Ranavirus infection

Any freshwater wetland supporting susceptible animals

Wildlife ✓
Livestock ✓
Human ✖

Synonyms: Ranaviral disease, ranavirosis

KEY FACTS

What is ranavirus?

Ranavirus is a genus of iridoviruses that can infect amphibians, reptiles, and/or fish. Ranaviruses can lead to high levels of mortality in certain species and subclinical carrier status in others. Signs include swelling of the limbs or body, reddening and ulceration of the skin, and internal haemorrhage. Death in susceptible amphibians can occur within a few days following infection or may take several weeks. Amphibian species differ in their susceptibility to ranaviruses. The occurrence of recent widespread amphibian population die-offs from ranaviruses may be an interaction of suppressed or naïve host immunity, anthropogenic stressors, habitat degradation and the introduction of novel virus strains.

Causal agent

Ranaviruses. There are several different types of ranaviruses, some of which may be more host specific than others.

Species affected

Amphibians of the orders Anura and Caudata: salamanders (*e.g. Ambystoma spp*.), toads (*e.g. Bufo spp*.), frogs (*e.g. Limnodynastes spp*., *Rana spp.*) and others. Ranaviruses also infect fish and reptiles, and some ranavirus isolates may be able to infect animals from more than one class.

Susceptible age groups: larvae and metamorphs are most commonly affected in North America. Adult morbidity and mortality is reported more commonly in Europe. The effect on eggs remains unknown.

Geographic distribution

The disease has been reported in North and South America, Asia, the Pacific and Europe.

Environment

Any freshwater environment inhabited by amphibians, fish or reptiles.

TRANSMISSION AND SPREAD

Vector(s)

Infected animals, especially those exhibiting carrier status. Mechanical transport on the feet of livestock or fomites (inanimate objects).

How is the disease transmitted to animals?

Horizontal transmission: direct contact, cannibalism, through the water. Vertical transmission (parent to offspring): suspected but remains unknown. Clinical carrier status with ranaviruses can occur. Movement of ranaviruses into an area will most probably happen by movement of infected amphibians, fish or reptiles or *via* equipment and other inanimate objects that have been contaminated with ranaviruses. Generally, ranaviruses have low host specificity (*i.e.* they can infect a wide range of species). The viruses are highly infectious and capable of surviving for extended periods of time in the environment, even in dried material.

How does the disease spread between groups of animals?	Environmental persistence of ranavirus virions outside a host may be several weeks or longer in aquatic systems. Transmission occurs by indirect and direct routes, and includes exposure to contaminated water or soil, contact with infected individuals, and ingestion of infected tissue during predation, cannibalism or necrophagy (consumption of carcases/carrion).
How is the disease transmitted to humans?	Ranaviruses are not zoonotic.

IDENTIFICATION AND RESPONSE

Field signs

Field signs can vary from numerous dead amphibians visible in, and surrounding, water bodies to no dead amphibians visible (especially in areas where they are swiftly scavenged). Diseased larval amphibians often have swollen bodies and signs of internal and cutaneous haemorrhage. Affected adult amphibians may have reddening of the skin, skin ulceration, bloody mucus in the mouth and might pass blood from the rectum; often there is systemic internal haemorrhaging (which also may be seen in affected fish and reptiles). Anorexia, lethargy and/or ataxia might also be evident. These signs are all typical of the disease syndrome 'red leg': ranaviruses are not the only possible cause of 'red leg' in amphibians and other differential diagnoses should be borne in mind.

Chronically infected, inapparent carriers have been described. Seasonal variations in disease outbreaks have been reported, with both their prevalence and severity being greater during the warmer months, therefore temperature is considered a likely factor influencing disease outbreaks.

Recommended action if suspected

The disease is notifiable in amphibians (as are certain fish ranaviruses) and suspected cases must be reported immediately to local and national authorities and the OIE. Dead animals should be submitted to a suitable diagnostic laboratory for *post mortem* examination. Surveillance of live animals should be carried out if possible and sick animals submitted for testing.

Diagnosis

Liver and/or kidney samples from dead animals should be sent to an appropriate laboratory for diagnostic testing. Toe or tail clips from live animals might also be used for diagnosis, but the reliability of these has not been validated.

Tests carried out on samples include: PCR, real-time PCR, electron microscopy, virus isolation (followed by immunofluorescence, PCR or electron microscopy) and histology (followed by immunohistochemistry or electron microscopy).

Before collecting or sending any samples from animals with a suspected disease, the proper authorities should be contacted. Samples should only be sent under secure conditions and to authorised laboratories to prevent the spread of the disease. Although ranaviruses are not known to be zoonotic, routine hygiene precautions are recommended when handling animals. Also, suitable precautions must be taken to avoid cross contamination of samples or cross-infection of animals.

PREVENTION AND CONTROL IN WETLANDS

Environment

Ensure that the site is regularly scanned for dead amphibians, fish and reptiles. Ideally any site containing a reasonable population of amphibians should be monitored for sick and dead animals as a matter of course. If sick or dead animals are found, they should be tested for ranavirus infection so that the site's ranavirus status can be determined.

People coming into contact with water, amphibians, reptiles or fish should ensure where possible that their equipment and footwear/clothing has been cleaned and fully dried before use if it has previously been used at another site.

To properly clean footwear and equipment:

- first use a brush to clean off organic material *e.g.* mud and grass
- rinse with clean water
- soak in disinfectant
- rinse with clean water and allow to dry.

If any clothing is particularly soiled during activities, then washing at 40^{o}C with detergent should be sufficient to remove any contamination with ranavirus. Ideally, different sets of footwear should be used at the site than are used by staff at home.

Biosecurity measures should be increased to reduce the chance of spread if disease is confirmed.

Livestock

It is important to reduce the chance that livestock moving between sites (especially those travelling from known infected sites) will carry infected material on their feet or coats. This can be accomplished by ensuring that feet are clean before transport. Foot baths can be used and animals should be left in a dry area after the bath for their feet to fully dry before transport.

Wildlife

Do not allow the introduction of amphibians, reptiles or fish without thorough screening and quarantine for ranavirus. This screening may still not pick up all subclinically infected individuals but will reduce the risk of actively infected animals being introduced to the site. Also, remember that the virus can be introduced with water or aquatic plants.

Humans

Humans must ensure that all biosecurity measures described above are followed to prevent introduction of the infectious agent into previously uninfected areas.

IMPORTANCE

Effect on wildlife

May cause epidemics with very high mortality rates, dependant on virus and host species. The disease has been shown to cause significant population declines of common frog *Rana temporaria* in the United Kingdom, apparently following virus introduction from North America. Ranavirus infection might be implicated in declines elsewhere, but data are lacking.

Effect on livestock

None other than farmed amphibians and fish. ► Economic importance

Effect on humans

None

Economic importance

Fish ranaviral diseases can cause major economic losses of high value species, such as rainbow trout *Oncorhynchus mykiss*. Ranaviruses also are considered to

be of some economic importance due to disease and mortalities in farmed American bullfrogs *Lithobates catesbeianus* and harvested edible frogs *Rana esculenta.* There are potential economic losses due to potential risk of disease spread to fish.

FURTHER INFORMATION

Useful publications and websites

- World Organisation for Animal Health (OIE). **Disease card: infection with ranavirus**. http://www.oie.int/fileadmin/Home/eng/Internationa_Standard_Setting/docs/pdf/Ranavirus_card_final.pdf [Accessed March 2012].
- European Association of Zoo and Wildlife Veterinarians (EAZWV). **Transmissible disease fact sheet: ranavirus infection in amphibians**. www.eaza.net/activities/tdfactsheets/050%20Ranavirus%20Infection%20In%20Amphibians.doc.pdf [Accessed March 2012].
- Robert, J. (2010). **Emerging ranaviral infectious diseases and amphibian decline**. *Diversity*, 2,3, 314–330. http://www.mdpi.com/1424-2818/2/3/314/ [Accessed March 2012].
- Speare, R. (2003). **Summary of formidable infectious diseases of amphibians**. www.jcu.edu.au/school/phtm/PHTM/frogs/formidable.htm [Accessed March 2012].
- World Organisation for Animal Health (OIE). **Diagnostic manual for aquatic animal diseases**. http://www.oie.int/doc/ged/D9568.PDF [Accessed March 2012].

Contacts

- OIE reference laboratories and collaborating centres for diseases of amphibians, crustaceans, fish and molluscs: http://www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/3_LIST_OF_LABS.pdf.