PROSPECTS FOR THE BIOLOGICAL CONTROL OF GORSE

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SUMMARY

Of the 94 insect species known to attack gorse (*Ulex europaeus*) in Europe, only 16 appear sufficiently host specific to show promise for introduction into New Zealand as biological control agents. Five of these attack reproductive structures and 11 feed on green shoots. There are no suitable agents which attack roots, crowns or woody stems. The four species with the greatest potential to damage gorse are being studied more closely. These are *Tetranychus lintearius* Dufour (Tetranychidae), *Agonopterix ulicetella* Stnt. (Oecophoridae), *Dictyonota strichnocera* Fieber (Tingidae), *Apion scutellare* Kirby (Curculionidae).

INTRODUCTION

Attempts to control gorse biologically in New Zealand began in 1931 when the seed weevil (*Apion ulicis*) was successfully introduced from Britain. This species now destroys a large proportion of all seed produced by gorse in spring and summer (Miller 1970). The insect fauna which attacked gorse in Europe was surveyed by the Commonwealth Institute of Biological Control, and several additional insect species were recommended as potential control agents (Zwölfer 1964). Recently Zwölfer's recommendations were re-examined when a study of the insect fauna attacking gorse in southern Britain was undertaken (Hill 1982). During this study further potential control agents were identified, and considerable biological information concerning the most promising species was obtained. Tests are underway to determine the host-range of four species to confirm their specificity to gorse and hence their safety for introduction as biological control agents in New Zealand.

METHODS

Information regarding the identity, life history and host-range of the phytophagous insects and mites closely associated with gorse in Europe was assembled from Zwölfer (1964) and other literature sources, and from personal observations between 1978 and 1981 (Hill 1982). The potential of each species as a biological control agent was assessed with special regard to host specificity, type of damage caused, and the potential of the species to achieve high population density in a new environment. The sites of attack of these agents were placed in order of significance, namely roots and crowns, green shoots, woody stems, and reproductive structures. Root and crown feeding species were considered to be most important because they weakened plants by removing food reserves, gave access to pathogens and saprophytes, and weakened the support system of the plant. Species feeding on green shoots were ranked in order of their potential to reduce plant vigour with minimum inter-specific interference, while those attacking reproductive structures were given lowest priority because of their possible competition with the seed weevil.

A list of the potential biological control agents was assembled. The first four species on that list namely *Tetranychus lintearius* Dufour (Acari; Tetranychidae), *Agonopterix ulicetella* Stnt. (Lepidoptera; Oecophoridae), *Dictyonota strichnocera* Fieb. (Hemiptera; Tingidae) and *Apion scutellare* Kirby (Coleoptera; Curculionidae) were tested to confirm their recorded host-plant specificity.

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RESULTS AND DISCUSSION

Of the 94 insect and mite species recorded feeding on gorse, 78 are not considered safe biological control agents because their host-range is too wide. The 11 species recorded from gorse roots, crowns, and woody stems are included in this group. Of the 16 species sufficiently host specific to warrant further research, five species feed on buds, flowers and pods. Two pod-feeding species, *Cydia internana* (Guen.) and *C. succedana* (D + S) (Lepidoptera; Tortricidae) have the potential to augment gorse seed control because they are active in autumn as well as in spring, but before they can be considered more information regarding their impact on spring seed destruction by gorse seed weevil is required.

The remaining 11 species attack foliage, and of these, four have been chosen for further study. The red mite *Tetranychus lintearius* is the only species which has been observed to kill gorse bushes. It forms large colonies which move about the bush causing severe bronzing. Heavy infestations cause the death of whole branches, produce very heavy webbing over the remainder of the bush, and on occasions kill whole gorse plants. Initial safety-tests suggest that this species is entirely host specific to gorse but its close relationship with two spotted mite *Tetranychus urticae* necessitates further careful study before it can be introduced into New Zealand.

Caterpillars of *Agonopterix ulicetella* infest new meristems at the onset of growth, and can often kill new shoots entirely. Older larvae feed on spines and other green foliage from a silken tube attached to the stem, and at high density can destroy potted plants. In Europe it occurs only at low density in the field, but since 30% of larvae are parasitised, and even more are lost through predation, it is likely that higher population levels would be achieved on transfer to New Zealand. Tests in Britain showed almost total specificity to gorse. A population of this species is being kept in quarantine in New Zealand for final assessment of host-range. If these results prove favourable releases will be made in 1983-84.

Dictyonota strichnocera is the only hemipteran species which can be considered a potential control agent for gorse. It feeds on leaf mesophyll, and causes bronzing of gorse stems, spines and leaves. Tingidae are normally very host specific, and tests in Britain suggested that this species is restricted to gorse. It is also being held in quarantine in New Zealand for final assessment and, subject to further host-testing, could be released next year.

Apion scutellare weevils lay eggs in gorse stems, and the hatching larvae produce pea-like galls on the shoot. This species is of particular importance because attack is almost restricted to stems regrowing from gorse crowns after physical damage or fire. The impact of this galling on plant growth is not known, but it may restrict the vigour of regrowth which follows most existing control methods. The 20% parasitism of *A. scutellare* larvae recorded in Europe means that this species too should reach higher population levels in New Zealand. Its host-range has not yet been determined but species of this genus are almost exclusively monophagous. Further consideration of this species will await the results of host-plant specificity tests.

CONCLUSIONS

With the absence of suitable agents attacking the structural parts of gorse, only the mite *Tetranychus lintearius* offers the prospect of causing lethal damage to gorse. The gorse programme therefore aims to introduce successive biotic pressures which will reduce gorse vigour, improve the susceptibility of gorse to existing control measures, and reduce the extent of regrowth. There also appears to be scope for further reduction of gorse seed production throughout the year. In a new environment without their own parasites predators and diseases, biological control agents often achieve a very high population density and so cause severe damage to the target weed. First releases should be made in 1983-84 but it will be some years before control agents become established over a wide area and any ensuing benefits become obvious.

REFERENCES

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