RHDV2 OUTBREAK
IN SOUTHWESTERN U.S. 2020

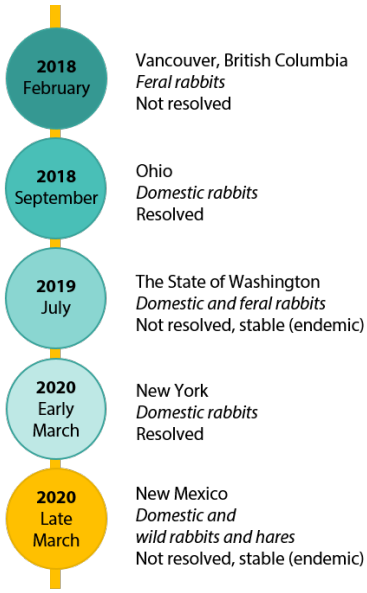
Introduction

Rabbit hemorrhagic disease virus 2 (RHDV2) is a foreign, transboundary and emerging disease in the United States (U.S.). The first detection of the RHDV2 in the U.S. was an isolated, small outbreak in domestic rabbits in Ohio in 2018. This was quickly controlled and eliminated. In 2019, RHDV2 was confirmed in domestic and feral rabbits in the state of Washington. Elimination was not possible due to feral rabbit infections, and RHDV2 is now considered endemic in parts of Washington. In early March 2020, RHDV2 was confirmed in New York at a veterinary clinic that had taken in a rescue rabbit. This outbreak was confined and eliminated. The RHDV2 virus, in each of these outbreaks, was similar to the RHDV2 virus detected in Canada in 2018. Investigations have not detected any linkages between these outbreaks.

In late March and early April of 2020, an outbreak of RHDV2 in New Mexico was confirmed in domestic rabbits and wild rabbits and hares. This was the first isolation of RHDV2 in wild lagomorphs in the U.S., and the virus isolated in this outbreak was different than the isolates from the outbreaks in the northern states and Canada. (For a brief overview of lagomorph types, see the information box on page 5.)

Below is a description of the outbreak that began in New Mexico and spread to six other states. This outbreak is a reminder that when a foreign animal disease enters wildlife, control is nearly impossible, but the impact can be managed and minimized with an effective and coordinated response by regulatory agencies and key stakeholders.

INCURSION DATES FOR RHDV2 IN NORTH AMERICA



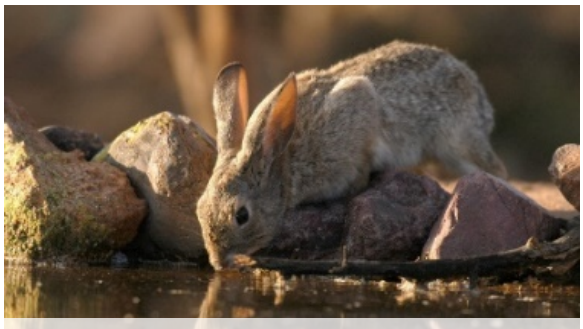
ABOUT **RABBIT HEMORRHAGIC DISEASE**

Rabbit hemorrhagic disease is caused by a calicivirus, and it is an OIE-listed disease, and a foreign animal disease in the U.S. This is a highly contagious and fatal disease of rabbits. There are two different serotypes of rabbit hemorrhagic disease virus (RHDV), RHDV1 and RHDV2. RHDV1, classical RHD, was first recognized in Europe during the 1970s and 1980s, and is highly fatal to rabbits of European lineage (*Oryctolagus cuniculus*). Wild lagomorphs (*Sylvilagus spp.* and *Lepus spp.*) are resistant to RHDV1. RHDV2 was first recognized in Europe in 2010. This serotype is also highly fatal to rabbits; however, it presents a more significant control challenge due to a host range that includes both rabbits of European lineage and wild lagomorphs. (See *Lagomorph Overview* for information about the different types.)

RHDV can cause fever, lethargy, hemorrhage, seizures, and acute death in rabbits. The incubation period for this virus is relatively short, e.g. 1-3 days. The predominant mode of transmission is ingestion, but also nasal and conjunctival routes are possible. The virus is present in all secretions and excretions from infected rabbits. It is very hardy and survives in infected meat and the environment for days, weeks, or longer depending on the conditions. Due to its survivability, fomite transmission is a major contributor to the spread of this virus. For example, RHDV is readily spread on contaminated food, equipment, and boots. Insects can serve as mechanical vectors, and birds and mammals that prey on infected lagomorphs are able to spread the virus; they can even excrete infectious viruses in their feces after eating infected rabbits. Following an outbreak, detailed cleaning and disinfection are necessary to eliminate the virus from the environment. Prevention strategies include strict biosecurity and vaccination. There is no licensed vaccine in the U.S., but vaccine may be imported for use in emergency situations. For more information go to the Center for Epidemiology and Animal Health, Rabbit Hemorrhagic Disease.

How it Began and Spread

In mid-March 2020, the New Mexico Department of Game and Fish (NMDGF) responded to reports of wild lagomorph die-offs. Tularemia was initially suspected, since it is not uncommon for it to cause deaths in wildlife. Samples from a group of dead jackrabbits were submitted for testing and were negative for tularemia. Meanwhile, the State Veterinarian (SAHO) at the New Mexico Livestock Board began receiving calls about unexplained deaths in domestic rabbits. Samples were submitted to the National Foreign Animal Disease Diagnostic Laboratory (FADDL) on Plum Island, NY, for testing.



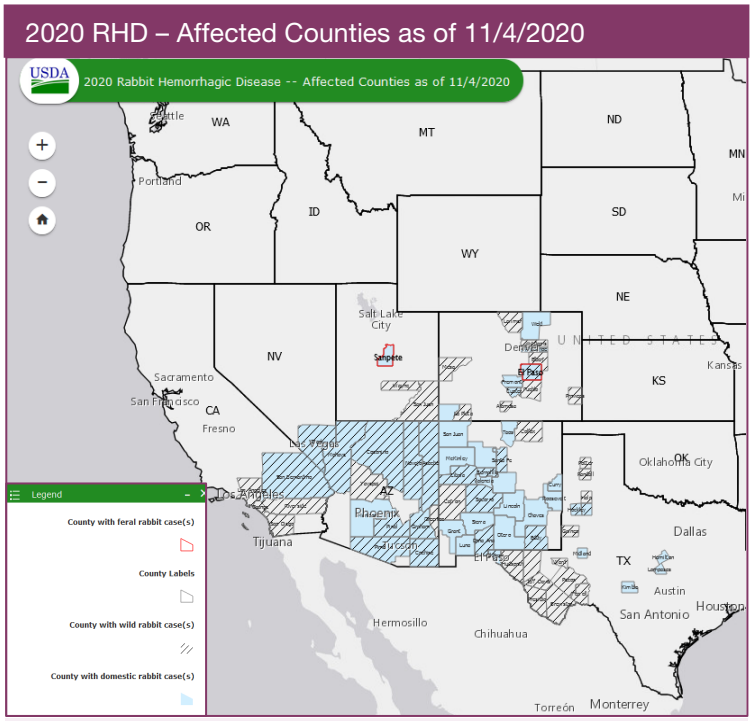
A desert cottontail. Photo credit: George Andrejko, Arizona Game and Fish Department

On March 24, RHDV2 was confirmed in samples from the domestic rabbits. Soon after, RHDV2 was confirmed in samples from jackrabbits (genus: *Lepus*) and cottontails (genus: *Sylvilagus*) found dead in New Mexico. This was the first time RHDV was diagnosed in wildlife in the U.S. The OIE was immediately notified. The disease spread quickly in both the wildlife and domestic rabbit populations. In some cases, it was suspected that owners of domestic rabbits might have been out hiking and stepped in contaminated wildlife feces and carried the virus home to their domestic rabbits. The fatality rates with this outbreak were remarkable and rapid. For example, an owner reported one dead rabbit, and by the time the Foreign Animal Disease Diagnostician (FADD) arrived, eight rabbits were dead. At another location, the owner lost at least 400 rabbits in a very short period of time.

"I was surprised to find out how many small rabbitries we have in New Mexico. The largest herd we've dealt with was actually a hobby herd (none of these folks were commercial) but they had 400 head. They did raise quite a few of them for meat, and also had some show rabbits, and some pets. It was kind of a hobby that got away from them, as rabbits will do. The numbers were up there. The second-largest herd that we dealt with was the guy that lost 200 head over a weekend." *Dr. Ralph Zimmerman, SAHO of New Mexico*

In early April, Arizona reported infections in domestic rabbits and wildlife. Deaths were significant, at one location approximately 1000 rabbits died. It is estimated that in some areas of Arizona and New Mexico, the virus killed 50% of the cottontails and jackrabbits. Spread continued to other states during April and May, with outbreaks in Texas, Colorado, Utah, Nevada, and California (see map).

On July 2, 2020, the USDA APHIS notified the World Organization for Animal Health (OIE) that due to the spread of the disease in wildlife, RHDV2 was not going to be eradicated, but the situation was stable (endemic) in the eight affected states. With that declaration, the USDA APHIS's reporting requirements to the OIE changed from weekly to every six-months for the affected states. In addition, the USDA APHIS approved expansion of laboratories allowed to test for RHDV2. Laboratories in NM, CA, UT, and CO were used by their SAHOs to test samples from both domestic and wild rabbits. Two wildlife laboratories, the National Wildlife Health Center (NWHC) and the Southeastern Cooperative Wildlife Disease Study (SECWDS), were approved to test wild rabbits from any state.



Map from the U.S. Department of Agriculture at https://www.aphis.usda.gov/aphis/maps/animal-health/rhd.

Identification of RHDV2 in any new species or any states outside of the stable (endemic) states still requires immediate OIE notification.

The Initial Response in New Mexico

When the disease first appeared in New Mexico, FADDs were sent to investigate and to depopulate the colony. In some cases, by the time the FADD arrived, the virus had killed all of the rabbits, so there were no rabbits left to depopulate. Depopulation was followed by cleaning and disinfection, and then a 90-day waiting period before repopulating. This waiting period is sometimes referred to as a fallow period. As more and more calls about death in rabbits, both domestic and wild, came in, it became clear the response needed to expand. The SAHO's office coordinated the response with the NMDGF; the SAHO's office focused on domestic rabbits, and the NMDGF focused on wildlife. USDA APHIS and the state of Washington provided guidance and shared information based on their experience with the disease in domestic and feral rabbits. The response expanded and coordination continued as the disease spread to neighboring states.

A Few Response Challenges: The Regulatory Authority for Rabbits and COVID 19

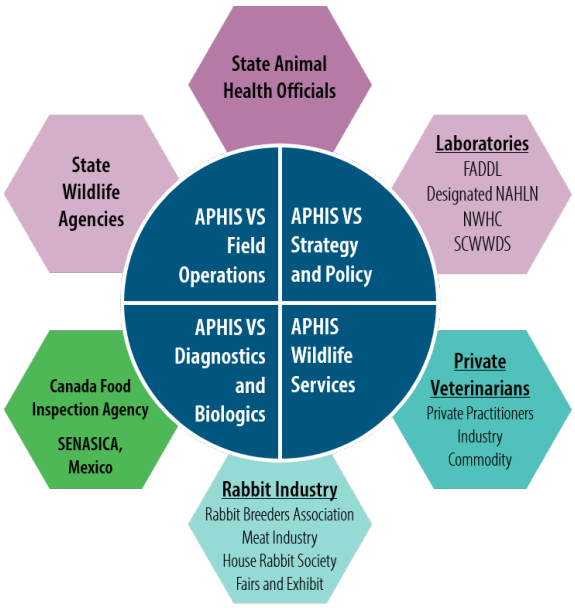
One of the unique challenges of this response was the regulatory authority for rabbits. While RHDV2 is a foreign animal disease, and USDA APHIS must report it to the OIE, the USDA APHIS does not have regulatory authority over rabbits, and therefore, could not order depopulations, quarantines, and movement controls like it would do in an outbreak of a FAD in a livestock species. In some states, the state has that authority; however, the responsible agency within each state varies. In other states, rabbits are not regulated. It became clear early on that a new type of emergency response system was going to be needed. A Coordinating Cell was established to bring all stakeholders together to help respond to this outbreak. This was the first time a Coordinating Cell had been used to manage a response.

The Coordinating Cell was the three units of USDA APHIS Veterinary Services, i.e., Field Operations, Strategy and Policy, and Diagnostics and Biologics, and the APHIS Wildlife Services. The Coordinating Cell's job was to coordinate all the other stakeholders, e.g., State Animal Health Officials, State Wildlife agencies, testing laboratories, various rabbit enthusiast groups, and more (see graphic). The Coordinating Cell established three main strategy areas for the response: Domestic Rabbit Activities, Wild Rabbit Activities, and Disease Awareness and Prevention.

Another challenge to this outbreak was the timing. This outbreak occurred almost precisely at the same time the nation was closing down due to the COVID-19 pandemic. USDA APHIS and State Officials were limited in their ability to travel and conduct field investigations. However, a benefit was that rabbit shows and fairs were canceled, and that undoubtedly helped prevent RHDV2 from spreading to pet rabbit populations in additional states.

Despite the challenges, cooperation between the various federal and state agencies and the industry has resulted in an effective response that will serve as a model for other outbreaks that affect both domestic animals and wildlife.

Coordinating Cell and Stakeholders in the Response



Communication and Education

A Rabbit Hemorrhagic Disease Working Group was formed by the The National Assembly of SAHOs. This working group collected information from a variety of sources, including the state of Washington, the American Veterinary Medical Association, the Center for Veterinary Biologics (CVB), and the state wildlife agencies. They created practical guidelines for biosecurity, carcass disposal, shows and exhibits, importation of the vaccine, and frequently asked questions. These documents were developed to establish continuity between the affected states' responses and to help unaffected states prevent and prepare for the virus. The documents were customizable so that SAHOs from each state could adapt them to the rules and regulations for rabbits in their state. At the federal level, the Center for Epidemiology and Animal Health posted informational materials about RHDV2, including information about how to prevent and respond to the disease.

A number of rabbit organizations were important in the response to this outbreak. These groups worked with the authorities to provide important information about domestic rabbits in the U.S. and also to alert and educate rabbit owners about the virus.

Veterinary associations and veterinary listserves were used to notify veterinarians of the outbreak and provide important prevention and response guidelines.

Vaccination

There are no licensed vaccines for this disease in the U.S. However, there are two killed vaccines licensed in the European Union. The USDA APHIS Center for Veterinary Biologics is allowing for the importation of these vaccines for emergency use in affected States under the direction of the SAHO. A special permit is required to import the vaccine. Only licensed veterinarians with permission from the SAHO may administer the vaccines. The veterinarian administering the vaccine is required to maintain accurate vaccination and identification records for each rabbit vaccinated. The vaccine is very expensive and is mainly used to protect valuable breeding stock and specialty rabbits.

Filavac vaccine. Photo credit: Ralph Zimmerman, New Mexico State Veterinarian

Impact

It is unclear exactly how many pet rabbits there are in the U.S. Estimates range from 2 million pet rabbits from the AVMA to up to 7 million based on information gathered by the Rabbit House Society. Other information on rabbit numbers includes the 2017 U.S. Census of Agriculture that reports approximately 4000 farms sold almost 500,000 rabbits. The domestic rabbit industry is valued by the USDA at more than $2 billion, mostly in pet supplies and care. Even though the exact numbers are not known, a variety of industries are impacted by this disease, including the rabbit meat industry, Angora wool, the biologics industry, rabbit breeders, and show and exhibit rabbits.

<table>
<tr><th colspan="4">Leporidae Family (Lagomorphs) Overview</th></tr>
<tr><td colspan="2">Oryctolagus spp. (European-lineage)</td><td>Sylvilagus spp.</td><td>Lepus spp.</td></tr>
<tr><td>Feral Rabbits</td><td>Domestic Rabbits</td><td>Cottontails</td><td>Hares</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Domestic rabbits released into the wild</td><td>Domestic rabbits have many roles in the U.S.:
- Pets
- Exhibit and Show (49 breeds)
- Meat
- Biologics
- Fur and Fiber
- Lab and Research</td><td colspan="2" rowspan="2">Important wildlife in the ecosystem, both by consuming and controlling various vegetation types and serving as food for predators.
There are around 10 different species of cottontails and six different species of hares in the U.S.
Gestation
○ Cottontails - ~ 30 days
○ Hares - 40-50 days
Weight
○ Cottontails - ~ 2 pounds
○ Hares – range 5-9 pounds
Other wild lagomorphs include pikas (Ochotona spp.) and pygmy rabbits (Brachylagus idahoensis)</td></tr>
<tr><td colspan="2">Do not interbreed with Sylvilagus spp.
Gestation ~ 30 days
Large variety of colors and sizes.
Weights ranging from 2-16 pounds</td></tr>
</table>

As mentioned previously, on the wildlife side, there are estimates in some areas that 50% of the wild rabbits and hares died. This type of loss is a threat to the wild ecosystems; there is concern for those threatened and endangered species that depend on lagomorphs for survival. Also, other predators of rabbits and hares, such as coyotes, bobcats, and mountain lions, may prey on more vulnerable species and endanger them and or these predators may enter more populated areas looking for food.

Conclusion

As of November 2020, this outbreak is continuing, although stable. To prevent further spread, animal health officials ask all stakeholders, e.g., veterinarians, owners, wildlife enthusiasts, and wildlife officials, to practice good biosecurity and immediately report any suspicious cases in domestic rabbits or wildlife. Everyone should also remember that while rabbit hemorrhagic disease is not zoonotic, other fatal diseases of rabbits are, e.g., tularemia and plague. Therefore, it is best to call a wildlife service to handle dead lagomorphs.

It is still unknown how and where these viruses entered the U.S., and investigations will continue to try and find the answers and determine how these different outbreaks are connected. The Northern States of Mexico are experiencing an outbreak of RHDV2, and authorities in the U.S. and Mexico are working together to analyze the viruses and determine if they are related.

Fortunately, lagomorphs reproduce rather quickly and there are signs in some areas that some of the populations are recovering. However, the virus must be controlled for all populations to rebuild and continue to play an important role in our world, from pets to prey.

Acknowledgement

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