BIOLOGICAL CONTROL OF WEEDS

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Over vast areas weeds are incidentally kept in check by the normal procedures of farm management; that is, by cultivation and cropping of arable lands, and by the maintenance of pastures. Under other circumstances, however, weeds become a special problem requiring direct attention for their control by mechanical and chemical means, which are merely palliatives at best, and certainly very costly; they have to be maintained from time to time and, though effective on occasions, the results are often so unsatisfactory that attention has turned to some means by which natural controlling influences can be utilised in the solution of the weed problem, especially on the many areas where no other method is at all practicable.

These natural controlling influences include all of the many environmental factors governing the life of the weeds in their natural home, that is, the ecological factors. The biologists are concerned with two of these environmental factors, the botanist with useful plants competing with weeds, and the entomologist with insects attacking the weeds. The suppression of weeds by plant competition is well illustrated, for example, where pastures are maintained and where re-forestation has been successful; and there can be no doubt that this principle can be carried further in many cases. On the other hand, the successful results secured by the use of insects against certain weeds in recent years illustrates the possibilities of biological control. However, when the entomologist has succeeded in controlling a weed with insects, the botanist must, where necessary, follow up with the proper plants to replace the weeds on cleared areas, otherwise the destroyed weeds will rapidly be replaced by others and the situation remain but little improved. For example, when large areas of St. John's Wort were recently cleared by an insect, the pasture fortunately followed at one, but in some places where the manuka scrub has been destroyed by the "manuka blight", fern and gorse have taken charge.

The outstanding successes secured in the biological control of weeds have caused this method to be recognised as an established technique, and recently the United States authorities, always holding rigid views in regard to alien insects, have now come to recognise the value of insects in weed control, and have lowered the barriers to allow the gorse-seed weevil from New Zealand and the St. John's wort from Australia to be imported.

The most outstanding success in biological control, owing to its magnitude, was the control by a caterpillar (*Cactoblastis cactorum*) of the prickly pear in Australia. This caterpillar was responsible for the virtual clearing of prickly pear over millions of acres and of opening the land for settlement. In this case it is of interest that the caterpillar was aided by micro-organisms which entered the wounds caused by the caterpillars and hastened the death of the pear, though the caterpillars would finally have attained the same result unaided.

Another weed problem in Fiji was overcome, not by the insects imported for the purpose of destroying the weed, but by retarding its growth, so that the normal plants, of the area, instead of being smothered by the weed as was the case prior to the introduction of the insect, were given a chance to grow and smother the insect-weakened weed, which could no longer compete.

In New Zealand the principal species of weeds studied with a view to biological control have been blackberry,

ragwort, piri-piri, gorse, St. John's Wort and manuka, while a little attention was given to bracken and variegated thistle, but the work on these two weeds was not followed up.

Some years were spent on the blackberry. This attempt was finally abandoned, however, since it was found that the adult of the only species of insect that could safely be used, favoured apple-tree foliage, although the larva bored into and destroyed the canes and crowns of blackberry.

The control of ragwort met with some minor success in the initial stages when the cinabar moth caterpillar was used; but this caterpillar was unable to maintain its populations owing to attacks by native parasites and by birds. A second insect, the ragwort seed-fly, has been established, and this year it is hoped to make a study of the position to ascertain the fate of the insect. During the first years it progressed well, and it is hoped that it will, by now, be found well established. The maggot of this insect lives in the florets of the ragwort flowers and completely destroys the seeds.

In the case of piri-piri we have met with a disappointing situation, in that, though the insect - secured from Chile - thrives year after year on the experimental plots at the Cawthron Institute, it fails to establish in the field where it has been liberated in large numbers.

Against gorse great success has been attained with the gorse seed-weevil, now so well established throughout the land that in certain regions gorse-seed cannot be secured by those requiring it. We have sent this insect to Tasmania where it has become equally well established, and this year consignments are being sent to the Hawaiian Islands and later to the United States.

The control of St. John's Wort is an activity being developed at present with outstanding success. A beetle was secured from the Australian authorities, and established. In the Upper Awatere Valley hundreds of acres have actually been cleared of the weed, and the same sort of thing is taking place in the south where the insect is being established. It is intended to make establishments of the insect this year in the North Island. Both St. John's Wort and tutsan are attacked.

"The manuka blight" is attracting much attention. This blight is a scale insect somewhat similar to the gum-tree scale. It was not introduced on purpose, but has developed unaided except where farmers have been spreading it in different parts of New Zealand. Plants, especially scrub-manuka, infested by the insect slowly die over a period of from some five to seven years.

The use of insects for the control of weeds is by no means a simple matter. Every care has to be taken in the selection of insects to ensure that they are ones known not to attack economic plants but only the weeds in question. The next step is to carry out exhaustive tests with the insects in all their stages upon a wide variety of plants. Having passed such tests in the country of origin the insects are then imported, freed of parasites, and the tests repeated under strict quarantine conditions before any liberations can be made.

When on the subject of liberation of weed-

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controlling insects, I must ask that individual requests for supplies are not made. It is quite impracticable to meet such demands. The insects are liberated on selected areas and when they become established, they will spread naturally.

GENERAL DISCUSSION.

Mr. M. A. Black - What possibility is there of the complete control of gorse? There is a period of the year when the gorse is seeding and the insect is not active.

Dr. Miller - There are two flowering periods for gorse - in spring, when the major crop of seeds is produced; and in January, when the percentage of seeds is comparatively low. The weevil normally takes the seed of the spring flowering, which is the normal period for the laying of eggs. As a rule the weevil has only one brood per year. We find in New Zealand that it does attack the second flowering and may be building up a second generation. The weevil will not get complete control of the seeding. Regarding the complete control of gorse, there are some insects which will attack the plant. If gorse is a weed, it is also a very useful plant for fences and shelter.

Dr. J. S. Yeates - It is generally considered that the gorse seed can remain in the ground for 50 years and then germinate. It is not possible to eradicate gorse in our lifetime.

Dr. Miller - No. The weevil will go on as an aid in attacking the seeds.

Q. - How long will it take to establish manuka blight, and will the St. John's Wort beetle be distributed in the North Island.

Dr. Miller - The way to spread the scale insect is to get an armful of infected manuka and scatter it about among the other plants between May and September, without planting. For the St. John's Wort beetle we have selected one or two areas in different districts in the North Island this year. Once it is established it can be spread, but we cannot send samples to all individuals.

Dr. Yeates - The St. John's Wort beetle seems to make such a job of it that it may die out?

Dr. Miller - Yes, in Upper Awatere that is becoming the case.

Q. - Along the foothills of Canterbury we can see big black patches of manuka killed by the blight. It is a pity that red manuka, which is grown as an ornament in private gardens, is becoming affected in the same way.

Dr. Miller - Spraying, probably with some of the oils, would be the only safeguard.

Mr. E. Madden (Grasslands Division) - In view of the value of manuka in soil conservation work, should we not encourage people to eliminate manuka from country only as that country is brought in? Will the spread of the blight be so rapid that we cannot stop it?

Mr. G. C. Warren (Canterbury) - Our experience is that gorse has taken the place of manuka on the Canterbury foothills.

Mr. Madden - The prickly pear of Queensland has spread to Hawke's Bay, and from two or three acres is spreading rapidly. Should the cactoblastus be brought from Queensland, or, in case it runs riot here, is there some effective spray instead of the insect?

Dr. Miller - That is very interesting, as I did not know the prickly pear had come to Hawke's Bay. In Australia it was a garden escape. The best procedure is to hit the pear hard now, as a fair area of it would be needed to establish the caterpillar.

In reply to further questions Dr. Miller issued a warning against indiscriminate use of D.D.T and gammexane, which, if used on plants, might wipe out also the enemies of certain pests. The grass-grub beetle could be destroyed by D.D.T., but use of it was killing the honey bee also.