RENEWED ACTIVITIES IN BIOLOGICAL CONTROL OF RAGWORT

P. SYRETT, S.M. SCHEELE, B.A. PHILIP

Entomology Division, DSIR, Lincoln

SUMMARY

The present status of two early insect introductions into New Zealand for biological control of ragwort (*Senecio jacobaea*) is described briefly. These are the cinnabar moth (*Tyria jacobaeae*) and ragwort seedfly (*Pegohylemyia jacobaeae*). Details of the recent introduction and release of the ragwort flea beetle (*Longitarsus jacobaeae*) are then given, and the prospects for controlling ragwort by biological means are discussed.

INTRODUCTION

Ragwort was one of the first weeds to be the subject of a biological control programme in New Zealand, and this work, initiated by New Zealand, has since been continued in the United States, Canada and Australia. Two beneficial insect species were imported into New Zealand from Europe, cinnabar moth from 1926-31 and ragwort seedfly from 1928-39. Although initial success in establishment was poor, both have survived and have extended their range. Cinnabar moth, whose larvae feed on foliage and flowers, is now common on ragwort in the southern North Island from Wellington to Eketahuna (Fig. 1). The distribution of ragwort seedfly now covers a large part of the central North Island (Fig. 2). Larvae of this insect consume developing seeds. Although two species of ragwort seedfly (*Pegohylemyia seneciella* and *P. jacobaeae*) were introduced into New Zealand, all recent recoveries have been *P. jacobaeae* (Holloway 1983). The aim of current work is to assess the status of these early introductions and to attempt to establish a third species, the ragwort flea beetle (*Longitarsus jacobaeae*) which has been used successfully for biological control of ragwort overseas (Hawkes 1981). Ragwort flea beetle larvae feed by tunnelling into the root crown.

METHODS

Cinnabar moth

Cinnabar moth larvae collected from the Wairarapa in January 1982 were caged over ragwort at Tai Tapu near Christchurch (200 larvae) and at Staveley, mid Canterbury (300 larvae). Three hundred larvae were also released near Karamea (Buller) in February. The cage at Tai Tapu was checked weekly from 10 November until 16 December 1982 and three adults were recovered. At Staveley strong winds tore the cage, a single pupa being recovered on 4 November but no adults were observed at the site. At the Karamea site two adults were observed on 12 January 1983, and the following season (12 November 1983) a single female and six eggs were noted. The weather during the 1982-3 summer was unusually cold and wet. These recoveries, although meagre, indicated that the insect could be transferred to new sites and survive.

Since it had never been clear why, from initial widespread releases through New Zealand, cinnabar moth failed to survive except in the southern part of the North Island, it was decided that larger scale releases should be made at a number of sites throughout the country. Monitoring these sites over 5 years will indicate whether some or all of these ragwort populations are suitable for supporting cinnabar moth populations. Thus during the 1983-4 summer 20,000 larvae were reared and releases made at Otautau (Southland), Whataroa (Westland), Karamea (Buller), Upper Takaka (Golden Bay) and Whangarei (Northland) (Fig. 1).

Proc. 37th N.Z. Weed and Pest Control Conf.

Fig. 1 Current distribution of Cinnabar Moth *Tyria jacobaeae* and Release Sites 1982-4

Fig. 2 Current distribution of Ragwort Seedfly, *Pegohylemyia jacobaeae* and Release Sites 1982-3

Fig. 3 Ragwort Flea Beetle *Longitarsus jacobaeae* Release Sites

Ragwort seedfly

Ragwort seedfly was collected from Wairakei (Taupo) by cutting ragwort stems with infested seedheads and extracting the larvae in the laboratory. Adopting the method of Hoy (1958) bundles of stems were suspended upside down so that larvae dropped into trays of damp sand into which they burrowed to pupate. Two releases of ragwort seedfly pupae were made during 1982-3. This stage was chosen since adult flies are delicate and difficult to transport, while larvae feed inside the seedhead and would need to be transferred with the live host plant. Pupae were placed beneath the soil surface with the sand in which they had been stored. Five hundred pupae were released near the Turimawiri river (Golden Bay) on 25 May 1982, and 500 by the Cobb reservoir on 7 January 1983 (Fig. 2). Among the latter pupae were included several newly

emerged flies. Several others had already emerged in the laboratory. The ragwort was at the 'bolting' stage, with some buds already suitable for oviposition. It has been noted that only buds of a critical size are selected for oviposition by female flies (J. Dymock, pers comm).

Ragwort flea beetle

A consignment of the ragwort flea beetle was imported into quarantine at Lincoln in November 1981 from Salem, Oregon, USA. Following successful completion of safety testing under quarantine, initial field releases of the New Zealand F₂ generation of ovipositing adults were made in April 1983. Three hundred beetles were released in cages at Lincoln over planted ragwort rosettes to monitor survival and phenology under New Zealand conditions. Field releases on naturally occurring ragwort plants were made at Inchbonnie (Westland) and Canvastown (Marlborough) (Fig. 3). Both were in paddocks grazed by cattle. At Inchbonnie 300 beetles were released in a 'quasi cage' constructed from a timber frame 1.5 m x 1.0 m x 1.0 m covered with Cyclone^R aluminium standard insect screening. The 'quasi cage' concept in which 20% of the surface area is not covered and thus 'open' was devised by Dunn (1976) to improve the validity of host specificity testing of biological control candidate insects. The purpose of using it here was to provide initial protection for the insects and to give plants inside the cage a high probability of being attacked. At the same time the open cage enables beetles to search for alternative host plants should those inside the cage be inadequate. An area approximately 25 m² around the cage was protected from grazing by an electric fence. A further 230 beetles were released at Canvastown. These insects were given no protection from normal grazing practice. During subsequent visits to these sites ragwort plants were closely inspected for beetles and typical feeding holes. Sweep netting was also used to check for the presence of beetles. Unprotected releases of 300 beetles at Ngatira (near Tokoroa) and 300 at Kaiparoro (Wairarapa) were made in March 1984. These sites were chosen particularly since ragwort seedfly is well established at Ngatira and cinnabar moth at Kaiparoro. If the flea beetle establishes at these sites we shall be able to investigate the effects of a combination of two species attacking the plants.

RESULTS

Cinnabar moth

Visits to Whataroa, Karamaea and Upper Takaka sites 5-8 weeks following releases of cinnabar moth larvae revealed plants heavily defoliated as a result of larval feeding.

Ragwort seedfly

Ragwort seedheads at both seedfly release sites were examined for the presence of seedfly larvae in late summer when insect damage should be most conspicuous. The Turimawiri site was visited on 1 December 1982 and sweeping ragwort plants revealed no adult flies. On 15 March 1982 ragwort seedheads at this site were examined for larval infestation without success. At Cobb, searches made on 15 November 1983, 19 February and 1 April 1984 were unsuccessful in finding adult flies or larval damage. However, pupal cases were noted on the November visit indicating that flies had emerged.

Ragwort flea beetle

From weekly counts of adult beetles made in the cages at Lincoln it appeared that adults emerged over a 6 week period from late January until the end of February. New generation (F₂) beetles were observed at the Inchbonnie release site on 3 February and 13 February 1984. A search at the Canvastown site on 18 February 1984 failed to find any beetles although plant damage typical of feeding by adults (released in April) was evident as late as November 1983.

DISCUSSION

The cinnabar moth is now well established in the southern part of the North Island, and although at times defoliation of ragwort plants is extensive, we do not know what effect this has on ragwort plant populations. Hawkes (1981) noted that in the United States regrowth of ragwort during autumn rains was able to compensate for very high levels of defoliation. In eastern Canada, however, early frosts were observed to kill

plants stressed earlier through defoliation by cinnabar moth larvae (Harris *et al* 1976). By monitoring the new release sites we hope to determine whether the Wairarapa populations of cinnabar moth are able to survive in other parts of the country and whether they have any significant impact on ragwort populations.

Released ragwort seedflies have not established well. Kelsey (1955) reported that, by 1950, seedfly survived at only one site where just 36 adult flies had been released in 1937. From the large numbers of seedflies introduced into Australia from New Zealand in the 1930s and 1950s there was no evidence of establishment (Waterhouse 1967). The attempts to transfer seedfly described here have apparently been unsuccessful and if a reliable method of transfer is to be devised, more information on the behaviour and requirements of the insect will be needed.

Insects imported into New Zealand from the northern hemisphere require rephasing to conditions here, so that adult emergence dates for the ragwort flea beetle noted above do not reliably predict the insect's seasonal synchrony. However, initial signs of field establishment are encouraging.

Many factors affect the survival and multiplication of introduced insects in a new environment. Even when an introduced species establishes well, however, it is not always easy to determine what influence it has on weed populations. It may appear to have no long term impact. Harris (1981) suggests that weeds are most often killed by an accumulation of stresses such as climatic factors and plant competition, and that biological control agents should be considered as additional stress factors. Thus if a weed is already subject to climatic stress, for example, a single insect species may be adequate. For example, ragwort growing on dry sites in eastern Canada has only a short growing season and summer grazing pressure by cinnabar moth larvae weakens plants so that they are killed by early winter frosts (Harris *et al* 1976). In other areas where regrowth occurs following cinnabar moth defoliation, control has been effected by addition of a second species, the ragwort flea beetle (Hawkes and Johnson 1976). Defoliation by cinnabar moth larvae is complemented by the activity of flea beetle larvae which tunnel into the root crown.

While neither cinnabar moth nor ragwort seedfly have been remarkably effective at controlling ragwort in New Zealand, we hope that by establishing the ragwort flea beetle to augment their activity we may achieve a measurable reduction in ragwort populations.

ACKNOWLEDGEMENTS

We thank Anne Schlaadt for rearing the cinnabar moth larvae released during summer 1983-4, and the Golden Bay County Council for providing financial support for a part of this project. Vaughn Hunt and Jenny Dymock have assisted by supplying ragwort seedfly pupae. We are also extremely grateful for the co-operation and interest shown by many farmers and Noxious Plants Officers throughout the country.

REFERENCES

- Dunn, P.H., 1976. Shortcomings in the classic tests of candidate insects for the biological control of weeds. *Proc. 4th Int. Symp. Biological Control of Weeds*: 51-73
- Harris, P., 1981. Stress as a strategy in the biological control of weeds. *In* Biological control in crop production. Ed. Papavizas G.C.: 333-340.
- Harris, P., Wilkinson, A.T.S., Thompson, L.S., Neary, M.E., 1976. Interaction between the cinnabar moth *Tyria jacobaeae* L. (Lepidoptera:Arctiidae) and *Senecio jacobaea* L. (Compositae) in Canada. *Proc. 4th Int. Symp. Biological Control of Weeds*: 174-180.
- Hawkes, R.B., 1981. Biological control of tansy ragwort in the state of Oregon, USA. *Proc. 5th Int. Symp. Biological Control of Weeds*: 623-626.
- Hawkes, R.B., Johnson, G.R., 1976. *Longitarsus jacobaeae* aids moth in biological control of tansy ragwort. *Proc. 4th Int. Symp. Biological Control of Weeds*: 193-196.
- Holloway, B.A., 1983. Species of ragwort seedflies imported into New Zealand (Diptera:Anthomyiidae). *N.Z. J. Agric. Res.* 26: 245-249.

- Hoy, J.M., 1958. The collection of *Hylemyia seneciella* (Meade) (Diptera, Muscidae) for shipment to Australia. *N.Z. J. Sci. 1*: 417-422.
- Kelsey, J.M., 1955. Ragwort seedfly establishment in New Zealand. *N.Z. J. Sci. Tech. A 36*: 605-607.
- Waterhouse, D.F., 1967. The entomological control of weeds in Australia. *Mushi 39*: 109-118.