FLUVALINATE AS A REPELLENT TO THE GORSE SPIDER MITE *TETRANYCHUS LINTEARIUS*

D.R. PENMAN and G.G. SEARLE

Entomology Department, Lincoln University, Canterbury

Gorse spider mite, *Tetranychus lintearius*, is highly colonial (Stone 1986). Once established on a plant it extracts mesophyll cell contents before migrating *en masse* to undamaged parts of the gorse plant. The apparently monophagous mite has been released in many areas of New Zealand since its introduction in 1988 (Hill *et al* 1989). The colonial behaviour of gorse spider mite may, however, limit the potential for rapid spread. Density-dependent competition for food resources within the colonies may reduce potential population buildup. Methods to enhance colony spread required investigation.

Many pyrethroid insecticides act as repellents or irritants to other tetranychid mites. This activity may be a factor in inducing outbreaks of the twospotted spider mite, *Tetranychus urticae*, by reducing competition (Penman and Chapman 1988). Fluvalinate (Mavrik 2F) is a particularly potent repellent or irritant to twospotted spider mite (Penman *et al* 1986) suggesting this chemical should be investigated for its potential to induce colony dispersal in the gorse spider mite.

Tests of both direct toxicity and repellency of fluvalinate were conducted. Direct toxicity was measured by the slide-dip method (FAO 1974) on adult female gorse mites. Twenty mites were placed dorsal side down on double-sided 'ScotchTM' tape on a microscope slide. Each slide was dipped for 5 seconds in a given aqueous solution of fluvalinate. Dried slides were placed in plastic trays lined with moistened filter paper and held at $18 \pm 1^\circ\text{C}$, 24:0 L:D photoperiod for 24 hours. Mites were considered dead if they did not move their legs after gentle prodding with a fine camel hair brush. Six replicates of 20 mites were used for each of five concentrations plus a water-treated control. Data were analysed by probit-analysis using POLO (Russell *et al* 1977).

The dosage-mortality relationship for fluvalinate to adult female gorse spider mites gave a LC_{50} of 0.023 g/litre (95% C.I. 0.017-0.031, Slope: 1.37). This is considerably lower than for the closely related, polyphagous twospotted spider mites (Penman and Chapman 1988).

The repellent properties of fluvalinate to gorse mites was tested using gorse shoots dipped in the insecticide. Four concentrations of fluvalinate were used and these were chosen on the basis of the repellency of fluvalinate to *T. urticae* (J. Holland, pers. comm.). The concentrations were 0.1, 0.01, 0.001, and 0.0001 g/litre.

Gorse shoots were cut approximately 15 cm long and were trimmed to two opposing branches with four or five smaller spines on each branch. The tip of one branch on each gorse shoot was marked with a black felt pen. The unmarked branch was fully immersed in fluvalinate solution for 5 seconds. The shoots were then placed upright in a glass vial which was glued to the centre of a plastic petri dish lid which contained distilled water. The shoots were supported by a piece of a plastic drinking straw placed through a hole in the centre of a cork. A ring of 'Tack Trap' was applied to the gorse stem to stop any mites running down and escaping.

Thirty adult female gorse mites were placed on the dry treated branch of each shoot and then left in the laboratory for approximately 1 hour so that mites could settle before being moved to a controlled temperature cabinet. Conditions inside the cabinet were maintained at $25 \pm 1^\circ\text{C}$, 16:8 L:D photoperiod and 70-80% RH. There were five replicates of each treatment.

After 72 hours the number of mites on the treated surface and untreated surface, and the number which had dropped into the surrounding water or run into the 'Tack Trap' barrier were recorded. If mites were unable to be found it was assumed that they

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had dropped off the gorse shoot. The results were analysed in three sections:

- Total run-off from the treated surface, which included mites on the untreated surface, mites in the 'Tack Trap', and those which had dropped off the shoot.
- The number of mites to move to, and colonise, the untreated branch.
- The number of mites to drop off shoots either voluntarily or as a result of death (no distinction could be made), and those to drown in the 'Tack Trap'.

Repellency of fluvalinate as measured by run-off, colonisation of untreated branches and drop-off is shown in Table 1. Given that the objective is to increase colonisation and dispersal, it is important to select a concentration that maximises colonisation yet minimises drop-off from the plant and mortality. The concentration of 0.001 g/litre achieved those objectives in contrast to both higher and lower concentrations. Concentrations of 0.01 and 0.1 g/litre significantly increased drop-off and hence reduced colonisation. The 0.0001 g/litre concentration was too low to get the initial run-off response.

TABLE 1: Behavioural effects of fluvalinate to adult female gorse spider mites on gorse shoots after 72 hours exposure. (Mean number of mites: 30 mites per shoot: 5 replicates).

Conc. (g ai/litre)	Run-off	Colonisation	Drop-off
0	4.2	1.0	3.2
0.0001	8.6	3.4	5.2
0.001	22.6	12.2	10.4
0.01	15.2	4.4	10.8
0.1	19.6	1.6	18.0
LSD (.05)	4.9	4.8	4.4
Nil vs FLuv.	**	*	**
Linear trend (fluv.)	**	not sig.	**
Curvature (Fluv.)	** (Cubic)	** (Cubic)	not sig.

* Significant at the 5% level

** Significant at the 1% level

These results suggest that fluvalinate may have a role in enhancing the rate of dispersal and colonisation of gorse spider mites. Our laboratory results now require whole plant and field assessments. Optimum field concentrations may well differ given environmental influences. The effects of fluvalinate on other life stages also requires investigation. An additional benefit from the use of fluvalinate as a manipulator of mite behaviour may be the protection of colonies from predation from phytoseiid mites. Phytoseiids are generally much more sensitive to pyrethroids than tetranychid mites.

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