1-1-1993

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Stuart Wheeler
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An update on the biological control of rabbits
By Stuart Wheeler, Senior Research Officer, Vertebrate Pest Research Section, Agriculture Protection Board of WA, Forrestfield

When myxomatosis was introduced into Western Australia in the early 1950s, farmers, pastoralists and government alike thought it was an answer to the rabbit problem.

The disease was devastatingly effective in the short term and initially had a 99 per cent kill rate. With time, the virus declined in strength, and the surviving rabbits have again multiplied.

There have been many recent reports about new forms of biological control for rabbits and potential improvements in old ones.

This article summarises each of the prospective methods and improvements, and assesses the potential usefulness of each.

Five possible avenues for improved rabbit control are:
- Spanish fleas
- 'Engineering' the myxomatosis virus
- Bacterial diarrhoea
- Viral haemorrhagic disease
- Immunocontraception

Spanish fleas
Dr Brian Cooke from the Animal and Plant Control Commission in South Australia has been searching in Spain for new species of fleas that live on wild rabbits. The objective of this work is not to find a replacement for the European rabbit flea, which is spread through the agricultural areas of Australia, but to find fleas that will live in areas of low rainfall. The European rabbit flea does not survive in regions that have less than about 200 mm average annual rainfall and, therefore, is not found in Australia's semi-arid and arid zones.

Fleas generally transmit myxomatosis from rabbit to rabbit extremely well, and the aim of this project is to improve the effectiveness of the disease in the drier regions.
A scourge on the land

Rabbits were brought into Victoria in the mid 1800s and quickly found the country to their liking. With few predators to keep numbers down, the rabbit spread like wildfire—covering up to 100 km in some years. By 1900, most parts of the continent that were habitable by rabbits had been invaded.

Under favourable conditions, females can have four to five kittens every month for up to five months of the year. It’s not unknown for a single pair to have produced 130 young in 15 months.

Rabbits can strip the land bare, especially during drought, driving valuable plants to extinction. They are estimated to cause a direct loss to the Australian economy of $90 million a year in the form of lost pastoral and agricultural production, and reduced land values. The loss to the environment is impossible to calculate.

The predicted distribution of the new flea in Western Australia covers the whole of the distribution of the rabbit but excludes the wetter regions of the South-West. There is little doubt that Xenopsylla has potential for transmission of myxomatosis in the drier areas, particularly the arid zone, where good vectors are scarce and myxomatosis generally spreads poorly.

Apart from visual differences, the European and Spanish fleas live on different parts of the rabbit’s body. The European flea is found mostly around the rabbit’s ears, face, back of the neck and the shoulders while the Spanish flea prefers the hindquarters and the tail. The Spanish flea also spends most of its time on the sand in the burrow rather than on the rabbit, making it difficult to find Spanish fleas by combing rabbits.

‘Engineering’ the myxomatosis virus

The discovery of genetic engineering techniques has suggested that the myxomatosis virus may be modified to improve its virulence. While this sounds like a good idea, and may be possible, it has potentially serious shortcomings.

The more virulent a strain of myxomatosis is, the shorter the time it takes to kill. This leads to poor transmission from rabbit to rabbit, because the virus is available for transmission for only a short time, and the virulent strain of myxomatosis ‘dies out’. Any project aimed at engineering the virus would need to attempt to break the link between virulence and time to death, if this is possible.

Wherever myxomatosis has been introduced, the wild rabbit has shown increased resistance to the disease. At the same time the virus has ‘evolved’ towards a lower virulence. When myxomatosis was first introduced into Australia, it killed almost all infected rabbits, but now the percentage killed is substantially lower. It is likely that the same sort of changes would result...
if a genetically engineered, virulent strain was released. Although there could be some initial beneficial effects, it is probable that the need would arise for a yet more virulent strain, and so on. This approach is not viewed with much favour.

Although the strains of myxomatosis that exist in the wild today kill fewer rabbits than they used to, they still kill useful numbers.

**Bacterial diarrhoea**

Bacterial diarrhoea in rabbits is being examined by scientists at the University of Melbourne. The diarrhoea is caused by a strain of a common gut bacterium. Nestling rabbits are susceptible to the disease, but even in rabbit farms (in Europe) infections have killed only up to 30 per cent of young rabbits. Bacterial diarrhoea’s potential for control of wild rabbit populations in Australia, therefore, seems limited, given this low level of mortality. Also, scientists do not know whether it will spread through populations of wild rabbits.

**Rabbit haemorrhagic disease**

Rabbit haemorrhagic disease is also known as ‘viral haemorrhagic disease’. It has been studied in wild rabbit populations in Spain by Dr Brian Cooke and Spanish scientists.

Symptoms of rabbit haemorrhagic disease are different from those of myxomatosis. There are no swellings, and the animals die quickly (within 72 hours). Domestic rabbits can be protected against it by immunisation.

In wild populations in Spain, death rates were fairly high, about 80 per cent, in the initial outbreak, but later outbreaks had variable effects. However, the disease does not appear to have diminished in overall virulence after three years, unlike myxomatosis did when it was first introduced into Australia. Rabbit haemorrhagic disease spread rapidly through the rabbit population in Spain in the initial outbreak, at 15 to 20 km per month.

The virus has been imported into Australia and is being held under high security quarantine at CSIRO’s Australian Animal Health Laboratories in Geelong. Laboratory work there in 1992 showed that two-week-old rabbits survived the disease, while those five to six weeks old died. European data suggested that rabbits less than two-to five-months old survive the disease. Wild rabbits appear to be more susceptible than domestic ones.

More needs to be known about the mechanism of transmission of this disease, and this will be studied at the Geelong laboratory, along with ‘safty’ testing on domestic animals, native mammals, and birds.

Participants at a workshop on rabbit haemorrhagic disease held in Canberra in August 1992 were cautiously optimistic about the probability of the disease being an acceptable and potentially effective form of biological control of rabbit populations. It cannot, however, be seen as the final solution to the rabbit problem.

**Immuocontraception**

Immuocontraception is a form of contraception that results from stimulation of an animal’s immune system. It involves fooling the body into thinking that certain proteins found on sperm and egg cells are foreign. The body’s immune system produces antibodies that bind on to these proteins. This prevents recognition between sperm and egg, which in turn stops fertilisation.

In the case of the rabbit, the immuno-contraceptive proteins will be carried on the myxoma virus. Known as virally-vectored...
immunocontraception, the technique has the most potential for successful biological control of rabbits and other vertebrate pests.

Apart from blocking fertilisation, this technique does not affect the target animal in any other way. The animal will behave as normal—it just won’t produce offspring.

Development of the method, if it succeeds (and it is not certain that it will) will take up to 10 years. Some important steps have already been taken; for instance, CSIRO scientists have located sites within the myxomatosis virus where it is possible to insert foreign protein.

The development of virally-vectored immunocontraception involves cooperative work in the fields of reproductive physiology, immunology, virology, ecology and social behaviour that are beyond the capabilities of any one organisation.

This research work is now undertaken by Australia’s Cooperative Research Centre for the Biological Control of Vertebrate Pest Populations (Vertebrate Biocontrol Centre, for short). Officially established in April 1992, the cooperating institutions are:

- Australian National University, Canberra
- Agriculture Protection Board, WA
- Division of Wildlife and Ecology, CSIRO, Canberra, and
- Department of Conservation and Land Management, Perth

The two principal target animals are the fox and the rabbit. These species were chosen because they damage farm production and the environment, and because they are, as predator and prey, closely linked.

The research contribution of the Vertebrate Pest Research Section of the Agriculture Protection Board is primarily field studies of the ecology and social behaviour of foxes (in conjunction with the Department of Conservation and Land Management) and rabbits.

Dr Laurie Twigg, of the Vertebrate Pest Research Section, is carrying out large-scale experimental work on rabbits in the field. He is studying the effects of different proportions of sterile rabbits on the productivity and growth of wild populations. Known proportions of rabbits in separate, small populations are sterilised and the population’s reproductive output and changes in numbers measured. The objective is to determine what level of sterilisation is needed to make rabbit populations decline. His 12 field sites were set up during 1992, and the actual sterilisation program began in early January 1993.

No single solution

Although each of the types of biological control of rabbit populations, or improvements in techniques, may play some part in controlling rabbit numbers, none of them should be seen as the final, single solution to the rabbit problem. If it succeeds, virally-vectored immuno-contraception may come closest to it, but this technique is many years down the track.

Meanwhile, the first statement from the conclusions and recommendations of an Australian Wool Corporation-sponsored conference on rabbit control, held in Melbourne in late 1990, is appropriate here: "There was general agreement that rabbit control will be based on existing methods of ripping, poisoning, and fumigation for at least the next 10 to 15 years, that myxomatosis will be an important control aid for many years, and that conventional methods can be highly effective if used correctly."

Further reading