Progress towards establishment of a seed beetle, *Bruchidius villosus*, for biological control of broom (*Cytisus scoparius*) in New Zealand

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Broom, *Cytisus scoparius* (L.) Link, a leguminous weedy shrub, introduced to New Zealand from its native Europe, occupies extensive areas of pastoral land, riverbeds, native grasslands, and deforested land. It has the potential to invade further, particularly at high altitudes. A seed-feeding beetle, *Bruchidius villosus* F. (Coleoptera: Chrysomelidae), has been introduced from the United Kingdom to reduce the rate of spread of broom. An efficient mass-rearing method for the broom seed-beetle has been developed over several years to enable a programme of widespread releases to take place. In spring, beetles are sleeved onto branches of flowering broom where they feed on broom pollen and lay eggs on green pods. They are re-sleeved onto new branches regularly throughout the oviposition period. Larvae develop to adults within the seeds. Adult beetles are collected from the sleeves after they emerge from the seeds, are fed with pollen and honey-water, and are then over-wintered under controlled conditions in the laboratory. Two factors have been identified as critical to successful beetle rearing. The reproductive development must be synchronized with flower- and pod-production of broom to ensure that the maximum number of eggs are laid. The development of broom flowers and pods is monitored in the field to determine the optimum time to begin warming and feeding over-wintered beetles so that oviposition is induced in female beetles when developing green pods are available in the field. The efficiency of the rearing method was increased 4-fold when beetles emerged naturally in the broom sleeves rather than from harvested seed stored in the laboratory. Misting with water was necessary to induce beetles to emerge from laboratory-stored seed. When field releases of beetles are made in spring, over-wintered groups of beetles are warmed at different times to synchronize their development with broom growing in different parts of New Zealand. Reproductively-mature adults are placed, uncaged, onto flowering broom bushes to allow females to select suitable pods for oviposition. Broom seed-beetles had been released at 41 sites throughout New Zealand by the end of 1995. Establishment is being assessed in subsequent years by counting flowering bushes for adult beetles and inspecting green pods for eggs. So far establishment has been confirmed at seven of the 12 sites that have been assessed. At one site at Lincoln, Canterbury, beetles were released in 1991, and populations have been monitored for the last three years. Numbers of eggs and adults have increased each year, with approximately 5% of seeds infested in 1994-1995. The rate of parasitism was 0.5% in 1994-1995. Four species of hymenopteran parasitoids have been recorded: *Pteromalus sequester* (Walker) (Pteromalidae), *Macroneura vesicularis* (Razius) (Eupelmidae), *Dibrazhys [?carus Walker] (Pteromalidae) and *Trichomalopsis* sp. (Pteromalidae). We are continuing to monitor infestation levels of broom seed-beetle and the impact of parasitoids at sites of establishment. Studies on the survival of broom seed in the soil, the fate of fallen seed, and seedling survival are in progress to assist in determining the impact of broom seed-beetle on broom populations.