ESTABLISHMENT OF GORSE SPIDER MITE AS A CONTROL AGENT FOR GORSE

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SUMMARY

Gorse spider mite (*Tetranychus lintearius*) has been released for the biological control of gorse at more than 171 sites throughout New Zealand, 62 of these during the spring and summer of 1990/91. Since the first release in February 1989, mites have established at 81 sites. So far, mites have only established at 22% of sites north of latitude 39°S compared with 87% south of this. The reasons for this difference in establishment success are uncertain. Mites have been recorded over 500 m from the release points at three sites. At Fereday's Island, Canterbury, mite colonies were found over 55 m from the release point within 5 months at a mean density of 0.2 colonies/m². At some sites, damage to gorse foliage was obvious and severe.

Keywords: biological control, gorse, gorse spider mite, *Tetranychus lintearius*

INTRODUCTION

Gorse spider mite (*Tetranychus lintearius*) is the invertebrate species which causes most damage to gorse in Europe and was considered to be the most promising of the potential biological control agents for gorse which might be imported into New Zealand (Hill 1987). Following detailed examination of the costs and benefits of controlling gorse (Hill and Sandrey 1986; Hill 1987) and detailed studies which showed that the mite was suitable to introduce into the New Zealand environment (Hill and O'Donnell in press a, b), it was released in New Zealand in February 1989 (Hill *et al* 1989).

METHODS

Mites were reared on potted gorse plants under ambient conditions in a shade house. Plants were sprayed every 2 weeks with 50% EC permethrin applied at 0.01 ml/litre. This did not kill gorse spider mites but eliminated predatory mites and deterred their recolonisation of the spider mite-infested plants (Penman *et al* 1986). Clusters of at least 100 active mites, mostly adults, were removed from plants and transferred to 10 cm long gorse shoots standing in water. These shoots had previously been treated with the same insecticide. In order to reduce the possibility of contamination by predatory mites, no mite webbing, eggs or chrysalids were transferred. Shoots were also microscopically examined before being securely packed in cooled polystyrene boxes for transfer to the field.

Selection of release sites was made in close consultation with field staff of cooperating organisations throughout New Zealand including Regional Councils, Government Departments and State-Owned Enterprises. Secure release sites with a northern aspect were generally chosen. The gorse spider mite-infested shoots were lodged in or tied to gorse bushes on the upwind side of each selected site, usually five shoots per release. Further releases were made in summer 1989/90 at the original 32 sites described by Hill *et al* (1989) and at an additional 77 sites (Fig. 1a). Releases were made at 62 new sites during summer 1990/91 (Fig. 1b). In addition to the releases shown in Fig. 1, mites were transferred from well-established populations to new sites by local

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Fig. 1: (a) Sites at which gorse spider mite was released between February 1989 and April 1990, and establishment success at those sites.
(b) Sites at which gorse spider mite was released between September 1990 and April 1991.

field staff. Including these releases, it is estimated that gorse spider mites have now been released at over 300 sites.

Each release was recorded along with detailed descriptions of sites and prevailing weather conditions. Sites were subsequently visited at irregular intervals by DSIR staff or local field staff. The fate of each mite colony was recorded with information about colony size, gorse damage, presence of mite predators and distance of dispersal from the original release points.

The natural dispersal of gorse spider mites was measured in more detail at Fereday's Island (Canterbury). The area chosen comprised several hundred hectares of 1.5 m tall gorse growing on a gravel bed which was exposed to the wind. Gorse cover was estimated at approximately 80% but it was possible to move between bushes. In September and November 1989, 250 and 750 mites were released at one location. In April 1990, transects were established along six compass bearings radiating from the release point (there was insufficient gorse to allow sampling in the SW quadrant). At 5 m intervals along each transect, the number of colonies within a 1 m radius of gorse canopy was recorded. If the sample point fell outside a gorse bush, the nearest bush was used. The size of each colony was estimated on a log scale (1 = 2-10 mites, 2 = 11-100 etc.). Sampling along any transect ceased when no mites were recorded in three consecutive samples.

RESULTS

Mites survived the winter and early spring at 15 of the 32 original release sites described by Hill *et al* (1989), but the pattern of establishment varied. Mites established at only four of the 19 sites north of latitude 39°S (21%), but at 11 of the 13 sites (85%) south of there. Populations subsequently failed at three of the four northern sites in the following summer compared with only one failure south of latitude 39°S. When mites were released again at the 32 sites, populations established at two further northern sites.

At the 77 new sites created in 1989/90, colonies survived beyond October 1990 at 86% of the sites south of latitude 39°S but at only 32% of the northern sites; a similar ratio to the previous year. The nationwide pattern of establishment of mites released up to April 1990 is shown in Fig. 1a. Releases made during summer 1990/91 (Fig. 1b) will be assessed in 1991/92.

Mite population growth varied greatly from site to site. Some of the colonies released multiplied *in situ*, encasing plants in webbing containing several hundred thousand mites. At other sites, for example at Fereday's Island, after an initial population increase, mites dispersed to nearby plants to form numerous small colonies. Thus colonies or parts of colonies moved freely around and between gorse bushes. In general, mite feeding destroyed gorse mesophyll tissue, and gave the foliage a mottled green or white appearance, depending on feeding intensity. Some heavily damaged shoots browned and died, while less intense feeding caused spontaneous abortion of flowers in spring at some sites. Death of plants from mite attack was not observed and regrowth from browned shoots was noted to be common.

Rate of dispersal from original release points also varied from site to site. Colonies have been found over 500 m from the original release point at three sites and over 300 m at others.

Fig. 2 shows the distribution of mite colonies from the release point at Fereday's Island 5 months after the initial release was made. The greatest concentration of mites was found within 10 m of the release point, but colonies were encountered in samples as far as 55 m away. The estimated number of colonies within this area was 2030, or 0.2 colonies/m². Transforming the mean scores, the mean estimated size of colonies in April was 32 ± 7 mites per colony.

Fig. 2: The density of gorse spider mite colonies around the release point at Fereday's Island in April 1990, 5 months after release.

DISCUSSION

Gorse spider mite is now firmly established in New Zealand. However, repeated efforts to establish gorse spider mite in the northern half of the North Island and on the West Coast of the South Island have been only moderately successful. The reasons for this are not clear because of major variability between release sites and mite performance at those sites. Most establishment failures have been in warmer, wetter regions but it is not known whether either is the limiting factor. The gorse spider mites established in New Zealand originated in Cornwall, Great Britain. Consequently the introduction of a mite strain from a warmer, wetter climate such as northern Portugal or North Spain is being considered.

The predatory ladybird, *Stethorus* sp. commonly occurs in small numbers in mite colonies during summer, but has not been recorded in sufficient numbers to account for failure of whole colonies. The predatory mite *Phytoseiulus persimilis* has been recorded at eight sites, often those within several kilometres of horticultural developments. This species had eradicated gorse spider mite colonies in the laboratory but there is no evidence that this has happened in the field. Gorse spider mite has established strongly at Mangonui and Richmond even though *P. persimilis* has been recorded in colonies at those sites.

Gorse spider mites move easily between contiguous bushes and can move from bush to bush along the ground. However, mites are dispersed longer distances by the wind. The extent of dispersal of the mite at Fereday's Island (Fig. 2) after only 5 months suggests that the mite can disperse relatively long distances in a short time. Indeed, mite colonies were observed over 60 m from the release point but did not fall within samples. Mite colonies may also have established far downwind at release sites, beyond the range of our observations.

Mite-induced gorse mortality has not yet been observed at release sites. However, damage to gorse foliage at most release sites is obvious and widespread. Chronic damage to gorse plants caused by mites may eventually lead to the death of existing plants. Long-term research to assess the effects of mite damage on the growth rate and reproductive success of gorse is currently underway.

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