PRELIMINARY OBSERVATIONS ON THE RAGWORT FLEA BEETLE IN NEW ZEALAND

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SUMMARY

Adult ragwort flea beetles (*Longitarsus jacobaeae*) were released into cages planted with ragwort (*Senecio jacobaea*) at Lincoln in April 1983. Regular counts of beetle numbers were carried out until March 1985. Sample plants were removed monthly to check for eggs, larvae and pupae. Beetle numbers increased five-fold in the first season and a further three-fold in the second year. During the second year a significantly greater number of ragwort plants died in cages containing beetles than in those cages without beetles.

INTRODUCTION

The ragwort flea beetle (*Longitarsus jacobaeae*) was introduced into New Zealand in November 1981 for biological control of ragwort (*Senecio jacobaea*). Following successful completion of host specificity testing (Syrett 1985) the beetle was released from quarantine in April 1983. This experiment was conducted to study the life cycle of the ragwort flea beetle at Lincoln and to measure its impact on ragwort plants in the field.

The ragwort flea beetle is native to Europe and the strain used in this study originates from Italy. The beetle was introduced into the United States for biological control of ragwort in 1968 (Frick 1970) where it established well (Julien 1982). The New Zealand beetles were obtained from Salem, Oregon. Frick (1970) has described the life cycle of the ragwort flea beetle. Adults emerge in early summer, feed actively for two or three weeks and then aestivate. They become active again in autumn, feeding heavily on the foliage for several weeks before laying eggs on leaves, the root crown or in the surrounding soil. Larvae feed mainly in the root crown during winter, often causing severe damage to plants. Pupation occurs in spring.

Biological control of ragwort employing the ragwort flea beetle has been successful in the western United States, and the beetle is also established in Canada (Julien 1982). Excellent control has been achieved in parts of California and Oregon, particularly at sites where the cinnabar moth (*Tyria jacobaeae*) is also established. Significant reduction in ragwort plant density has also been achieved at some sites where cinnabar moth is absent (Hawkes 1981).

METHODS

Beetles were caged over rosette ragwort plants at Lincoln, Canterbury. Cages were 1 m³, constructed of fibreglass screen mesh (Sarlun 20 x 20 gauge) supported by steel fence stakes at each corner. The stakes were covered by 1 m lengths of 5 cm PVC piping with 5 cm pipe caps to protect the mesh cage from abrasion. The top of the screen mesh cage could be opened and was fastened on three sides by Velcro. Twelve cages were erected in two rows of six. Rows were about 4 m apart and adjacent cages separated by about 1 m. Each cage had been planted with 24 ragwort rosettes, all of approximately equal size. These were arranged in 5 x 5 rows with a space at the centre where an observer could stand without trampling plants. On 12 April, 1983, 50 beetles were released into each of six of the cages. Cages were paired, and beetles placed into one of the pair at random.

Every four weeks one plant was removed in a 0.2 x 0.2 x 0.08m soil block, from each cage, and replaced by a fresh plant. The plant was taken from the same equivalent

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position in each cage, selected at random from the 24 possible positions on each sampling occasion. No position was used more than once during the experiment. Each plant with its associated soil block was hand searched for eggs, larvae and pupae. Adults were sampled separately. The plant was then separated into its above and below ground components, and each was dried and weighed. When a plant died during the experiment, the event was noted and the plant replaced. By January 1984 the plants had bolted and some were flowering. All flowering stems were cut down to prevent seeding, and maintain plants as rosettes.

At two weekly intervals adult beetles were counted in each cage by hand searching. They were collected by aspirator and returned to the cage at the end of a 20 minute searching period. An equivalent amount of trampling and disturbance was carried out in the uninfested cages where no beetles were found. From 13 December, 1984, adults collected were not returned to the cages.

RESULTS

The seasonal distribution of life stages during 1984 is shown in Figure 1. Numbers of eggs, larvae and pupae recovered during 1983 were too small for analysis, but between July and October 1984 the mean number of larvae per plant had risen to 44 ± 17 . Numbers of adults recovered from 1983-5 are shown in Figure 2.

Analysis of variance was carried out on log transformed mass of dry material of ragwort plants taken from beetle infested and uninfested cages. Data for roots and foliage were analysed both separately and combined but no significant differences were found. Analysis of the number of dead plants which were replaced by April 1984 also showed no significant difference between beetle infested and uninfested cages. However between April 1984 and March 1985 plant mortality was significantly ($P < 0.01$) higher in the infested cages compared to those without beetles (Table 1).

Fig. 1: Life stages of the ragwort flea beetle at Lincoln during 1984.

TABLE 1: Mean number of ragwort plants per cage died and replaced during experiment.

	With ragwort flea beetle	Control	
April 1983 — April 1984	7.3	6.3	ns
April 1984 — March 1985	17.8	7.5	**

DISCUSSION

Life Cycle

Eggs were found from April onwards corresponding to the beginning of oviposition in early October in North America (Hawkes and Johnson 1976). A large proportion of the eggs were recovered from the soil, very few being collected from

Fig. 2: Mean number of adult ragwort flea beetles collected per cage from 1983-5.

foliage. This could have been a result of low humidity around leaf surfaces since eggs are very sensitive to drying (Frick & Johnson 1972). Larvae were found from May onwards and some were still present well into spring and early summer (Figure 1). Pupation occurred mainly in November and December corresponding to May in North America (Hawkes and Johnson 1976). Adult beetles have been observed emerging in late May and June in California and Oregon (Hawkes 1981). At Lincoln in 1984 no new generation beetles were recovered until the second week in December, and they continued emerging until late February 1985 (Figure 2). This seems to be a little later than the comparable time in North America (Hawkes 1981).

Five times as many adults emerged in 1984 as were released in 1983 and a further threefold increase occurred from 1984 to 1985. Also in 1985 adult beetles first appeared nearly six weeks earlier than in the previous year. This is probably attributable to the time necessary for the beetles to readjust to a univoltine life cycle after several generations under artificial conditions where short days induced continuous reproduction without aestivation (two to three generations per year).

Impact on ragwort

It was very difficult to obtain a measure of damage to ragwort plants by the chosen method of selecting a single plant from each cage on each sampling occasion. This was because of the wide variation in plant size which occurred in spite of all rosettes being of approximately equal size at the outset of the experiment. However, more plants died in the beetle infested cages than in the uninfested cages, so some plant deaths were attributable to beetle damage.

While beetle populations under caged conditions may be artificially high, survival of ragwort plants may also be enhanced. If the ragwort flea beetle can cause plant deaths under these conditions, then under field conditions, where ragwort is subjected to competition from other plant species, equivalent larval densities could be at least as damaging.

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