

Facts about Wildlife Diseases: Raccoon-Borne Pathogens of Importance to Humans—Parasites¹

Caitlin Jarvis and Mathieu Basille²

Northern raccoons (*Procyon lotor*, Figure 1) can carry many diseases that present significant health hazards to both people and pets. Some of these diseases are asymptomatic, showing no signs of infection, and often do not affect raccoons, but can still be passed on and deadly to other animals, including humans. Because it is not possible to be certain if a wild animal is sick, it is safer to consider the animal a hazard and avoid it. Contact animal control or a wildlife rehabilitator if you suspect an animal is sick or behaving abnormally (contact details for Florida wildlife rehabilitators can be found on the [Florida Fish and Wildlife Conservation Commission website](#)). Sick wild animals can act tame and confused but should never be approached as if they are domesticated. They are still wild animals that will likely see you as a threat, and can act aggressively. Due to their successful adaptation to urban environments, it is common for raccoons to come into contact with humans. This document is part of a series addressing health hazards associated with raccoons and specifically describes important internal and external parasites. Information on raccoon-borne [viruses and bacteria](#), as well as more details about the [raccoon roundworm](#) *Baylisascaris procyonis*, can be found in other documents of this series. The following parasites are known to occur in or on raccoons and are a concern for people and/or pets: *Baylisascaris procyonis* (raccoon roundworm), *Toxoplasma gondii*, *Trypanosoma cruzi*, *Dirofilaria immitis* (heartworm), *Dirofilaria tenuis*, *Trichinella*, fleas, and ticks (See Table 1 for a summary description and prevention).



Figure 1. A juvenile raccoon in a tree in Broward County, south Florida. Credits: Mathieu Basille, UF/IFAS

Internal Parasites

Baylisascaris procyonis (raccoon roundworm)

Baylisascaris procyonis, known as the raccoon roundworm (Figure 2), is a nematode in the family Ascarididae that does not typically harm raccoons but that can cause the serious illness **baylisascariasis** in many other animals, including humans. The eggs of *B. procyonis* can remain viable in the environment for months, and even years in favorable conditions. After ingestion of infective eggs (through direct or indirect contact with feces), the eggs hatch and larvae penetrate the intestinal mucosa and migrate throughout the

1. This document is WEC434, one of a series of the Department of Wildlife Ecology and Conservation, UF/IFAS Extension. Original publication date November 2020. Visit the EDIS website at <https://edis.ifas.ufl.edu> for the currently supported version of this publication.
2. Caitlin Jarvis, former technician, UF/IFAS Fort Lauderdale Research and Education Center; and Mathieu Basille, assistant professor, Department of Wildlife Ecology and Conservation, UF/IFAS Fort Lauderdale Research and Education Center, Davie, FL 33314

body. Raccoons are the natural definitive host, in which *B. procyonis* larvae develop into adults in the small intestine and reproduce to complete the life cycle. Young raccoons have a higher rate of infection than adults. *B. procyonis* in raccoons reaches highest densities in raccoons in the Midwest, Northeast and West Coast of North America (Figure 3). The Southeast United States was considered low risk, but recent cases of clinical and asymptomatic infection have emerged, including in Florida. Further details can be found in a dedicated document about [the raccoon roundworm](#).



Figure 2. Larvae (top, magnification $\times 40$) and adults (bottom) *Baylisascaris procyonis*. Adult females (bottom left) are about 20–24 cm long; males (bottom right) are about 9–12 cm long.
Credits: Shafir et al. 2011 and Roussere et al. 2003 (public domain)

Many mammals and birds, including humans, can act as paratenic hosts. When a paratenic host ingests eggs, larvae do not reach maturity; instead they migrate through the host to various areas of the body and cause a condition known as larva migrans. Altogether, the disease is very rare in humans in the United States, with fewer than one documented case of baylisascariasis each year. Reported cases primarily occurred in people with [pica](#), geophagia, or developmental delays, or in very young children, who are more likely than other groups to come into contact with raccoon feces (from playing on the ground or in sandboxes, for instance) and to practice poor hygiene. *B. procyonis* infection is often asymptomatic. Exposure to a small number of *B. procyonis* eggs is usually not sufficient to cause clinical disease, but it can cause the production of *B.*

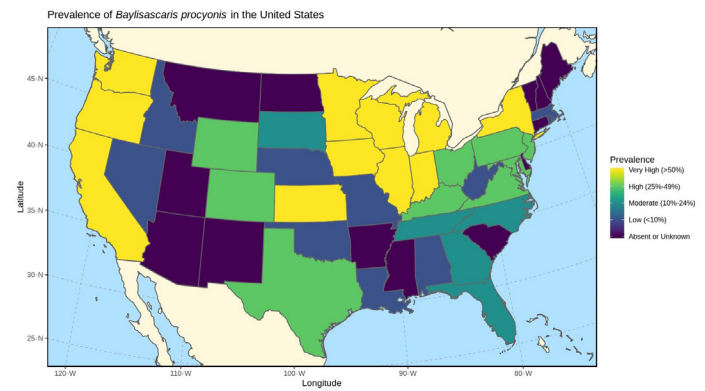


Figure 3. Prevalence of *Baylisascaris procyonis* in raccoons in the United States.

Credits: Map recreated from data from Sapp et al. 2016

procyonis antibodies in otherwise healthy adults. Baylisascariasis can manifest as neural larva migrans (NLM), ocular larva migrans (OLM), and visceral larva migrans (VLM) based on the migration of the parasite. Most patients with NLM exhibit a sudden and severe inflammation of the membranes that surround the brain and spinal cord. Early symptoms include low fever, irritability, lethargy, and loss of coordination, which can progress into missed developmental milestones, weakness of limbs, muscle contraction, and seizures. The patient may rapidly deteriorate into stupor, coma, and death. OLM occurs when one or more larvae enter the eye and cause sudden reduced or lost vision. VLM is caused by migration of the larvae into other organs and tissues where inflammation and damage occur.

Treatment of OLM with laser therapy and anti-inflammatory corticosteroids has been successful, and antiparasitic treatment has been used with mixed results. NLM and VLM are treated with the antiparasitic albendazole and corticosteroids. Especially for older cases, most cases of NLM end with death of the patient or neurologic impairment. Until 2004, no cases of full recovery were reported. Increased survival and recovery rates in recent years are due to faster diagnosis and early treatment.

Raccoon roundworm can also infect pet dogs, rabbits, many rodents, birds, and zoo animals that come into contact with raccoon feces or with an area that once had raccoon feces. Dogs can also act as an alternate definitive host by shedding infective eggs. Deworming of dogs can prevent this. Domestic cats appear to be immune to infection. In the wild, vulnerable species tend to avoid areas where risk of contracting raccoon roundworm is higher, such as latrines where raccoons defecate. In contrast, certain rats will scavenge the feces for food without apparent negative consequences.

Toxoplasma gondii

Toxoplasma gondii is a common yet unusual protozoa parasite in the family Sarcocystidae, which causes **toxoplasmosis**. Felids (cats) are the definitive host, and the parasite must be shed in cat feces to be infective to other animals such as rodents and birds. Cats then prey upon these intermediary hosts and complete the parasite's life cycle so it can reproduce. Cats are only infective for a short time (1–3 weeks). Toxoplasmosis is known to alter host behavior. The most well known example is that it causes rodents to be more likely to be eaten by cats. Raccoons, along with nearly any mammal or bird, can be infected with this parasite through cat feces and become paratenic hosts. Raccoons are typically asymptomatic. Studies throughout the Midwest, Northeast and Southeast regions have shown varied prevalence in raccoons (15%–85%); raccoons seem to be one of the reservoir species of the parasite in Florida. Humans can in turn be infected through contact with cat feces or by eating undercooked meat from animals that had contact with cat feces.

The vast majority of people will typically never notice the infection and experience nothing more severe than flu-like symptoms. The Centers for Disease Control and Prevention (CDC) estimates that 60 million people have *Toxoplasma gondii* in the United States alone. The disease is most hazardous to developing fetuses and those whose immune systems have been compromised. Pregnant women can pass the infection to the fetus, which can result in miscarriage. Babies born after the mother is infected can develop vision loss, mental disabilities, seizures, and suicidal tendencies. More [recent evidence](#) suggests that toxoplasmosis infection can increase the risk of violent suicide. However, it is not well established if this is truly a result of infection or due to other factors. Blood tests and treatments are available for toxoplasmosis.

Trypanosoma cruzi

The protozoan parasite *Trypanosoma cruzi* causes the potentially fatal **Chagas disease**. All mammals are considered susceptible, but the most common carriers are rodents, raccoons, coyotes, opossums, armadillos, and skunks. Humans and dogs are the only animals that are well known to show clinical symptoms. In raccoons, Chagas disease can cause mild infection of the heart called myocarditis; data shows high prevalence of *Trypanosoma cruzi* (about 40%–60 %) in Oklahoma, Georgia, and South Carolina; medium prevalence (15%) in North Carolina; and low prevalence (2%) in Florida. Infection is spread through the feces of triatomine insects, commonly called kissing bugs, a type of [assassin insect](#) in the family Reduviidae. The [eastern](#)

[bloodsucking conenose](#) is one such species. Triatomine insects are found in much of the United States but are more common in southern regions. Formerly a disease of rural Latin America, Chagas disease has spread to cities in the southern United States and is now recognized as an emerging disease there. An estimated 8 million people are infected worldwide, with 20% to 30% potentially developing life threatening complications. There are cases of Chagas disease being spread through human blood transfusion, organ donation, and birth, but no documented cases directly from vertebrate animals. Blood screening for Chagas disease began in 2007, leading to an increase in known prevalence in the United States; however the majority of cases are in Latin America.



Figure 4. *Triatoma sanguisuga*, the eastern bloodsucking conenose. This species, among others, are vectors of Chagas disease.

Credits: Robert Webster / xpda.com / CC-BY-SA-4.0. Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Triatoma_sanguisuga_P1290887a.jpg

In humans, symptoms from the acute phase of Chagas disease occur within a few months after infection and include swelling of the infection site, fever, fatigue, rash, body aches, headache, loss of appetite, nausea, diarrhea, and vomiting. The most characteristic symptom of Chagas disease is swelling of the eyelid closest to the infection site. These cases normally occur suddenly and resolve on their own but can pose a serious risk for patients with compromised immune symptoms. The chronic phase of infection may occur 10 to 20 years after infection. Symptoms include

irregular heartbeat, congestive heart failure, cardiac arrest, difficulty swallowing, and abdominal pain. Symptoms in dogs include fever, depression, lethargy, increased or abnormal heart rate, weakness, diarrhea, loss of appetite, seizures, and sudden death. Benznidazole was approved for use in the United States in 2017 and can be used to treat Chagas disease. Nifurtimox is also used to treat Chagas disease but has not yet been approved by the United States Food and Drug Administration.

***Dirofilaria immitis* (heartworm)**

Dirofilaria immitis, also known as heartworms, are roundworms in the family Onchocercidae (nematodes) that can cause **pulmonary dirofilariasis**, a serious infection in mammals. Occurrences are rare, but raccoons are known to be infected by heartworms occasionally. Canids, however, are the natural definitive host. Heartworm infection in humans is uncommon and usually not serious, though it can cause excess fluid to build up between the tissues that line the lungs and the chest cavity, and its symptoms occasionally include coughing blood. Heartworms are spread by [mosquitoes](#) after they feed on the blood from an infected animal, and heartworm infections are therefore most common in areas with high mosquito populations. In dogs, heartworms can be fatal if not treated. They are uncommon in cats, but also untreatable and may cause death without warning. Monthly heartworm preventatives are available from veterinarians. More information on heartworms can be found [on the American Heartworm Society website](#) and in [Mosquito-Borne Dog Heartworm Disease](#).

Dirofilaria tenuis

Dirofilaria tenuis, another roundworm in the family Onchocercidae (nematodes) transmitted by mosquitoes, rarely infects humans but causes **dirofilariasis** with small, irritating nodules under the skin and in rare cases the eye. It is much more common in raccoons, the natural definitive host, where similar symptoms may occur. *D. tenuis* is prevalent in raccoons in Florida.

Trichinella

Trichinella nematodes, acquired through eating undercooked contaminated meat, especially game meat from carnivores, cause **trichinellosis**. The *Trichinella* parasite has been documented in raccoons but has not been shown to cause illness in raccoons. Symptoms in humans vary widely, beginning with nausea, diarrhea, vomiting, fatigue, fever, and abdominal discomfort and in some cases progressing to chills, headaches, cough, aching joints, swelling of the face, and itchy skin. Severe cases with heavy parasite loads can cause heart and breathing complications, as well as

difficulty with coordination. Most cases resolve in a few months; however, the most severe can result in death. Antiparasitic prescription drugs are available for treatment, along with corticosteroids and pain relievers. Infection in animals generally goes unnoticed, but *Trichinella* can cause symptoms in dogs that are similar to those seen in humans.

Other worms

There are many parasitic worms not mentioned here that are carried by raccoons and other wildlife. Lungworms (*Crenosoma goblei* and *Filaroides* sp.), stomach worms (*Gnathostoma procyonis*), hookworms (*Placoconus lotoris*), and acanthocephalans have all been isolated in raccoons. These are generally of low concern to humans, although some species are of concern to pets.

External Parasites

Ticks

The University of Rhode Island's [Tick Encounter](#) webpage has an excellent identification guide of ticks by life stage and sex, as well as tick activity levels by region (be sure to select your region); you can even submit a tick for disease testing. Several publications on fleas and ticks can be found in these [UF/IFAS factsheets](#). Five species of ticks are known to occur on raccoons, sometimes abundantly. Three of these are of concern to humans: the American dog tick *Dermacentor variabilis*, the blacklegged or deer tick *Ixodes scapularis*, and the lone star tick *Amblyomma americanum*. The prevalence of these ticks and of their associated diseases varies by region (Table 2). The species *Ixodes cookei* rarely bites humans, but carries the deadly Powassan virus. *Ixodes texanus* primarily parasitizes raccoons and has not been shown to carry significant diseases.

Fleas

Raccoons are known to carry *Ctenocephalides felis*, the cat flea. Despite its name, the flea can parasitize dogs and many other mammals such as raccoons, which have been suggested as possible reservoirs for the flea; infestation of humans from suburban raccoons has been documented in Maryland. Fleas can carry a wide range of diseases that infect people and pets, including tapeworms, feline distemper, plague (extremely rare), and Murine typhus caused by *Rickettsia typhi* (extremely rare), but primarily they cause itching and allergic reactions. The best prevention for fleas is topical repellents on dogs and cats. These are commonly available in pet stores, although many fleas are developing resistance, and veterinarian-prescribed treatments are often needed. Several publications on fleas and ticks can be found in these [UF/IFAS fact sheets](#).

Conclusions and Prevention

With increased development and habitat fragmentation, the risk that humans will come into contact with raccoons and other adaptable species increases. Raccoons readily adapt to urban environments (Figure 5), thus increasing the chance for raccoon-borne diseases to spread to humans and pets. There are a few simple solutions to prevent the spread of raccoon-borne diseases. First, never feed wild animals. In addition to being illegal, feeding wildlife causes animals to associate humans with food, and sometimes to become dependent upon humans. They may lose their natural fear, and they may become aggressive. Feeding wildlife also increases population density and territorial overlap, and the chances of disease transmission between individuals. In addition to not feeding wildlife, feed pets inside, or at least bring food in at night. Purchase raccoon-proof garbage cans if they are getting into your garbage. If you have an unwanted raccoon on your property, call a wildlife removal specialist. The Florida Fish and Wildlife Conservation Commission keeps a list of wildlife removal specialists on [their website](#). Removing a raccoon without professional assistance is difficult and risky, and there is a very high chance the raccoon will come back, or that you remove only part of a family and leave orphans.

Raccoon-borne diseases pose a significant threat to humans, wildlife, zoo animals, livestock, and pets. With knowledge and simple measures, we can avoid these hazards and be proactive in treatment. Most problems arise when people attract raccoons intentionally or unintentionally. When treated with respect and caution, raccoons can live near humans as an interesting part of the urban ecosystem.



Figure 5. A group (gaze) of five raccoons in a dumpster, a common gathering spot.
Credits: Caitlin Jarvis



Figure 6. American dog tick *Dermacentor variabilis*
Credits: Jerry Kirkhart/ Wikimedia Commons



Figure 7. Blacklegged or deer tick *Ixodes scapularis*
Credits: Scott Bauer/ Agricultural Research Service/Wikimedia Commons/Public Domain



Figure 8. Lone star tick *Amblyomma americanum*
Credits: James Gathany/ CDC PHIL/Wikimedia Commons/Public Domain

Sources and Further Reading

Forrester, D. J. 1992. *Parasites and Diseases of Wild Mammals in Florida*. University Press of Florida, Gainesville. pp. 123–150. <http://ufdc.ufl.edu/AA00025659/00001>

Kern, W. H. 2018. *Northern Raccoon*. WEC-34. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/uw033>

Baylisascariasis

Gavin, P. J., K. R. Kazacos, and S. T. Shulman. 2005. “Baylisascariasis.” *Clinical Microbiology Reviews*. 18:703–718. <https://doi.org/10.1128/CMR.18.4.703-718.2005>

Kazacos, K. R. 2016. “*Baylisascaris* Larva Migrans.” U.S. Geological Survey Circular 1412. <https://doi.org/10.3133/cir1412>

Weinstein, S. B., C. W. Moura, J. F. Mendez, and K. D. Lafferty. 2017. “Fear of feces? Tradeoffs between disease risk and foraging drive animal activity around raccoon latrines.” *Oikos*. 127:927–934. <https://doi.org/10.1111/oik.04866>

Toxoplasmosis

Centers for Disease Control and Prevention. n.d. “Toxoplasmosis.” Accessed May 14, 2020. <https://www.cdc.gov/parasites/toxoplasmosis/>

Wilcox, C. 2012. “Toxoplasma’s Dark Side: The Link Between Parasite and Suicide.” *Science Sushi* blog at Scientific American. <https://blogs.scientificamerican.com/science-sushi/toxoplasmas-dark-side-the-link-between-parasite-and-suicide/>

Chagas’ Disease

Bern, C., S. Kjos, M. J. Yabsley, and S. P. Montgomery. 2011. “*Trypanosoma cruzi* and Chagas’ Disease in the United States.” *Clinical Microbiology Reviews*. 24:655–681. <https://doi.org/10.1128/CMR.00005-11>

German, A. 2010. “Chagas Disease in Dogs.” Pet MD website. https://www.petmd.com/dog/conditions/infectious-parasitic/c_dg_chagas_disease

Kobylinski, Kevin and Roxanne Rutledge Connelly. 2010. ENY-726. *Blood Feeding Insect Series: American Trypanosomiasis - Chagas Disease*. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://ufdc.ufl.edu/IR00003523/00001>

Heartworms

American Heartworm Society website. “Heartworms in cats.” n.d. <https://www.heartwormsociety.org/heartworms-in-cats> Accessed May 14, 2020.

Nayar, J. K., and C. R. Connelly. 2017. *Mosquito-Borne Dog Heartworm Disease*. ENY-628. Gainesville: University of Florida Institute of Food and Agricultural Sciences. <https://edis.ifas.ufl.edu/mg100>

Trichinellosis

Centers for Disease Control and Prevention. n.d. “Trichinellosis.” Accessed May 14, 2020. <https://www.cdc.gov/parasites/trichinellosis/>

Fleas and Ticks

EDIS. n.d. *Fleas and Ticks*. Accessed May 14, 2020. https://edis.ifas.ufl.edu/topic_fleas_and_ticks

Tick Encounter Resource Center. n.d. “Tick identification.” University of Rhode Island. Accessed May 14, 2020. https://tickencounter.org/tick_identification/

Table 1. Summary of raccoon-borne internal parasites.

Parasite	Disease	Spread	Infect humans and pets?	Prevention	Outcome
<i>Baylisascaris procyonis</i> (raccoon roundworm)	Baylisascariasis	Ingestion of eggs from infective raccoon feces	Infects humans, birds, and many mammals, not including cats	Sanitation; avoid raccoon feces	Subclinical to life-threatening, neurologic impairment, blindness
<i>Toxoplasma gondii</i>	Toxoplasmosis	Exposure to parasite after it has passed through cat feces	Cats are the natural host; infects humans and pets	Sanitation	Very often subclinical, but deadly to developing fetuses
<i>Trypanosoma cruzi</i>	Chagas disease	<i>Trypanosoma cruzi</i> spread by triatomine bugs	Infects humans and dogs	Sanitation, insect repellent	Mild to life-threatening in humans and dogs
<i>Dirofilaria immitis</i> (heartworms)	Pulmonary dirofilariasis	Acquired through mosquito vectors	Rare in humans, rare in cats, more common in dogs	Avoid mosquitoes, heartworm; prevention pill for pets	Mild symptoms in humans, deadly to cats, potentially deadly to dogs
<i>Dirofilaria tenuis</i>	Subcutaneous dirofilariasis	Spread through mosquitoes	Uncommon in humans	Avoid mosquitoes	Irritating nodules under skin and, rarely, in eyes
<i>Trichinella</i>	Trichinellosis	Ingestion of parasite in undercooked meat	Can infect humans and pets	Do not eat raccoons	Mild to life-threatening in humans and dogs

Table 2. Raccoon-borne tick species of concern to humans and diseases associated with those tick species

Species	Picture	Disease carried	Main regions
American dog tick <i>Dermacentor variabilis</i>	See Figure 6	Rocky Mountain spotted fever, tularemia	Widely distributed east of the Rocky Mountains. Also occurs in limited areas on the Pacific Coast.
Blacklegged or deer tick <i>Ixodes scapularis</i>	See Figure 7	Lyme disease, babesiosis, anaplasmosis, Powassan virus, ehrlichiosis, <i>Borrelia miyamotoi</i> disease	Widely distributed across the eastern United States.
Lone star tick <i>Amblyomma americanum</i>	See Figure 8	STARI, tularemia, ehrlichiosis, heartland virus	Widely distributed in the southeastern and eastern United States.