ESTABLISHMENT AND SEASONALITY OF TWO RAGWORT FEEDING INSECTS AT HANMER, NEW ZEALAND

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SUMMARY

Observations over three seasons (1986-89) were made on the establishment of two ragwort feeding insects, cinnabar moth (*Tyria jacobaeae*) and ragwort flea beetle (*Longitarsus jacobaeae*) released in December 1985 and April 1986 respectively. On each sampling occasion randomly selected ragwort plants were grouped according to six developmental stages. Peak numbers of cinnabar moth larvae occurred when ragwort was in the early flowering stage. Adult flea beetles were first found at the same stage and numbers peaked when flowering plants were senescing. Some dispersal of both species occurred in the second and third seasons. A simple monitoring system for use by extension workers is being developed based on flowering stage of ragwort.

INTRODUCTION

Ragwort (*Senecio jacobaea* L.) is a toxic weed which is widespread throughout New Zealand and is recognised as a serious problem. Attempts at biological control date back to the 1920's (Miller 1970) with the introduction of the cinnabar moth (*Tyria jacobaeae* L.) which was originally established over a limited area (Syrett 1983). Currently, Entomology Division of the DSIR is redistributing cinnabar moth as well as the ragwort flea beetle (*Longitarsus jacobaeae* (Waterhouse)) which was imported in 1981 and first released in the field in 1983 (Syrett *et al* 1984). The beetle has since been released at 95 sites throughout New Zealand and is known to have established at 18 sites (Syrett and Grindell, unpublished data).

Cinnabar moth caterpillars feed on the leaves and flowers of ragwort plants, often stripping the plants to bare stems. Regrowth often occurs, however, after larval pupation. Ragwort flea beetle larvae feed on the crown of the ragwort plant during winter and, when in sufficient numbers, may cause the death of rosette plants.

This paper describes a preliminary trial undertaken to establish how best to monitor the establishment of the two insect species at a given field release site. The insect sampling methods and sampling intensity were selected so as to be suitable for use by extension workers surveying a large number of sites. There is regional variation in the phenology of the insect species and extension workers have a limited ability to make sampling visits. The aim was to relate peak insect populations to plant developmental stage so that optimum times for sampling visits to field sites could be determined.

MATERIALS AND METHODS

A site with a high density of ragwort plants (patches having up to 40 rosette plants/m²) was selected near Hanmer, North Canterbury (grid reference NZMS 1 S54 214 786, altitude 385 m). The area was a rough grassy clearing resulting from a 'wind throw' in a plantation of larch trees lightly grazed by horses. In December 1985, 100 *T. jacobaeae* larvae were released in the area, and in April 1986, 1500 *L. jacobaeae* adults were released at the same place. The site was monitored regularly from November 1986 until June 1988, at 2 weekly intervals in summer and monthly through winter. On each occasion 100 plants were selected by a random walk method (Greig-Smith 1983) and classified qualitatively according to developmental stage. These stages were defined as 1: rosette, 2: flowering stem, but buds not showing yellow, 3: flowering stem, buds showing yellow, 4: flowering stem, flowering (a single flower to less than half the flowers dead), 5: flowering stem, seeding (half or more of the flowers dead to partial

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senescence), 6: flowering stem, completely senescent (plant 'browned off'). In the first season plants with flowering stems were under-represented in the samples as ragwort is usually biennial, and most plants at any time are rosettes. In the second season data were also recorded from the nearest plant with a flowering stem if the randomly selected plant was a rosette.

A 30 minute visual search for *T. jacobaeae* adults was made on each occasion by one person walking systematically through the vegetation in the vicinity of the release point. The number of adult moths observed was recorded. The same method was used for sampling larvae. *L. jacobaeae* adults were sampled over a period of 30 minutes by sweeping the vegetation in the release area with a net (width 300 mm) while moving at a slow walking speed. After several sweeps from side to side, beetles in the net were counted and immediately released. Sweeping did not occur if the vegetation was wet. To ascertain whether *L. jacobaeae* larvae were present, 10 rosette plants randomly selected from the release area (defined as a plot approximately 20 m² centred on the release point) were removed and larvae extracted by a method described by Goldson (1978). Roots and material above ground were extracted separately. All sampling took place in the middle of the day. On occasions when insects appeared to be numerous, the furthest distance that an individual was found from the release point was noted. This information was also collected in 1989.

RESULTS AND DISCUSSION

The proportion of plants at each of the stages 1-6 was similar for 1986-7 and 1987-8. Since the percentage of plants with flower stems was small compared to those with rosettes (0-25%), more attention was paid to stages 2-6 in 1987-8 by classifying 100 plants with stems. These results are presented in Fig. 1a.

No *T. jacobaeae* adults were seen in summer 1987-7, but a single adult was noted on 16 December 1987. Larvae were found during December and January 1986-7 and January and February 1987-8 (Fig. 1b). *L. jacobaeae* adults were caught between December and June of both years (Fig. 1c) and the larvae extracted from November to January in 1986-7 and from August to January in 1987-8 (Fig. 1d). The furthest distances that individual insects were recorded from the release point are given in Table 1.

Peak numbers of *T. jacobaeae* larvae occurred in mid-January when the plants with flowering stems were at stage 3-4 (the early flowering stage). Most plants containing *L. jacobaeae* larvae were in the rosette stage, although larvae were still present as plants were undergoing stem elongation. A few were found as plants began to flower (stage 4). In both seasons *L. jacobaeae* larvae were found later than had been observed in a caged trial at Lincoln when no larvae were collected later than December (Syrett 1986).

Adult *L. jacobaeae* first appeared in January and did not peak in either year until late March. Again this was later than in the Lincoln trial when beetle numbers peaked in February. Newly emerged beetles were observed as late as March at Hanmer. In general, the adult beetles first appeared when plants with stems were at the early flowering stage (3-4) and numbers peaked when plants with stems were senescing (stages 5-6). At other sites (Syrett, unpublished data) adult ragwort flea beetles may first appear as early as November or as late as April.

TABLE 1: Furthest distance from release points that ragwort feeding insects were observed at Hanmer

Species	Year	Distance
<i>Tyria jacobaeae</i> (larvae)	1987	30 m
	1988	50 m
	1989	>100 m
<i>Longitarsus jacobaeae</i> (adults)	1987	30 m
	1988	70 m
	1989	>200 m

Fig. 1: Time of appearance of developmental stages of ragwort plants (*Senecia jacobaea*) (a) and ragwort-feeding insects, cinnabar moth larvae (*Tyria jacobaeae*) (b) and ragwort flea beetle (*Longitarsus jacobaeae*) adults (c) and larvae (d) at Hanmer, Mid Canterbury.

Mean annual temperatures for Hanmer were at least 1 °C lower than Lincoln for the years in question, which could partly explain the delay in development of the beetles there compared with Lincoln. It is also possible that caging the beetles at Lincoln accelerated their development by changing the microclimate.

At Hanmer, peak numbers of adult and larval *L. jacobaeae* and *T. jacobaeae* coincided with the same development stage of plants in both years. Numbers of *T. jacobaeae* larvae peaked and adult *L. jacobaeae* first appeared at stage 3-4 (the early flowering stage of ragwort) which may therefore be an appropriate plant condition to select for an annual sampling visit. Although there may be greater variation in the phenology of both insect species at different sites than in plant development, this information gives a good first estimate of optimum sampling times at sites in different parts of the country. Further work is planned to see if this sampling scheme applies in other parts of New Zealand.

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