

Baylisascariasis (*B. procyonis*)

Aetiology Epidemiology Diagnosis Prevention and Control
Potential Impacts of Disease Agent Beyond Clinical Illness References

AETIOLOGY

Classification of the causative agent

Baylisascaris procyonis is a common species-adapted ascarid (roundworm) found in the small intestinal tract of racoons in parts of North America, Europe, and Japan, and less commonly in South America. *B. procyonis* can cause severe disease in humans and other animals. *B. procyonis* is not currently notifiable to the OIE.

Resistance to physical and chemical action

Temperature:	Larvae can be killed in temperatures >100°C or <62°C
pH:	Not determined
Chemicals/Disinfectants:	Eggs are highly resistant to many common chemical disinfectants. Bleach and other disinfectants are not proven to kill eggs but can be used to prevent eggs from adhering to surfaces and used to wash them away.
Survival:	Eggs can survive in the environment for at least 2-4 weeks

EPIDEMIOLOGY

Primary Host

- Racoons (*Procyon lotor*)
- Wild and domestic canids

Paratenic Host

Over 130 species of wild and domesticated animals have been identified with *B. procyonis* larval infestations. Below are the most common paratenic hosts:

- Birds (*Aves* spp.)
 - Emus (*Dromaius novaehollandiae*)
- Chinchillas (*Chinchilla lanigera*)
- Porcupines (*Erethizon dorsatum*)
- Prairie dogs (*Cynomys* spp.)
- Primates, including humans
- Rabbits (*Oryctolagus cuniculus*)
- Weasels (*Mustela* spp.)
- Woodchucks (*Marmota monax*)
- Woodrat (*Neotoma magister*)

Transmission & Life Cycle

- Infection occurs through ingestion of infective eggs or infected paratenic hosts

- Eggs passed in racoon faeces are shed in the environment and take 2-4 weeks to embryonate and become infective.
- Many mammals and birds can become paratenic hosts after consuming the eggs.
- Once infective eggs are ingested, the eggs hatch and larvae penetrate the intestinal wall where they can migrate to various tissues (liver, lungs, eyes, and brain), and infect the host.

Sources

- Infected eggs in faeces
- Other Infected animals (infected eggs in fur)
- Latrine sites of racoons

Occurrence

B. procyonis is a common roundworm infection of raccoons in parts of North America, Europe and Japan, and less commonly in South America. The parasite is indigenous to North America and emerging in Europe and Asia after the introduction of North American racoons for the commercial fur trade in the early 20th century, and into Japan as pets or for zoo exhibits.

DIAGNOSIS

B. procyonis is considered a common cause of clinical larval migrans in animals living in close proximity to racoons, and usually associated with fatal or severe neurological disease. The zoonotic potential of *B. procyonis* has become evident more recently: *B. procyonis* larvae can invade the brain and eye to cause severe neurologic disease and/or death. The incubation period is usually 2 to 4 weeks.

Clinical diagnosis

- Infected racoons and dogs are usually asymptomatic, but heavy infestations may cause lesions such as intestinal obstructions.
- When *B. procyonis* eggs are ingested by a host other than a racoon, aberrant migration of larvae through tissues, termed larval migrans, ensues.
- Symptoms can include: blindness, lethargy, depression, circling/rolling, torticollis, extensor rigidity, and blindness

Lesions

- Neuronal degeneration
- Lesions along larval migration route:
 - Granulomas
 - Haemorrhagic lesions
 - Necrotic lesions
- Intestinal obstruction with *B. procyonis* worms

Differential diagnoses

- Distemper virus
- Infectious Canine Hepatitis
- Leptospirosis

- Optic neuritis
- Rabies virus
- Retinoblastoma
- Rocky Mountain Spotted Fever
- Larval migrans of *Toxocara canis*
- Toxoplasmosis

Laboratory diagnosis

Samples

For isolation of agent in definitive host

- Faeces
 - Samples should be collected and screened for at least 3 days before concluding that a racoon is not infected.
 - Eggs are more readily identified in fresh faeces than from environmental samples.
- Vomitus

For isolation of agent in paratenic host

- Post-mortem tissue samples

Serologic samples

- Blood
- Cerebrospinal fluid (CSF)
 - Eosinophilia in CSF or blood is consistent with infection

Procedures

A definitive diagnosis depends on the identification of the parasite within tissues by biopsy, or more often, in CSF samples taken at necropsy. However, misidentification is common and must be taken into account when searching for larvae within the tissues.

Identification of the agent in definitive host

For immunodiagnosis:

- *B. procyonis* excretory-secretory (BPES) antigen-based enzyme-linked immunosorbent assay (ELISA), which are by-products from *B. procyonis* larvae consisting of complex glycoproteins
- Polymerase chain reaction (PCR) assays for *Baylisascaris* have been published, but are not currently used in clinical laboratories
- Western blot assays (however cross-reactivity is presently problematic with this method)

Microscopic identification:

- Identification of the eggs in faeces
- Identification of the worms in faeces, vomitus, or biopsies

Identification of the agent in paratenic host

- Larvae may be observed microscopically in tissues during post-mortem examination.

Serological tests

- A recombinant *B. procyonis* antigen, BpRAG, has been reported for use in the development of improved ELISAs for the diagnosis of *Baylisascaris* larval migrans
- Eosinophilia in the CSF and blood are consistent with infection

PREVENTION AND CONTROL

Sanitary prophylaxis & control

- Raccoon latrines should be treated as infectious sites and efforts should be made to limit access of pets and people.
- Properly use personal protective equipment (PPE) when removing faeces in any setting.
 - Adhere to cleaning and disinfection protocols
- Proper hand hygiene through hand washing and use of gloves when handling faeces.
- Captive raccoons should be kept in dedicated cages that can be cleaned.
 - Newly acquired animals should be quarantined and dewormed
- Captive paratenic hosts in high-risk areas may be treated prophylactically with anthelmintic.
- Discourage public practices such as feeding wild raccoons and keeping wild raccoons as pets.

Medical control

- Several anthelmintic drugs (ex: pyrantel, ivermectin, moxidectin, albendazole, fenbendazole, and flubendazole) can kill adult *B. procyonis* within definitive hosts if the worm burden is not significant

POTENTIAL IMPACTS OF DISEASE AGENT BEYOND CLINICAL ILLNESS

Risks to public health

- Potential for human infection can be mitigated by decontaminating areas frequented by raccoons or where *B. procyonis* eggs may be found.
- Although infections are rare, *B. procyonis* is a risk to human health due to the close proximity of raccoons and human dwellings.
- Severity and signs of human infection are influenced by location of invasion (ex: eyes, organs, or brain).
- Children are most at risk due to the potential of ingesting eggs through dirt or animal waste.
- Proper hand washing after playing or working outside will help prevent infection.
- If racoon faeces are present, remove and dispose of them immediately; avoid contaminating hands and clothes.
 - Decks, patios, and other surfaces where racoon faeces are found can be treated with boiling water.

Risks to agriculture

- There is currently no evidence that *B. procyonis* presents a risk directly to agriculture.

REFERENCES AND OTHER INFORMATION

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The OIE will periodically update the OIE Technical Disease Cards. Please send relevant new references and proposed modifications to the OIE Science Department (scientific.dept@oie.int). Last updated 2019. Written by Marie Bucko and Samantha Gieger with assistance from the USGS National Wildlife Health Center.