



## RHDV2 in Australia and implications for current rabbit biocontrol initiatives

*Rabbit Biocontrol Scientific Committee*

Rabbit haemorrhagic disease virus (RHDV), previously known as rabbit calicivirus, has been used as a biocontrol for rabbits in Australia since 1996. Researchers have discovered several different strains or variants of RHDV, but not all have the same effect on wild rabbits in Australia.

The strain used for rabbit control in Australia since 1996 is RHDV1 from Czechoslovakia. Over time, rabbits have developed genetic resistance to RHDV1 and its effectiveness as a biocontrol agent has been reduced. The Invasive Animals CRC's RHD Boost project has been investigating whether other RHDV variants can overcome this resistance and be used to 'boost' rabbit biocontrol in Australia. One strain from Korea (RHDV K5) has been found to be a good candidate.

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In May 2015, RHDV2 virus was found in wild rabbits in the ACT, and has since been discovered across NSW, SA and VIC (see map, page 2). This new virus is referred to as RHDV2 because the mode of death is the same as RHDV1, however they are two separate viruses. In contrast to RHDV1, RHDV2 can cause death in young kittens (3-4 weeks) and vaccinated adults. The currently available vaccine is not fully protective against disease from RHDV2. While a new vaccine is being developed for RHDV2, a revised vaccination protocol using the current vaccine is now available on the AVA website and we recommend to contact your veterinarian for further advice.



*European rabbits. Image: Chris Cox*

The currently available vaccine is not fully protective against disease from RHDV2. While a new vaccine is being developed for RHDV2, a revised vaccination protocol using the current vaccine is now available. It is recommended that kittens be vaccinated at 4 weeks, with a booster given at 12 weeks, followed by yearly vaccinations. For breeding adults, a six monthly booster is recommended. Please contact your veterinarian for further advice. RHDV2 has been reported to infect certain sub-species of hares in Europe as well as rabbits. In June 2016 it was confirmed in a small number of European Brown Hares in Australia, the only hare species present here. It is currently unclear if these were rare spillover infections from rabbits to hares, or if RHDV2 actually spreads effectively between hares as it does between rabbits.

In December 2013 an RHDV1-type Chinese strain was also found in NSW and then later in the ACT, but this virus has not been widely reported since.

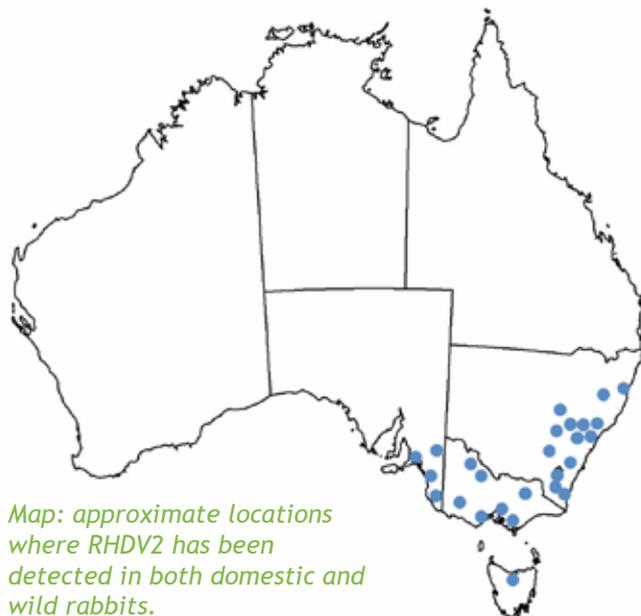
Studies in Europe suggest that RHDV2 has a strong competitive advantage over the earlier viruses. It appears to be replacing previous RHDV strains in parts of Europe, and recent reports suggest that rabbit numbers in Europe have been trending down since the arrival of RHDV2. Its potential to spread rapidly is likely aided by its ability to infect rabbits that are vaccinated or immune to field strains, and possibly the ability to infect younger rabbits. If the RHDV2 present in Australia is highly virulent, this could potentially benefit rabbit control in Australia, as it may overcome immunity to circulating field strains of RHDV1. Alternatively, if it completely replaces existing strains but has lower virulence leading to increased survival of rabbits during virus outbreaks, it could lessen the impact of current and future biocontrol initiatives using RHDV in Australia.

The ability to overcome immunity to field strains also means that this virus may also be able to overcome vaccination. However, preliminary studies from Europe show that the commercially available vaccine at least partially protects against RHDV2, and protection is increased if regular boost vaccinations are applied. Keeping domestic or pet rabbits' vaccinations up to date is therefore recommended to provide maximum possible protection against this new variant.

The effect of RHDV2 on biocontrol in Australia will largely depend on three properties of this virus, i) its virulence, ii) its ability to infect young rabbits and iii) its ability to overcome immunity to Australian field



*Researchers sampling rabbits in the field for disease testing. Image: Tanja Strive*



*Map: approximate locations where RHDV2 has been detected in both domestic and wild rabbits.*

*Source: Invasive Animals CRC*

strains. Estimating any of these effects of RHDV2 on Australian rabbits and current and planned biocontrol initiatives largely relies on a speedy and thorough characterisation of the RHDV2 variant isolated in Australia.

In addition, it remains critically important to continue and ramp up epidemiology and surveillance efforts, to determine the distribution of the new RHDV2 variant in Australia, its impact on wild rabbits and its interactions with viruses already established. For this purpose it is critical that specific serological diagnostic tools are developed to determine exposure of wild rabbit populations to the different viruses. The proposed release of the new RHDV K5 should be deferred until Autumn 2017 to first allow an evaluation of the distribution and potential impact of both RHDV2 and the RHDV1 Chinese strain, and to maximise the effectiveness of the release.

Finally, it is important to emphasise that biocontrol is only one tool available for land managers to manage rabbits. Control programs that complement biocontrol (usually baiting, warren ripping, and fumigation of missed or re-opened burrows in that order) are the best way to keep rabbit numbers very low. Should the spread of RHDV2 reduce the overall effectiveness of biological control, these methods will need to

be brought to the fore even more. The present uncertainty shows the need for a timely review of pest control agencies to ensure that they have the capacity to train and offer advice on effective rabbit control especially if there were to be a lessening of effectiveness of biological control.

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## Recommendations:

That:

1. The proposed release of the new RHDV K5 virus strain go ahead in Autumn 2017, complemented by conventional control (baiting, warren ripping and fumigation of missed or re-opened burrows).
2. Diagnostic technology, epidemiology and surveillance efforts are enhanced as quickly as possible to determine the distribution of RHDV2 and the Chinese RHDV1 variant in Australian wild rabbits and its interactions with established viruses. This should include additional abundance estimates in Spring 2016, models to help understand virus epidemiology, impact and strain competition at the local scale, development of an efficient fly-based sampling diagnostic system to enable more rapid determination of RHDV strains present, and development of vaccines and serological tests for multiple RHDV viruses including RHDV2.
3. The national sampling program that has commenced in the lead-up to the release of K5 incorporate the above recommendations.
4. A thorough biological characterisation of RHDV-2 under Australian conditions is carried out, including an assessment of its morbidity, mortality, in adult and young rabbits, and the ability to overcome natural and maternal immunity and vaccination.



Trapping rabbits for field samples. Image: Tanja Strive

## References:

- Dalton KP, Nicieza I, Balseiro A, Muguerza MA, *et al* (2012). Variant rabbit hemorrhagic disease virus in young rabbits, Spain. *Emerg Infect Dis*, 18:2009-2012.
- Le Gall-Recule G, Lavazza A, Marchandeu S, *et al* (2013). Emergence of a new lagovirus related to rabbit haemorrhagic disease virus. *Veterinary research*, 44:1-13.
- Lopes AM, Dalton KP, Magalhaes MJ, Parra F, *et al* (2015). Full genomic analysis of new variant rabbit hemorrhagic disease virus revealed multiple recombination events. *Journal of General Virology*, 96:1309-1319.
- Lopes AM, Correia J, Abrantes J, Melo P, Ramada M, *et al* (2015). Is the New Variant RHDV Replacing Genogroup 1 in Portuguese Wild Rabbit Populations? *Viruses-Basel*, 7:27-36.
- Almeida T, Lopes AM, Magalhães MJ, Neves F, *et al* (2015). Tracking the evolution of the G1/RHDVb recombinant strains introduced from the Iberian Peninsula to the Azores islands, Portugal. *Infection, Genetics and Evolution*, 34:307-313.
- Delibes-Mateos M, Ferreira C, Carro F, Escudero MA, Gortazar C (2014). Ecosystem Effects of Variant Rabbit Hemorrhagic Disease Virus, Iberian Peninsula. *Emerg Infect Dis*, 20:2166-2168.
- Mutze GJ, Sinclair RG, Peacock DE, Capucci L, Kovaliski J (2014). Is increased juvenile infection the key to recovery of wild rabbit populations from the impact of rabbit haemorrhagic disease? *Eur J Wildl Res*, 60: 489-499.
- Camarda A, Cavadini P, Circella E, Capucci L, *et al* (2014). Detection of the new emerging rabbit haemorrhagic disease type 2 virus (RHDV2) in Sicily from rabbit (*Oryctolagus cuniculus*) and Italian hare (*Lepus corsicanus*). *Research in Veterinary Science*, 97:642-645.
- Puggioni G, Cavadini P, Maestrale C, Scivoli R, *et al* (2013). The new French 2010 Rabbit Hemorrhagic Disease Virus causes an RHD-like disease in the Sardinian Cape hare (*Lepus capensis mediterraneus*). *Veterinary research*, 44:1-
- Dalton, KP, Nicieza I, Abrantes J, Esteves PJ, and Parra F (2014). Spread of new variant RHDV in domestic rabbits on the Iberian Peninsula. *Veterinary microbiology*, 169: 67-73.
- Schirrmeier H (2015). Zum Auftreten von RHDV-2 in Deutschland - aktuelle Herausforderungen in der Diagnostik und Bekämpfung. *Der LabLoeffler News* 2015; 1:10, p4-7

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