light was required for

Table 1. Effects of light on germination of some weed seeds and native plant species. Asterisks indicate a significant difference between treatments at the 5 % level.

	Occurrence	Germination (%) ± S.E. at 15°C Light (16h day)	Dark (24h)
Invasive Weeds			
Lonicera japonica	Ubiquitous	45.0 ± 6.4*	11.7 ± 4.1
Ligustrum sinense	Disturbed forest, forest margins or gaps, parks, gardens	8.3 ± 3.6	8.3 ± 3.6
Solanum mauritianum	Roadsides, pasture, gardens, forest margins	0.0 ± 0.0	0.0 ± 0.0
Hedychium gardnerianum	Disturbed forest, forest margins or gaps, open areas	81.0 ± 3.9	76.0 ± 4.3
Senecio mikanioides	Disturbed forest, forest margins or gaps, parks, gardens	38.3 ± 6.3	31.7 ± 6.0
Rumex sagittatus	Gullies, stream banks	98.0 ± 1.4	93.0 ± 2.6
Cotoneaster sp.	Disturbed forest, forest margins or gaps, stream banks	74.0 ± 4.4	81.0 ± 3.9
Agapanthus sp	Bluffs and coastal areas	85.0 ± 4.6	91.7 ± 3.6
Native Plants			
Coprosma repens	Ubiquitous	5.0 ± 3.4	0.0 ± 0.0
Hebe stricta	"	7.0 ± 2.6	5.0 ± 2.2
Kunzea ericoides	"	18.0 ± 3.8*	0.0 ± 0.0
Leptospermum scoparium	"	14.0 ± 3.5*	0.0 ± 0.0

germination of *Leptospermum scoparium* and *Kunzea ericoides*, but not for *Hebe stricta*. *Coprosma repens*, a forest margin species, also appeared to germinate better in the light although the results of these tests are inconclusive due to the low germination rates of all of the New Zealand species used. A better understanding of factors affecting the viability of native plant seed, and their germination requirements, is needed if establishment of these plants into re-forestation schemes is to be optimised. Similarly, there is a paucity of information related to the interaction of invasive weed seeds/seedlings with native plants. Root and/or leaf exudates from weeds may affect germination of more desirable plants. Preliminary results presented in this poster paper showed that the roots of *Rumex sagittatus* seedlings were able to successfully penetrate through mesh into the nutrient solution below. In future work exudates from a number of weed species will be screened for their effects on germination of native plants and seedling growth.

Acknowledgements

We thank Alistair MacArthur, Auckland Regional Council, for the provision of a print of climbing asparagus (*Asparagus scandens*) which was used as a background to the poster presented at the Seed Symposium.

References

Burrows, F.J. and Kohen, J. 1986. Inhibition of germination in privet. *Plant Protection Quarterly* ***1***, 107-108.

Campbell, P.L. and van Staden, J. 1994. The viability and germination characteristics of exhumed *Solanum mauritianum* seeds buried for different periods of time. *Plant Growth Regulators* ***14***, 97-108.

Fountain, D.W. and Outred, H.A. 1991. Germination requirements of New Zealand native plants: a review. *New Zealand Journal of Botany* ***29***, 311-316.

Ray, J.W. and Richardson, B. 1993. A rapid screening method for selecting grass species with potential for suppressing pampas growth. Proceedings of the 46th Plant Protection Conference, pp 313-318.