Raccoon-borne pathogens: Parasites

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Northern raccoons (*Procyon lotor*, Fig. 1) can carry many diseases that present significant health hazards to both people and pets. Some of these diseases may not affect raccoons directly, but can be deadly to other animals. Many of these diseases are spread by multiple species, others are primarily spread by raccoons. As it is not possible to be certain if a wild animal is sick, it is safer to consider it as 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 [myFWC website](http://myfwc.com/media/2779805/licensedwildliferehabilitatorsbyregion.pdf)). Sick wild animals can act tame and confused, but should never be approached as if they are domesticated. They are still wild animals that can see you as a threat. More information on raccoons can be found in this [EDIS document](https://edis.ifas.ufl.edu/uw033). 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 describes the most important internal and external parasites associated with raccoons. Information on raccoon-borne bacteria and viruses, as well as more details specifically about Baylisascaris procyonis, can be found in other documents of this series [*also to be published on EDIS*]. 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,* heartworms, trichinellosis, *Dirofilaria tenuis*, fleas, and ticks (see a summary of raccoon-borne parasites in Table 1).

<insert figure\_1\_raccoon\_in\_tree.jpg>

Figure 1. A juvenile raccoon in a tree in Broward County, South Florida.

Credit: Mathieu Basille, UF/IFAS.

[Click thumbnail to enlarge.]

# **Internal Parasites**

## Baylisascaris

***Baylisascaris procyonis*/raccoon roundworm** is a nematode in the family Ascarididae that does not typically harm raccoons, but can cause the serious illness baylisascaris in many other animals. In this section, we only present an overview of the disease; further details can be found in a dedicated document about baylisascaris. Baylisascaris can manifest as neural larva migrans (NLM), ocular larva migrans (OLM), and visceral larva migrans (VLM) based on the migration of the parasite. Eggs 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 body. When outside of the natural host larvae do not reach maturity, instead they migrate through the host to various areas of the body and are known as larva migrans.

Reported cases of NLM in humans are rare. This has primarily occurred in people with [pica](https://www.nationaleatingdisorders.org/learn/by-eating-disorder/other/pica), geophagia, developmental delays, or very young children who are more likely to come into contact with raccoon feces and practice poor hygiene. 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. This continues to 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. Cases of OLM often occur in patients with no increase in exposure risk. All documented cases of NLM, OLM, and VLM in the US are presented in Figure 2. These cases can occur alone or in conjunction with one another. Healthy, asymptomatic adults have been found to produce *Baylisascaris* antibodies. This suggests that they were exposed to a small number of *B. procyonis* eggs that were not sufficient to cause clinical disease.

<insert figure\_2\_baylis\_cases\_map.jpg>

Figure 2. Reported clinical cases of baylisascaris in the United States (1949-2017), all three presentations (total = 49 cases). Instances where an individual is infected with multiple presentations are counted as one case.

Data from [Kazacos, K.R., 2016](http://dx.doi.org/10.3133/cir1412) , [Sircar et al. 2015](http://dx.doi.org/10.15585/mmwr.mm6535a2), and [Kawakami et al. 2017](http://dx.doi.org/10.15585/mmwr.mm6702a6).

[Click thumbnail to enlarge.]

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 an area that once had raccoon feces. Dogs can also act as a 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.

## Toxoplasmosis

**Toxoplasmosis** is caused by *Toxoplasma gondii*, a common yet unusual protozoa parasite in the family Sarcocystidae. Raccoons, along with nearly any mammal or bird, can be infected with this parasite, but felids (cats) are the definitive host. The parasite must be shed in cat feces to be infective to other animals. 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 and complete the parasite’s life cycle. Cats can also become infected through indirect contact with contaminated feces from other animals. Humans can in turn be infected through contact with cat feces, or by eating undercooked meat from animals that had contact with cat feces. Cats are only infective for a short time.

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 US alone. The disease is most hazardous to developing fetuses and those whose immune system has been compromised. Pregnant women can pass the infection to the fetus, which can result in miscarriage. If the baby is born after the mother is infected, they can develop vision loss, mental disabilities, seizures, and suicidal tendencies. More [recent evidence](https://blogs.scientificamerican.com/science-sushi/toxoplasmas-dark-side-the-link-between-parasite-and-suicide/) 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.

## Chagas’ disease

**Chagas’ disease** is a potentially fatal disease caused by the protozoan parasite *Trypanosoma cruzi*. 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. Infection is spread through the feces of triatomine insects, commonly called kissing bugs, a type of [assassin insect](https://citybugs.tamu.edu/factsheets/landscape/others/ent-1003/) in the family Reduviidae. The [eastern bloodsucking conenose](http://edis.ifas.ufl.edu/in1018) is one such species. Triatomine insects are found in much of the US, but are more common in southern regions. Formally a disease of rural Latin America, Chagas’ disease has spread to cities in the southern US, and is now recognized as an emerging disease.. An estimated 8 million people are infected, with 20 to 30 percent potentially developing life threatening complications; however the majority remain in Latin America. 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 US.

<insert figure\_3\_Triatoma\_sanguisuga.jpg>

Figure 3. *Triatoma sanguisuga*, the eastern bloodsucking conenose. This species, among others, are vectors of Chagas’ disease.

Credit: Robert Webster / [xpda.com](https://xpda.com/) / [CC-BY-SA-4.0](https://creativecommons.org/licenses/by-sa/4.0/). Wikimedia Commons.

[Click thumbnail to enlarge.]

In humans, symptoms from the acute phase occur within a few months after infection and include swelling of 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 and 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 US in 2017 and can be used to treat Chagas’ disease. Nifurtimox is also used treat Chagas’ disease, but has not yet been approved by the US Food and Drug Administration (FDA).

## Heartworms

**Heartworms**, *Dirofilaria immitis*, are roundworms in the family Onchocercidae that can cause serious infections in mammals. Raccoons are known to be infected by heartworms, but canids are the natural host. It uncommonly infects humans, and infections are usually not serious, but may occasionally include coughing blood and excess fluid between the tissues that line the lungs and the chest cavity. Heartworms are spread by [mosquitoes](http://edis.ifas.ufl.edu/topic_mosquitoes) after feeding from an infected animal, making heartworm most common in areas with high mosquito populations. In dogs, heartworms can be fatal if not treated. It is uncommon in cats, but is 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](https://www.heartwormsociety.org/) and in this [EDIS Document](http://edis.ifas.ufl.edu/mg100).

## Trichinellosis

**Trichinellosis** is caused by the *Trichinella* nematodes, and acquired through eating undercooked contaminated meat, especially game meat from carnivores. 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. This may progress 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 go unnoticed, but *Trichinella* can cause symptoms in dogs that are similar to that seen in humans.

## *Dirofilaria tenuis*

***Dirofilaria tenuis***, a nematode in the family Onchocercidae, can rarely infect humans via mosquito bites, causing small, irritating nodules under the skin, and in rare cases the eye. It is much more common in raccoons where similar symptoms may occur.

## Other worms

There are parasitic worms not mentioned here that are carried by raccoons and other wildlife. Lungworms (*Crenosoma goblei* and *Filaroide*s sp.), stomach worms (*Gnathostoma procyonis*), hookworms (*Placoconus lotoris*), acanthocephalans**,** have all been isolated in raccoons. These seem to be of low concern to humans. Multiple species of *Filaroides* infect cats and dogs, though these exact species have not been found in raccoons.

# External Parasites

## Ticks

[Tick Encounter](http://www.tickencounter.org/tick_identification) 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 [EDIS documents](http://edis.ifas.ufl.edu/topic_fleas_and_ticks). Five species of ticks are known to occur on raccoons (Table 2). Their associated diseases and prevalence vary by region. The species *Ixodes texanus* primarily parasitizes raccoons and has not been shown to carry significant diseases. *Ixodes cookei* rarely bites humans, but carries the deadly Powassan virus.

Table 2: Tick species found on raccoons and associated diseases

|  |  |  |
| --- | --- | --- |
| **American dog tick**  *Dermacentor variabilis* | **Black-legged or deer tick**  *Ixodes scapularis* | **Lone star tick**  *Amblyomma americanum* |
| <insert Dermacentor\_variabilis\_M.jpg> | <insert Ixodes\_scapularis\_F.jpg> | <insert Amblyomma\_americanum\_F.jpg> |
| Credit: Jerry Kirkhart/ Wikimedia Commons | Credit: Scott Bauer/ Agricultural Research Service/Wikimedia Commons/Public Domain | Credit: James Gathany/ CDC PHIL/Wikimedia Commons/Public Domain |
| Diseases Carried:  [Rocky Mountain spotted fever](https://www.cdc.gov/rmsf/), [tularemia](https://www.cdc.gov/tularemia/) | Diseases Carried:  [Lyme disease](https://www.cdc.gov/lyme/), [babesiosis](https://www.cdc.gov/parasites/babesiosis/), [anaplasmosis](https://www.cdc.gov/anaplasmosis/), [Powassan virus](https://www.cdc.gov/powassan/), [ehrlichiosis](https://www.cdc.gov/ehrlichiosis/), [*Borrelia miyamotoi* disease](https://www.cdc.gov/ticks/miyamotoi.html) | Diseases Carried:  [STARI](https://www.cdc.gov/stari/), [tularemia](https://www.cdc.gov/tularemia/), [ehrlichiosis](https://www.cdc.gov/ehrlichiosis/), [heartland virus](https://www.cdc.gov/heartland-virus/index.html) |

## Fleas

Raccoons are know to carry *Ctenocephalides felis*, the cat flea. Despite its name, the flea can parasitize dogs and many other mammals. 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 [EDIS Documents](http://edis.ifas.ufl.edu/topic_fleas_and_ticks).

# Conclusions and Prevention

With increased development and habitat fragmentation, the risk of humans coming into contact with raccoons and other adaptable species increases. Raccoons readily adapt to urban environments (Fig. 4), thus increasing the chance for spreading diseases 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, sometimes resulting in dependence on humans, loss of their natural fear, and aggression. 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. Removing a raccoon yourself 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.

<insert figure\_4\_dumpster\_raccoons.jpg>

Figure 4. A group (gaze) of five raccoons in a dumpster, a common gathering spot.

Credit: Caitlin Jarvis.

[Click thumbnail to enlarge.]

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

# Tables

**Table 1. Summary of raccoon-borne parasites**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parasite** | **Spread** | **Infect humans and pets?** | **Prevention** | **Outcome** |
| **Baylisascaris** | Ingestion of eggs from infective raccoon feces | Infects humans, avians, many mammals, not including cats | Sanitation, avoid raccoon feces | Subclinical to fatal, neurologic impairment, blindness |
| **Toxoplasmosis** | Exposure to parasite after it has passed through cat feces | Can infect humans and pets, cats are the natural host | Sanitation | Very often subclinical, but deadly to developing fetuses |
| **Chagas’ disease** | *Trypanosoma cruzi* spread by triatomine bugs | Infects humans and dogs | Sanitation, insect repellant | Nifurtimox and benznidazole |
| **Heartworms** | Acquired though 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 |
| ***Dirofilaria tenuis*** | Spread through mosquitoes | Uncommon in humans | Avoid mosquitoes | Causes irritating nodules |
| ***Trichinellosis*** | Ingestion of parasite in undercooked meat | Can infect humans and pets | Cook meat to a safe temperature | Antiparasitic treatment available |

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