Classical weed biocontrol and vesicular-arbuscular mycorrhizal (VAM) fungi

PETER HARRIS and M.J. CLAPPERTON

Research Centre, Agriculture and Agri-Food Canada, Box 3000 Lethbridge, Alberta, T1J 4B1 Canada

We describe an exploratory study to determine whether or not vesicular-arbuscular mycorrhizal (VAM) fungi play a role in the biological control of weeds. VAM fungi form associations with the roots of most herbaceous plants. In adapted plants, VAM fungi increase assimilate partitioning in the roots and stimulate growth by enhancing nutrition, but with a carbon cost to the plant. The mycorrhizal association is particularly important for weeds of late seral stages, as they tend to have a poorer ability than those of earlier stages to absorb minerals from the soil, and so are more likely to be dependent on VAM fungi. This study shows that there is no correlation between colonization by VAM fungi and the success of root- and shoot-feeding insects. However, there is an interaction between the success of root-feeding insects, plant assimilate partitioning and VAM fungi. In the perennials, *Euphorbia esula* and *Centaurea diffusa*, colonization by VAM fungi increases assimilate partitioning to the roots and both have a high ratio of root:shoot feeding insects. It is shown that attack and survival of the root beetle, *Sphenoptera jugoslavica*, is influenced by the presence of VAM fungi in *C. diffusa* and in the associated vegetation. In the biennials, *Carduus acanthoides* and *Cirsium vulgare*, colonization by VAM fungi did not increase assimilate partitioning to the roots which may indicate tolerance to the fungus. The large growth reduction and increased root:shoot ratio in the annuals *Centaurea solstitialis* and *Ambrosia artemisiifolia* indicates a low tolerance to VAM fungi. Neither the biennials nor the annuals had any specialized root insects. We suggest that the plant-fungal interaction should influence the choice of root or shoot-feeding insects as biological control agents, and this exploratory study justifies further investigation of the relationships between VAM fungi and weed control.

A model of the determinants of plant invasions

STEVEN I. HIGGINS and DAVID M. RICHARDSON

Institute for Plant Conservation, Department of Botany, University of Cape Town, Private Bag, Rondebosch 7700, South Africa

A plant invasion model that integrates plant life-history attributes, disturbance regimes and human-modified disturbance regimes into a spatially-explicit individual-based simulation environment is developed. A simulation experiment is used to investigate the invasion of two pine tree species (strategies *r* and *K*) into forest, grassland and shrubland landscapes subject to five levels of disturbance (ranging from natural to highly modified). The results illustrate the importance of interactions between environment, disturbance and plant strategy. We propose that these interactions can explain many of the anomalies reported in syntheses of invasion case-studies.