Calicivirus
proves effective, but fickle

The escape of rabbit calicivirus disease (RCD) from Wardang Island in October 1995, and its subsequent release at more than 700 sites across the country, is thought to have halved Australia's rabbit population, which previously stood at 300 million.

For pastoralists in the arid areas of New South Wales and South Australia, where the impact of the rabbit is particularly serious, the disease has brought spectacular changes. In higher rainfall districts, however, the results have been mixed.

Factors influencing the spread and environmental impact of RCD across Australia are being investigated by the Australian Rabbit Calicivirus Disease Program. The program was begun in 1996 and has two parts: monitoring and surveillance, and epidemiology. Dr Tony Robinson, head of the RCD laboratory at CSIRO Wildlife and Ecology, is chairman of the program's Science Sub-committee.

RCD monitoring and surveillance is coordinated by Dr Mary Bomford, a project officer at the Bureau of Resource Sciences. Changes in rabbit populations, disease prevalence, flora, fauna, predators and vegetation are measured at 10 intensive sites by state and territory agricultural and conservation agencies (see map on p26). As well, 54 broadscale sites provide information on RCD activity and rabbit abundance. On all the intensive sites, rabbit numbers had fallen by more than 65% by November 1997.

It is still too early to determine long-term trends in predator numbers and diet in response to the arrival of RCD. Early indications suggest there may be a decline in foxes and feral cats. Where foxes have depended on rabbits, some foxes are changing their diet to include more insects and fruits.

Increased loss of Mallee fowl eggs has been reported at one site, but whether this is caused by foxes has yet to be determined. Plants are regenerating, but it is too soon to say if these changes will be sustained. In some areas vegetation is responding immediately and pastoralists in SA and western NSW report a remarkable resurgence of grasses and bush.

In the Flinders Ranges, SA, there have been several outbreaks of RCD, in November 1995, autumn and spring 1996, and autumn and spring 1997, proving the disease can recur in a population. Despite breeding over spring, rabbit population levels at the Flinders Ranges in October 1997 were lower than after the first major outbreak in November 1995 (less than 10% of the original numbers), and were the lowest ever recorded for the site. Scientists don't yet understand the reasons for the 'patchiness' of RCD's effect in some areas.

Unlike myxomatosis, RCD is rarely detected by the casual observer. Its presence in an area is often missed, even by people experienced in studying rabbits. In wetter areas, RCD is moving through slowly and will wipe out a series of warrens quite spectacularly, while just over the next ridge, a population of rabbits will be untouched.

RCD may have failed to gain a foothold in some areas for a number of reasons: the presence of non-susceptible, young rabbits in the population when RCD arrived; absence of insects to spread the virus; and unknown climatic factors.

Serological tests (ELISAs), developed in Italy by Dr Lorenzo Capucci, have enabled detailed analysis of the epidemiology of RCD, with particular reference to the susceptibility of young rabbits. CSIRO's Dr Brian Cooke has used these tests to investigate the epidemiology of the disease in SA and state laboratories are now using them to determine antibody levels in rabbits on monitored sites.

Most rabbits up to five weeks old are not particularly susceptible to infection. In addition. Female rabbits that have recovered from RCD pass antibodies onto their young across the placenta. This gives young rabbits some additional, though temporary protection against RCD. Cooke and Robinson are using the ELISAs to determine the level of protection afforded to young rabbits by maternal antibodies.

Once over five weeks, young rabbits become increasingly susceptible and they lose their maternal antibodies as well, making them fully susceptible to RCD. Many young rabbits become infected at this stage and many die, but a proportion survive and form their own antibodies. From then on they have permanent protection from the disease.

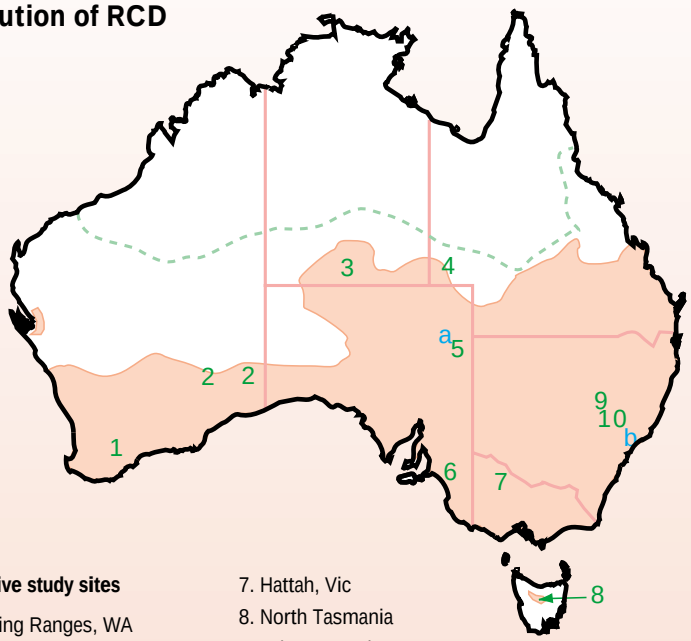
The role of insects in spreading the disease is now better understood.

RCD releases in Australia to November 1997

State/Territory	Number of release sites	Number with obvious RCD activity	Number with no obvious RCD activity	Number not known
ACT	8	2 (25%)	3 (38%)	3 (38%)
New South Wales	422	255 (60%)	125 (30%)	42 (10%)
Northern Territory	9	2 (22%)	5 (56%)	2 (22%)
Queensland	83	25 (30%)	5 (6%)	53 (64%)
South Australia*	27	-	-	27
Tasmania	14	1 (7%)	-	13* (93%)
Victoria	116	67 (58%)	31 (27%)	18 (15%)
Western Australia	30	11 (36%)	16 (53%)	3* (11%)
Total	**709**	**363**	**185**	**161**

*Subsequent serological testing in SA has shown that RCD had arrived at all sites prior to release. It is therefore not possible to separate the impact of natural spread and RCD releases on rabbit numbers at these sites.

Monitoring sites and distribution of RCD



Intensive study sites

1. Stirling Ranges, WA
2. Nullarbor (two sub-sites), WA
3. Erldunda Station, NT
4. Muncoonie Lakes, Qld
5. Flinders Ranges, SA
6. Coorong, SA
7. Hattah, Vic
8. North Tasmania
9. Lake Burrendong, NSW
10. Central Tablelands, NSW

Supplementary sites

a. Strzelecki
b. Cattai

(Based on data from state and territory pest control agencies. RCD is patchy in this range. The dotted line shows the northern limit of rabbit distribution.)

Laboratory studies by CSIRO's Australian Animal Health Laboratory have shown that fleas, mosquitoes and bush flies can all transmit RCD. These insects have also been found to be contaminated in the field. Cooke believes blowflies are also involved in RCD transmission.

Flies fed on infected rabbit liver may retain virus in their gut for several days and their faeces (flyspots) often contain viable virus. There is enough virus in a single fly spot to infect a rabbit. Trapping of insects on study sites has provided data on seasonal changes in abundance of flies, mosquitoes and rabbit fleas.

Changes in weather are important in the spread of RCD. In arid areas there appears to be a distinctive pattern of spring and autumn spread, and a huge drop-off in the rate of spread of the disease during hot summer months.

Cooke is developing a bioclimatic model to explore the seasonal behaviour of RCD in Australia. This can be tested against the seasonal timing of disease outbreaks in other countries. The model predicts that in southern Australia outbreaks should occur mostly in spring and autumn, while in inland Australia, winter outbreaks would be more common. Some states and territories, including NSW, Victoria and the ACT, are planning new releases of RCD in autumn 1998.

Deliberate release of the virus involves the labour-intensive task of injecting rabbits individually. However, trials have shown that the virus can be spread by mixing it with bait such as carrot or oats and an application is being prepared for submission to the National Registration Authority for approval to use the virus in this way.

The RCD virus has given landholders in many areas their best chance to control rabbits. But even in places where the disease is working, farmers need to follow up with other control measures, such as ripping, to maximise the benefits.

The monitoring and surveillance program and the associated epidemiology program will help scientists predict when outbreaks are likely to occur naturally, or when the disease will spread best. This knowledge should allow RCD to be integrated with existing methods of rabbit control.

More about rabbits and RCD

Coman B (1997) Rabbit Control and Rabbit Calicivirus Disease – *A field handbook for land managers in Australia.* Meat Research Corporation, Sydney.

Robin Taylor

Vegetation losses from rabbit grazing threaten the survival of native birds, mammals, and insects that rely on plants for food and shelter. One example is the bilby, which disappeared from southern Australia within 10 years of rabbits arriving. The bilby is now endangered and is only found in isolated areas of central Australia where rabbits are absent.

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