Mycobacteriosis in Australian reptiles

Fact Sheet

June 2025

Key points

- Mycobacterial infections have been reported in a wide variety of reptiles (snakes, turtles, lizards and crocodiles).
- Mycobacteriosis (disease caused by *Mycobacterium* species) is considered uncommon in reptiles compared to birds and mammals.
- A number *Mycobacterium* species have been isolated from cases of disease in reptiles.
- The mycobacterial species most commonly associated with disease in reptiles are found worldwide as environmental commensal organisms.
- Infections have the most impact on captive reptiles.
- Predisposing conditions for infection likely include close confinement, high population density, immunosuppression and poor hygiene.

Aetiology

Order Actinomycetales, family *Mycobacteriaceae*, genus *Mycobacterium*.

Mycobacteria are small rod-shaped bacteria that grow inside the host's cells [1]. Mycobacterial species are commonly grouped into categories according to how they manifest disease in humans. "Tuberculous mycobacteria", also known as the "MTB complex", cause serious disease in humans, characterised by granuloma (tubercle) formation (or "tuberculosis"). Infections with the MTB complex have not been described in reptiles [2].

Mycobacterial species which do not cause tuberculosis in humans are often referred to as "atypical mycobacteria" or "nontuberculous mycobacteria" [3]. Many different species of atypical mycobacteria have been isolated from cases of disease in reptiles. These include *Mycobacterium avium, M. schlangen, M. tropidonotus, M. marinum, M. thamnopheos, M. xenopi, M. chelonae, M. fortuitum*, *M. intracellulare*, *M. phlei*, *M. smegmatis, M. ulcerans, M. confluentis, M. haemophilum, M. hiberniae, M. neoaurum, M. nonchromogenicum, M. marinum, M. gordonae, M. kansasii, M. kumamotonense, M. szulgai, M. abscessus, M. mageritense and M. genavense* [2, 4-6].

One Health implications

Wildlife and the environment: atypical mycobacteria infect a wide range of reptile species, although their prevalence in wild Australian populations is not known.

Domestic animals: atypical mycobacteria have been known to cause disease in domestic animals [7]. Wild reptiles are unlikely to be a significant source of infection for domestic animals, which are most likely to contract infection via environmental contamination.

Humans: atypical mycobacteria can cause disease in people that are immunosuppressed [8]. *Mycobacterium marinum,* a common pathogen of fish and reptiles, has been reported in humans (e.g. 'fisherman's finger', 'seal finger', 'swimming pool granuloma')**.** While the environment is the most likely source of infection in humans, reptiles that are shedding atypical mycobacteria could pose a risk of infection to immunosuppressed people. While rare, atypical mycobacteria can also cause disease in non-immunosuppressed people [9].

Natural hosts

The mycobacterial species commonly infecting reptiles are environmental pathogens (found in soil, freshwater and seawater), with the environment being the source of opportunistic infection (an infection that does not normally cause disease but becomes pathogenic when the host is compromised). A wide range of reptiles are known to be susceptible to mycobacterial infection. Mycobacteriosis appears to be most common in aquatic reptiles, especially those in production systems such as crocodilians.

World distribution and occurrences in Australia

Mycobacteriosis in reptiles occurs worldwide [10] .

Mycobacteriosis occurs sporadically in captive and wild reptiles in Australia. Cases have been reported in injured or diseased free living animals undergoing rehabilitation. Mycobacterial species identified in diseased Australian reptiles (both captive and wild) include *M. marinum, M. chelonae, M. ulcerans, M. avium, M. abscessus. M. fortuitum, M. intracellulare and M. mageritense*[1] [2].

In Australia, *Mycobacterium* species have been isolated from a number of reptiles (Table 1). Overseas, mycobacteriosis has been reported in central bearded dragons (*Pogona vitticeps*) and leatherback turtle (*Dermochelys coriacea*) [11, 12].

Table 1: Australian reptile species from which *Mycobacterium* species have been isolated

Taxa	Species
Lizards	Shingleback lizard (*Tiliqua rugosa*)[1]
	Southern angle-headed dragon (*Lophosaurus spinipes*)[1]
	Gippsland water dragon (*Intellagama lesueurii howittii)* [2]
	Painted dragon (*Ctenophorus pictus*) [13]
	Eyrean earless dragon (*Tympanocryptis tetraporophora*) [2]
	Southwestern crevice-skink (*Egernia napoleonis*) [2]
	Rusty monitor (*Varanus semiremex*) [14]
	Knob-tailed gecko (*Nephrurus levis*) [13]
Snakes	Children's python (*Antaresia children*) [2]
	Centralian carpet python (*Morelia bredli*) [13]
	Darwin carpet python (*M. spilota variegata*) [13]
	Desert death adder (*Acanthophis pyrrhus*) [13]
	Arafura file snake (*Acrochordus arafurae*) [13]
	Common death adder (*Aca. antarcticus*) [2]
Chelonians	Green sea turtle (*Chelonia mydas*) [13]

	Loggerhead turtle (*Caretta caretta*) [13]
	Hawksbill turtle (*Eretmochelys imbricata*) [13]
	Flatback turtle (*Natator depressus*) [13]
	Broad-shelled turtle (*Chelodina expansa*)[1]
	Red-bellied short-necked turtle (*Emydura subglobosa*) [13]
	Eastern long-necked turtle (*Chelod. longicollis*) [6]
Crocodilians	Saltwater crocodile (*Crocodylus porosus*) [15];
	Freshwater crocodile (*Cr. johnstoni*) [16]

[1] National Wildlife Health Information System (eWHIS)

Epidemiology

Atypical mycobacteria are shed in the faeces of infected animals and are commonly found in the environment in large quantities [8]. In the environment, mycobacterial organisms can persist for long periods of time, opportunistically infecting reptilian hosts and acting as commensals in healthy reptiles. Infection is likely to be the result of ingestion or inhalation of the aerosolised organism in contaminated soil or water or through cutaneous routes via a break in skin integrity [10, 17]. For reptiles, ingestion of infected prey species may also be an exposure source [18].

Mycobacteriosis is considered uncommon in reptiles compared to birds and mammals [10, 18]. However, it is possible that many cases go undiagnosed because of limited post-mortem investigation and diagnostic testing [10].

Little information is available on prevalence and incidence of mycobacterial infections in Australian reptiles. Whether exposure results in infection will depend upon the number of organisms to which the reptile is exposed and the host's immune response to infection [6]. Co-infection with other pathogens, age, stress, injury, malnutrition and other factors impacting the immune system may make reptiles more susceptible to infection and disease [2].

A relatively high prevalence of infections has been seen in captive settings compared to wild populations [2]. Many diseased chelonians are either wild animals being brought into captivity or free-ranging wild animals being rehabilitated in captivity [10]. The higher prevalence of infection in captive reptiles may be the result of poor hygiene, high population density, exposure to large numbers of organisms in the environment, inadequate environmental conditions (such as sub-optimal temperature or humidity, poor ventilation, poor water quality) or human-induced stress (such as repeated handling, relocation) [2, 19].

Clinical signs

Mycobacteria can infect a wide range of tissues in the body and reptiles may present with many different non-specific signs, depending on the location and severity of the infection [13]. Reptiles may refuse to eat and show vague non-specific signs such as abnormal posture, weight loss, anorexia, lethargy and emaciation [2]. If spinal involvement occurs, the snake may present with neurological abnormalities or evidence of a spinal fracture [17]. Reptiles may present with skin or oral granulomas lesions [2]. If the respiratory system is affected, reptiles may show signs of rapid

breathing, laboured breathing and nasal discharge [6]. Affected reptiles may be found dead with no obvious proceeding clinical signs [20].

Diagnosis

Ante mortem diagnosis of mycobacteriosis in reptiles can be difficult unless granulomas are present in the skin or radiography detects bone abnormalities or space occupying lesions. At necropsy granulomas spreading through multiple organs is suggestive of mycobacteriosis. A presumptive diagnosis can be made by finding acid-fast organisms within the granulomas using the Ziehl-Neelsen stain, but culture is required for a definitive diagnosis [17]. Culture of affected tissues however is a difficult and time-consuming process which is not routinely offered by diagnostic laboratories. PCR and DNA sequencing of infected tissues is highly sensitive and specific, providing a fast and accurate means of determining the species of *Mycobacterium* [21], however mycobacterial PCR is not readily available in many laboratories currently.

Laboratory diagnostic specimens and procedures

Samples required include liver, spleen, kidney, lung, skin, gut; biopsies of lesions (frozen, formalin). Sample collection at the margin of the granulomatous lesion is recommended due to the often necrotic centres [13].

Clinical pathology

Reptiles with mycobacteriosis typically have an elevated white blood cell count, often containing azurophilic granules in their cytoplasm.

Pathology

Mycobacteriosis in reptiles can cause granulomas or 'tubercles' (a mass composed of inflammatory cells and mycobacteria) to develop through a variety of organs. The most common primary sites in reptiles are the liver, spleen and gut. Secondary involvement commonly occurs in the lung (especially in marine turtles), bone and skin. Bone involvement produces osteomyelitis, discospondylitis and pathological fractures. Skin lesions appear as well-circumscribed subcutaneous nodules [13, 17].

Histologically, granulomas often have a central core of necrosis surrounded by mononuclear cells. Fibroplasia occurs in the later stages. Acid-fast organisms are visible within the granulomas, with the number of bacteria varying from massive to very few [17].

Differential diagnosis

Clinical signs in the reptiles are non-specific and could be caused by a range of chronic diseases including other bacterial infections, systemic fungal infections, chronic parasitic infections, metabolic disease, malnutrition and neoplastic disease.

Treatment

Currently, there are no proven or approved treatments for mycobacteriosis in reptiles, and because of the general poor response to treatment and zoonotic potential of these bacteria, none is recommended [10]. Systemic antimicrobial treatment and debridement of skin lesions have been used with cutaneous mycobacteriosis, however treatment is often lengthy (up to a year) and difficult [19]. In a captive situation, treatment may not be an appropriate option if there is a risk that infected reptiles may be a source of environmental contamination for other reptiles and infection in humans, and euthanasia may be the preferred option.

Prevention and control

Control of mycobacterial infections in wild and captive reptiles is challenging. Since atypical mycobacteria are found in the environment, any reptile could become infected if it is exposed to sufficient numbers of organisms and is otherwise susceptible. Control of mycobacteriosis in a captive situation may require removal or euthanasia of individuals showing signs of systemic mycobacteriosis.

Mycobacteria are resistant to a number of disinfectants and ultraviolet exposure [22]. The most important element of mycobacterial hygiene is to remove contaminated organic material from the environment when cleaning. This can be difficult in many captive settings with naturalistic furniture and substrate, and impossible in free-ranging situations. Specific control measures for turtles that have been used in captive settings include using a sterilisation element within water filtration systems [13].

It is generally thought that the *Mycobacterium* spp. gain systemic access through cutaneous routes, so protecting cutaneous lesions may limit a reptile's exposure to these pathogens. This is especially important in animals undergoing rehabilitation because they are generally considered to be immunocompromised and more susceptible to opportunistic infections [10]. It is recommended that turtles undergoing rehabilitation are kept in individual water bodies for the duration of their treatment to minimise chance of cross infection [13].

It is not feasible to completely prevent the introduction of atypical mycobacteria into a collection of reptiles, given the organisms are commensal environmental organisms. It is possible to avoid heavy contamination of the environment by practising excellent hygiene (including regular substrate changes), optimising husbandry (avoid overcrowding, provide good nutrition), and by detecting and isolating infected and shedding reptiles. Infected reptiles should be kept in isolation from people and other reptiles and when appropriate, euthanasia should be considered [6]. All incoming reptiles should be routinely screened for signs of illness that might indicate mycobacterial disease.

Research

The status of mycobacterial infection or disease in free-living Australian reptiles is unknown. Research is needed to describe the incidence of mycobacterial disease and infection in both captive and free-living reptiles in Australia. There is very little known about the carrier state of reptiles, either captive or free-living.

Surveillance and management

There is no targeted surveillance program for mycobacteriosis in reptiles in Australia.

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.

We are interested in hearing from anyone with information on this condition in Australian native reptiles, 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.

Acknowledgments

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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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