EFFECT OF AN INTRODUCED BEETLE ON ST JOHN'S WORT

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SUMMARY

A trial designed to assess the effect of the St John's wort beetle (*Chrysolina hyperici*) on St John's wort (*Hypericum perforatum*) was carried out between October 1983 and January 1985 at Mt Gerald Station, Lake Tekapo. Plots were sprayed with fenvalerate at monthly intervals during the period of St John's wort beetle activity. Monthly stem counts were made of St John's wort stands in sprayed and unsprayed plots, and a point analysis was carried out to check for differences in percentage cover of other components of the vegetation. Results showed that St John's wort stem numbers were significantly higher in sprayed plots than in unsprayed plots in the spring when St John's wort beetle was at the larval stage.

INTRODUCTION

The St John's wort beetle was introduced into New Zealand for control of the pasture weed St John's wort in 1943 (Miller 1970). The initial release in the Awatere Valley, Marlborough was very successful and beetles were collected and redistributed throughout the country. The beetle is now established on St John's wort wherever the weed occurs. Early observations indicated that large areas infested with St John's wort were cleared of the weed following the introduction of the beetle (Miller 1970; Moore 1976). No quantitative data on the effect of the beetle on plant densities was recorded, however. Therefore in March 1983 a trial was set up to measure beetle damage using an insecticide interference method (Kirkland and Goeden 1978).

METHOD

The site chosen for this trial was on Mt Gerald Station, Lake Tekapo, at an altitude of 880 m. The area contained dense patches of St John's wort growing among native and introduced grasses and herbs. St John's wort appeared to be growing particularly vigorously in association with matagouri (*Discaria toumatou*) which was prominent in the area with bushes up to approximately 0.5 m in height.

In January 1983 10 split plots were marked out. Each sub-plot was 1.5 m x 0.75 m separated from its neighbouring half-plot by a 0.3 m wide strip. The plots were spread over an area of about 250 m x 50 m and each plot was several metres from its nearest neighbour. Because the distribution of St John's wort on the site was patchy, the plots were selected by eye to give a dense and uniform infestation of weed. As an initial measure of St John's wort density within the plots, stem counts were recorded for each sub-plot in January 1983.

One sub-plot was randomly chosen for spray treatment while the other provided a control. Treated plots were sprayed with fenvalerate (Sumicidin 20 WP) at 0.8 g ai/10 litres. Vegetation in treated plots was sprayed to run-off with a knapsack sprayer. Fenvalerate was selected because its insecticidal action lasts for 2 weeks, it repels insects for a further 2 weeks and has minimal phytotoxicity and little effect on soil organisms. It is also safe to handle for a lone operator at a distance from services.

Spray treatments were carried out at approximately 4 weekly intervals from 28 January 1983, except during winter (May-October) when beetles are inactive. From 1 November 1983 numbers of stems of St John's wort per sub-plot were recorded at each treatment date until January 1985. A square root transformation was used to normalise stem counts for analysis of variance.

Between 1 November 1983 and 18 December 1984 10 spade squares (0.2 m x 0.2 m) of vegetation, including St John's wort, to a soil depth of approximately 50 mm were collected from outside the plots. They were examined by hand in the laboratory for St John's wort beetle eggs, larvae, pupae and adults. Other insect species found were also extracted and recorded so that the possible effect on vegetation of removing any which appeared in significant numbers could be considered.

In order to detect any major difference in vegetation other than the numbers of St John's wort stems in the plots, a point analysis of vegetation was carried out on 19 November 1984. Fifty points were recorded for each sub-plot uniformly on a 10 x 5 point grid. At each point the species of each component of vegetation impinged by a needle point lowered vertically through the vegetation was recorded.

The percentage mean cover was analysed by ANOVA and the differences in mean cover that would have been detected by the sampling used were calculated using the technique of Cockran and Cox (1957).

$$\delta = \sqrt{\frac{2}{r}}\,\sigma(t_1 + t_2)$$

Where δ = true difference desired to detect
σ = true standard error per unit
r = number of replicates
t_1, t_2 = significance values of Students t.

RESULTS AND DISCUSSION

Pre-treatment stem counts in January 1983 showed no significant difference between treatment and control sub-plots. In addition, 98% of the total sum of squares in ANOVA was attributed to plot variation rather than variation between paired sub-plots.

Mean stem counts per sub-plot are shown in Figure 1.

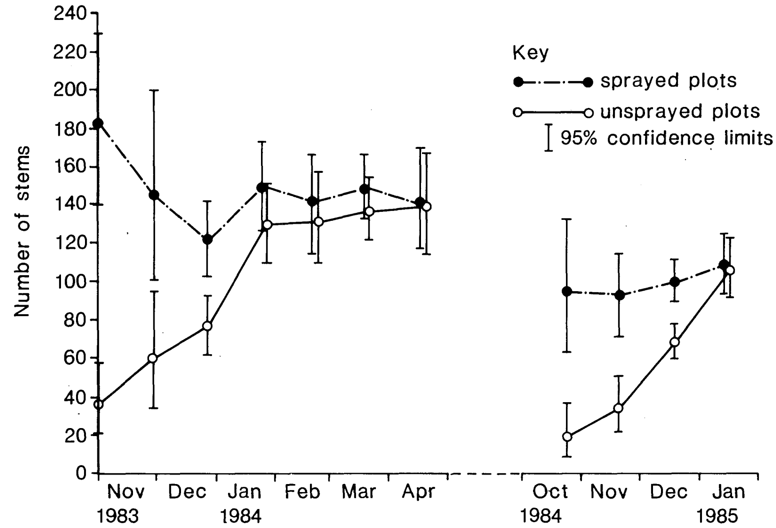

Fig. 1: Mean numbers of St John's wort stems in insecticide sprayed and unsprayed plots.

There is a consistent difference in St John's wort stem numbers between sprayed and unsprayed sub-plots for spring months in both years. While stem counts were being made heavy feeding damage was often noticed in the unsprayed but never in the sprayed sub-plots. Plants appear to compensate for spring damage later in the year but since St John's wort is one of the earlier plants to produce new growth, and is preferentially grazed at this time, reduction of the quantity of St John's wort available in the spring reduces the likelihood of stock poisoning.

From the spade square samples, a total of 55 adults, 12 pupae, 86 larvae and 530 eggs were extracted allowing the distribution of life stages through the year to be described (Fig. 2). The period of larval feeding corresponds with the differences in stem counts recorded in spring, but on 1 November 1983 37% of larvae recovered were already in the fourth instar indicating that larval feeding commenced earlier than this. Only one larva (second instar) was recovered on 23 October 1984.

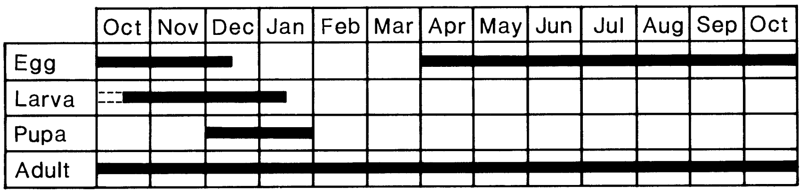

Fig. 2: Life stages of St John's wort beetle October 1983-October 1984.

Lower numbers of other insect species were found. Of the groups collected, root feeding scarabaeid larvae were the most numerous. Adult scarabaeids (*Odontria* sp and *Costelytra zealandica*) were also collected. Others found in sufficient numbers to be more than casual records were tipulid and therevid flies and adults of the root feeding bug *Chaerocydnus nigrosignatus.* While fenvalerate is unlikely to have affected root feeding insects as much as St John's wort beetle, removal of root feeders would have resulted in increased growth of grasses in sprayed sub-plots. The increased competition from grasses would have directly countered the increases in St John's wort stem numbers in sprayed sub-plots (Fig. 1).

Twenty-two species of herbs, six grasses and two shrubs were encountered in the point analysis. The most frequently recorded plants were sweet vernal (*Anthoxanthum odoratum*) and browntop (*Agrostis capillaris*) which together accounted for over a third of all plants encountered. Matagouri, a species of piripiri (*Acaena caesiiglauca*), hard tussock (*Festuca novae-zealandiae*), purging flax (*Linum catharticum*) and patotara (*Cyathodes fraseri*) were all more frequently recorded than St John's wort.

Results of analysis of variance on counts of plants in sprayed and unsprayed sub-plots are presented in Table 1.

TABLE 1: Point analysis data for sprayed and unsprayed plots at Mt Gerald Station, Lake Tekapo, 19 November 1984.

	95% confidence interval for mean % cover		% change in mean % cover which should have been detected (at the 5% level)
	Sprayed	Control	
St John's wort	2.8 – 8.4	1.0 – 5.2	150
Grasses	36 – 56	34 – 54	50
Herbs	28 – 46	22 – 38	60
Matagouri	5.8 – 16.6	2.2 – 20.4	150

The total number of points taken for point analysis (1000) was insufficient to detect less than a 2.5x increase in the sprayed sub-plots (Table 1) as on only 39 occasions was a St John's wort plant recorded. The method was more sensitive to changes in total herb cover (excluding St John's wort) and total grass cover, but none were found.

Although further work is necessary to demonstrate a long term effect on St John's wort populations, this preliminary study has shown that St John's wort beetle does reduce the amount of weed present in spring.

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REFERENCES

Cockran, W.G. and Cox, G.M., 1957. Experimental design (2nd ed). Wiley, New York. 611 pp.

Kirkland, R.L. and Goeden, R.D., 1978. An insecticidal check study of the biological control of puncturevine (*Tribulus terrestris*) by two imported weevils *Microlarinus lareynii* and *M. lypriformis* (Col.: Curculionidae). *Environ. Ent., 7:* 349-354.

Miller, D., 1970. Biological control of weeds in New Zealand 1927-48. *DSIR Information Series No. 74.* 104 pp.

Moore, L.B., 1976. The changing vegetation of Molesworth Station, New Zealand. *DSIR Bulletin No. 217.* 118 pp.