

EXOTIC

Severe Perkinsea infection of tadpoles

Fact sheet

Introductory statement

Severe Perkinsea infection (SPI) is an emerging infectious disease of tadpoles in North America. It has been associated with multiple reports of mass mortalities of tadpoles across many states of the USA, including Alaska. Evidence suggests it is the third most common infectious disease of amphibians in USA (Isidoro-Ayza et al. 2017). There is **no evidence** that SPI is present in Australia, however ongoing research, surveillance and appropriate biosecurity protocols are recommended, to minimise any potential risk to Australian amphibians.

Aetiology

Severe Perkinsea infection is associated with the pathogenic Perkinsea clade (PPC) of frogs, a lineage of protozoa belonging to the phylum Perkinsozoa. PPC falls within the tentatively named Novel Alveolate Group 1 (NG01) of Perkinsea. It appears that this distinct group of Perkinsea is responsible for disease outbreaks and mass mortalities in tadpoles in the USA (Isidoro-Ayza et al. 2017; Isidoro-Ayza et al. 2018).

Natural hosts

The natural hosts and host range of PPC are unknown. SPI has impacted numerous species of frogs within the family Hylidae and Ranidae, including some endangered species. Hylidae and Ranidae both have world-wide distribution and Australia has 78 species of Hylidae (this includes tree frogs), and only one species of Ranidae, the Australian wood frog (*Rana daemeli*).

Other *Perkinsus* spp. are known to cause mass mortalities in molluscs (Isidoro-Ayza et al. 2018).

World distribution

Severe Perkinsea infection (SPI) has only been detected in the USA, across the east coast, west coast, Gulf of Mexico and mid-west. The geographic range of SPI appears to be spreading (Isidoro-Ayza et al. 2017; Isidoro-Ayza et al. 2019).

Non-pathogenic clades of NAG01 are widespread across multiple continents (North America, South America, Africa and Europe). PPC has not been detected outside the USA.

Epidemiology

The epidemiology of SPI is largely unknown, and it is not yet known how or where the virulent strain of PPC emerged.

The organism has a direct life cycle. The method of infection is unknown but is hypothesised to be via the gastrointestinal tract, mouth, gills or skin (Isidoro-Ayza et al. 2018) and it has been suggested that the organism may persist in the environment, paratenic hosts or in small numbers of tadpole hosts in a given year. PPC can survive at a low threshold host population density; spores are highly persistent in harsh environmental conditions and remain viable during desiccation of wetlands (Isidoro-Ayza et al. 2017).

PPC appears to be a primary pathogen but it may also be associated with, or even synergistic with, other pathogens such as ranaviruses (Isidoro-Ayza et al. 2017). Its impact at a population level is unquantified, but it is assumed that it could cause population level effects.

There is rapid onset of morbidity and mortality. In many cases, hundreds to thousands of tadpoles are involved and reported mortality rates have been as high as 95%. Events are more common in northern summer months in temperate areas, and in winter and spring in subtropical areas; these coincide with tadpole season. Local recurrence of outbreaks is common. The range of habitats stretches from boreal to subtropical. Subclinical infections appear uncommon.

Disease and infection is not seen in adult frogs. Only tadpoles (not adult frogs) are affected during mass mortality events, and there are no reports of other sympatric amphibian species being affected. It is not known if all affected tadpoles die or if there are factors which result in adult frogs being resistant to infection (Isidoro-Ayza et al. 2017).

Clinical signs and pathology

A case definition has been developed by Isidoro-Ayza et al. (2018)

<http://journals.sagepub.com/doi/10.1177/0300985818798132#articleCitationDownloadContainer>. Sick tadpoles are lethargic, often swimming abnormally, but in good body condition. They may have distended abdomens, sub-cutaneous oedema and skin abnormalities. Sudden mass mortalities of immature frogs with no clinical signs have also been observed.

Disease is severe and systemic with a range of pathological changes seen, including ascites, enlargement of liver, kidney, spleen, changes to intestine and skin. There is necrosis of affected organs and replacement of existing intracellular and extracellular tissues with many Perkinsa organisms. Death is a result of multiple organ failure and may result from vascular damage to the organs by the protozoa. Differing life stages of the protozoa may be visible histologically (Isidoro-Ayza et al. 2018).

Diagnosis and differential diagnoses

Diagnosis is by histopathology and molecular detection (PCR) of PPC, generally from the liver (Karwacki et al. 2018).

Other causes of mass mortality and debility in tadpoles should be considered, including chytridiomycosis, rana virus, bacteraemia.

Treatment, prevention and control

There is no reported treatment. Little is known about methods for prevention and control however, increased awareness, surveillance and strict biosecurity practices are indicated, given the persistence of the organism outside the host. In endangered species, management processes have been undertaken to counter effects of the pathogen (Isidoro-Ayza et al. 2017).

Surveillance and management

Wildlife disease surveillance in Australia is coordinated by Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public. Coordinators in each of Australia's States and Territories report monthly on significant wildlife cases identified in their jurisdictions. NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. Please contact admin@wildlifehealthaustralia.com.au.

Research

Research is required to better understand this emerging disease, including studies on controlled infection, treatment trials, surveillance and ecological investigations.

Human health implications

None known.

Conclusions

Severe *Perkinsea* infection of tadpoles is a virulent, emerging infectious disease in the USA. It has the potential to impact frog populations, including those of threatened species. It may act synergistically with other frog pathogens such as chytrid fungus and ranavirus. Much remains to be learnt of the epidemiology and emergence of SPI and PPC. Australia should take suitable precautions and promote awareness, to protect our native frogs from this potential threat.

Acknowledgements

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References

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To provide feedback on this fact sheet

We are interested in hearing from anyone with information on this condition in Australia, including laboratory reports, historical datasets or survey results that could be added to the National Wildlife Health Information System. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

Wildlife Health Australia would be very grateful for any feedback on this fact sheet. Please provide detailed comments or suggestions to admin@wildlifehealthaustralia.com.au. We would also like to hear from you if you have a particular area of expertise and would like to produce a fact sheet (or sheets) for the network (or update current sheets). A small amount of funding is available to facilitate this.

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