Trypanosomes in Australian wildlife

Fact sheet

August 2023

Key points

- Trypanosomes are protozoal parasites that infect a wide variety of animal species across the world.
- A range of trypanosome species (mostly endemic) have been found in Australian wildlife.
- Endemic Australian trypanosomes are generally considered non-pathogenic; however they may be associated with disease in Australian wildlife under some circumstances.
- The vectors for Australian trypanosomes are currently unknown.

Introductory statement

Trypanosomes infect a wide range of vertebrates globally, causing varying severity of disease (trypanosomiasis). Exotic trypanosomes such as *Trypanosoma vivax* (nagana) and *T. evansi* (surra) have devastating effects on domestic livestock in Africa, Asia and tropical America. Exotic pathogenic trypanosome species, including *T. cruzi* (Chagas disease), *T. evansi* and *T. equiperdum* are nationally notifiable in Australia [1]. Surra is the subject of another WHA fact sheet ("Exotic - Surra and Australian Wildlife Fact Sheet").

Aetiology

Trypanosomes are flagellate haemoprotozoans in the genus *Trypanosoma*; family *Trypanosomatidae.*

One Health implications

Wildlife and the environment: trypanosomes found in Australian wildlife are generally considered non-pathogenic.

Domestic animals: trypanosomes found in Australian wildlife are not known to occur in domestic animals and are considered unlikely to cause disease in these species.

Humans: trypanosomes found in Australian wildlife are not known to be zoonotic.

Natural hosts

Trypanosoma species are known to infect a wide variety of vertebrate hosts including mammals, birds, amphibians, fish and reptiles.

World distribution

Trypanosomes occur throughout the world with different species having varied geographic distributions.

Occurrences in Australia

Trypanosomes are widespread in wildlife throughout Australia. Trypanosome species have been identified in a wide range of Australian vertebrate wildlife including birds, amphibians, reptiles, fish [2] and 37 mammalian species including marsupials, monotremes, bats and native rodents [3]. Cases of trypanosome detection in macropods, dasyurids, potoroids, monotremes, flying-foxes, microbats and koala (*Phascolarctos cinereus*) have been reported to the National Wildlife Health Information System.

Trypanosome species reported in Australian mammals include *T. thylacis*, *T. dionisii, T. lewisi, T. pteropi*, *T. hipposideri*, *T. binneyi*, *T. teixeirae, T. irwini*, *T. gilletti*, *T. copemani*, *T. vegrandis*, *T. noyesi T. cyclops* and other novel species still under characterisation [4-8]. Australian mammals with trypanosomes have been found in every state and territory except for ACT (however that may be due to sampling bias) [8-11].

Epidemiology

Trypanosomes have an indirect life cycle with an invertebrate vector. The vectors for Australian trypanosomes are currently unknown. Possible vectors include tabanid flies, biting midges [7], leeches [12] and ticks [13, 14].

Trypanosome species that infect Australian wildlife are genetically diverse, have been detected in a wide range of species and can occur in mixed infections [2]. The species of trypanosome infecting Australian wildlife appear to be mostly endemic (exist only in Australia), and their ability to cause disease is not well understood.

While generally considered non-pathogenic, some Australian trypanosomes may be capable of detrimental effects in the host in the presence of a naïve host, stress, co-infections, or poor body condition [15]. It is hypothesized that trypanosomes' ability to invade and damage hosts tissues could potentially cause tissue inflammation and an overall reduced fitness, resulting in skin disease and poor body condition. Additionally, it is thought the parasites may cause antibody-mediated or physical erythrocyte destruction within the host [16].

Trypanosoma lewisi have been implicated in the extinction of Christmas Island rodents *(Rattus macleari* and *R. nativitatis*). After finding evidence of *T. lewisi* infection in museum specimens of native rats, it is theorized that introduced black rats (*R. rattus*) brought *T. lewisi* to Christmas Island, causing the native rats to become ill when infected with the protozoa [16, 17]. Similarly, there is some evidence that *T. copemani* may play a role in the population declines of the woylie, including differences in the protozoa's prevalence between host populations and the isolation of the parasite from diseased woylie tissues [15, 18]. It has also been speculated that trypanosomes can cause disease in the quokka (*Setonix brachyurus*) [19], little red-flying fox (*Pteropus scapulatus*) [20] and koala [21]. However, the parasite's potential to cause disease in Australian wildlife remains unclear.

The prevalence of trypanosome infection can vary greatly across different Australian host species and populations [22]. Mixed infections with multiple trypanosome species are relatively common in Australian species [23, 24].

Australia may be at risk of the introduction of pathogenic species of trypanosomes that have the potential to cause significant disease in Australian native wildlife and livestock [25]. Experimental infection of agile wallabies (*Macropus agilis*) with *T. evansi* (an exotic trypanosome) [26] and the common brushtail possum (*Trichosurus vulpecula*) and short-beaked echidna (*Tachyglossus aculeatus*) with *T. cruzi* (an exotic trypanosome) [27] has shown they are susceptible to severe infection and have the potential to spread these parasites to other species.

Clinical signs

Most infections with trypanosomes in Australian wildlife are not associated with disease. Any clinical signs, if present, are generally non-specific and have no clear association with the trypanosome infection. Most effects are likely subclinical.

It is thought that clinical disease may develop in a host with comorbidities or physiological stress. Trypanosome infections have been theorized to cause poor body condition and skin lesions in koalas [21] and woylies [15], and anaemia in koalas [28], quokkas [19] and flying-foxes [20]. Signs observed in infected Australian wildlife include lethargy, depression, generalized weakness, jaundice and pale mucous membranes [20, 28].

Diagnosis

Microscopic examination of fresh, Giemsa or Wright's stained blood smears can be used to detect trypanosome infection. *Trypanosoma* spp. can be detected among the red blood cells (Figure 1), although this method can be insensitive when the parasite load is low.

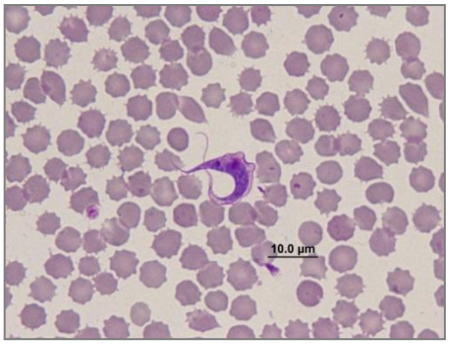

Figure 1. Giemsa stained trypomastigote of a trypanosome species observed in a blood smear from a woylie (*Bettongia penicillata*) [Courtesy Craig Thompson].

PCR is a more sensitive method for trypanosome detection in blood samples [29]. In wildlife, PCR in combination with sequencing is considered the gold standard for detection and species identification from blood and tissues [30].

Most diagnostic tests use blood samples. Whole blood stored in EDTA tubes or separated from sera and stored at -20˚C can be used for later molecular characterisation. PCR can detect trypanosomes

in brain, lung, liver and skin and other tissues [30]. During the acute stage of infection, diagnosis of trypanosomes via microscopy or molecular techniques is simplified due to the large parasite load. During chronic stages of infection, detection of trypanosomes can become difficult due to the low parasite levels in the blood.

Pathology

Pathology of infection within Australian wildlife is not well understood and is generally considered non-specific.

Pathological findings in the heart, oesophagus and tongue have been associated with single and mixed *T. copemani* clade infection in woylies. Inflammation was observed, consisting of plasma cells, mast cells, macrophages, lymphocytes and neutrophils. Muscle degeneration and necrosis of the heart, inflammation of the oesophagus, and tongue and skeletal muscle degeneration were found in infected animals [15]. Similar inflammation was observed in the lymphoid tissue of an infected flying fox presenting with clinical disease, as well as moderate nephrosis of the kidneys [20].

Low packed cell volume (PCV) and extravascular and intravascular haemolysis has been seen in some native species with trypanosome infection [3, 23]. These changes may occur as a consequence of the parasites causing antibody-mediated or physical erythrocyte destruction [16].

Differential diagnoses

Clinically abnormal cases where trypanosomes are identified should also be investigated for any other relevant diagnoses.

Treatment

There is no specific treatment available for infection of trypanosomes in Australian wildlife. If clinical disease is present, supportive therapies such as blood transfusions and fluid therapy may be beneficial [16].

Prevention and control

Prevention and control are dependent on breaking the cycle of transmission. Knowledge of competent vectors is required to do this effectively. While the vectors for the *Trypanosoma* spp. affecting Australian native wildlife are currently unknown, limiting exposure of wild hosts is not feasible.

Research

Current and future studies are focusing on:

- identification of vectors and route of transmission for *Trypanosoma* spp. infecting Australian wildlife
- understanding the life cycle of trypanosomes in Australia including the identity of any reservoir hosts for various species of trypanosome
- investigating disease associated with trypanosome infection in Australian wildlife

- surveillance of Australian wildlife for exotic trypanosomes
- understanding the impact between vector population fluctuations and trypanosome levels within the environment [3].

Surveillance and management

There is no coordinated national program for surveillance of trypanosomes in Australian native wildlife. However, the findings of trypanosomes in wildlife in Australia would be considered interesting and unusual and would therefore be logged in the national wildlife health information system as part of national general wildlife surveillance activities.

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. Negative data are also valuable. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

Wildlife Health Australia administers Australia's general wildlife health surveillance system, in partnership with government and non-government agencies. Wildlife health data is collected into a national database, the electronic Wildlife Health Information System (eWHIS). Information is reported by a variety of sources including government agencies, zoo based wildlife hospitals, sentinel veterinary clinics, universities, wildlife rehabilitators, and a range of other organisations and individuals. Targeted surveillance data is also collected by WHA. See the WHA website for more information https://wildlifehealthaustralia.com.au/Our-Work/Surveillance and https://wildlifehealthaustralia.com.au/Our-Work/Surveillance/eWHIS-Wildlife-Health-Information-System.

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Wildlife Health Australia recognises the Traditional Custodians of Country throughout Australia. We respectfully acknowledge Aboriginal and Torres Strait Islander peoples' continuing connection to land, sea, wildlife and community. We pay our respects to them and their cultures, and to their Elders past and present.

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