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# Raccoon Roundworm: Facts and Prevention

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The raccoon is one of the more common animals in Ohio, and is an important wildlife species in rural and urban landscapes. In Ohio and most of the Midwest, the raccoon population has increased dramatically since the 1940s, possibly in response to agricultural practices, urban development, and a decline in trapping. Chances are, regardless of where you live, there is probably at least one raccoon in close proximity to your residence during most of the year (figure 1). Because of their opportunistic behavior, raccoons can thrive in suburban/urban areas, with some urban populations reaching densities much



Figure 1. A raccoon visiting a latrine (photo by Stanley D. Gehrt).

higher than those in natural habitats. Even in rural areas, raccoons frequently use buildings as resting sites and forage in yards for trash or pet food.

Most people appreciate having raccoons nearby, and recognize the important role raccoons play in nature. However, it is important to recognize that raccoons (like all wildlife) usually carry diseases, some of which are important for people and pets. One of these diseases people should be aware of is the raccoon roundworm, *Baylisascaris procyonis*.

Although the adult form of the worm is usually harmless to raccoons, the larval form can be devastating to many animals, including humans. There is no effective treatment once infected, therefore prevention is crucial to avoiding the devastating effects of this disease.

## What is raccoon roundworm?

*Baylisascaris procyonis* is a common large roundworm parasite that resides in the small intestine of the raccoon. Although the adult worms are usually restricted to raccoons, the larvae (intermediate form) can infect a wide range of species. Adult worms are found in the small intestine of raccoons, and the female worms in one raccoon can collectively produce millions of eggs each day, which are subsequently shed in raccoon feces. Indeed, the reproductive rate of female worms is truly impressive: a single adult female worm may produce 115,000 to 877,000 eggs per day, and a raccoon infected

with multiple worms can shed up to 45,000,000 eggs daily. The eggs are resistant to a wide range of environmental conditions and, with adequate humidity, infective eggs will survive for years in the soil. Another adaptation of the egg is a sticky coating, which allows it to adhere to different surfaces, including dust particles. Intermediate hosts, such as birds or small mammals, usually become infected by accidentally ingesting the eggs in contaminated areas. People and animals can ingest eggs from the environment directly from feces, through contaminated soil, water, or from contaminated hair, feet, or hands.

After ingestion, the eggs hatch in the small intestine and the larvae penetrate the intestinal wall and many eventually migrate to the central nervous system. The severity of the infection is affected by the number and location of the larvae. Infection often results in neurological disease, paralysis, or blindness. For many animals the infection is either fatal or severely debilitating, and the cycle is completed when the raccoon consumes an infected animal and the larvae mature to adults in the raccoon's digestive tract. The whole process takes about 63 days after egg infection, and about 35 days after raccoons ingest larvae in the tissue of an intermediate host.

### What are raccoon latrines?

Raccoons often defecate in sites called latrines (figure 2), where fecal material accumulates for weeks or years. Latrines are often located near denning or feeding sites, and are associated with structures such as the base of large trees, barn lofts, fallen logs, or even up in the crotch of trees. In suburban and urban areas, latrines are found in attics, on and under decks, at the base of chimneys, on rooftops, woodpiles, and swing/play sets, in tree houses, and on picnic tables, in addition to natural structures. Most



Figure 2. Typical raccoon latrine, with multiple feces on a log (photo by Stanley D. Gehrt).

latrines are small and are usually produced by a single raccoon during a season. However, some latrines become quite large, are probably created by many raccoons, and are maintained in successive years. If raccoons are infected, large numbers of roundworm eggs can accumulate at latrines. Because the eggs can remain alive for years, these latrines can serve as long-term sources of infection for people and other animals.

### How prevalent is raccoon roundworm?

Prevalence of raccoon roundworm in natural populations of raccoons is relatively high in the temperate regions of the Midwestern United States. Infection rates from populations in the Midwest and northeast can be as high as 68–82%, and infection rates of young raccoons by *B. procyonis* can be over 90%. However, prevalence can vary among locations and seasons, and just because a raccoon is infected with worms does not mean that it is shedding infective eggs. Infection rates and egg shedding are higher within the raccoon population during late summer and autumn than in spring. Habitat fragmentation may affect the frequency of the disease. In agricultural landscapes, infection rates of small animals are higher in small woodlots than those in larger forest fragments. This is probably a result of a relatively higher density of raccoon latrines in small habitat fragments than in large fragments. Latrine densities also appear to be higher in urban fragments such as parks. A survey of residential properties in communities in California found that as many as 48% had raccoon latrines, and over 50% of these latrines had roundworm eggs.

### Which animals are affected?

Many animals are susceptible to raccoon roundworm larva, including at least 90 different wild and domesticated animals. Outbreaks of the disease have occurred on farms, in zoos, and commercial operations of quail, pheasants, and rabbits. All rodents, birds, and rabbits appear to be susceptible and compose the natural intermediate hosts for the disease. Natural infections have also been reported in many carnivores (dogs, foxes, weasels), marsupials (opossum), and primates, including humans. Human cases have been reported from California, Illinois, Massachusetts, Michigan, New York, and Pennsylvania, including some fatalities.

### How does it affect people?

Infection of humans is usually the result of ingesting eggs through the mouth. Children are especially vulnerable because of their habit of putting objects in their mouth,

and they are often attracted to objects on the ground. Once ingested, larvae migrate to nervous tissue, especially the brain and eyes. Although there have been few reported human cases of raccoon roundworm infection, the disease is difficult to diagnose and is probably underreported.

Clinical signs of nervous system infection by raccoon roundworm may appear as soon as two to four weeks after ingestion of eggs. Symptoms range from mild neurological signs to more severe paralysis, coma, blindness, and death. How different people are affected by infections is still poorly understood, but it appears the greater number of eggs ingested results in more severe infections.

Diagnosis is difficult unless a person exhibits symptoms. Once an infection becomes advanced, current treatments are usually ineffective. Because a “cure” does not exist for this disease, prevention is the most effective means of controlling the disease.

### How do I prevent raccoon roundworm infections?

One strategy to reduce exposure to raccoon roundworm is to reduce raccoon presence on the property. In yards, raccoons are attracted to water and food, so removing these can help limit raccoon visits. Homeowners should remove trash or keep trash cans closed, and pet food for outdoor pets should be brought indoors each evening. Feeding of wildlife should be discouraged, which can include bird feeders where raccoons are common. Bird feeders can also be brought in during nighttime if feeding of birds is highly desired.

Homeowners should make periodic checks on the property for accumulations of raccoon feces, especially where small children play (figure 3). Feeding of raccoons should be discouraged, as raccoons often defecate near feeding areas. Try to think like a raccoon and look in areas that might be used by the animal, such as large trees, woodpiles, chimneys, etc. If a latrine is found, it should be removed with caution. Gloves, rubber boots, and coveralls should be worn when removing fecal material. The material should be placed in plastic bags and deposited in trash containers or incinerated. If the latrine is located on the ground, 2–3 inches of topsoil should also be removed. When a latrine must be removed from a confined area such as an attic or barn loft, a particle face mask should also be worn to avoid inhaling dust laden with eggs. Because the eggs are sticky, clothes worn during handling the fecal material should not be brought inside. Washing with bleach will remove the sticky outer covering on the egg but will not destroy the egg. Boiling lye or propane torching is necessary to destroy eggs; however, using flame sources around a home



Figure 3. A raccoon latrine on a children's playset in a backyard (photo by Stanley D. Gehrt).

is hazardous and should be discouraged unless surfaces like concrete or soil are to be decontaminated.

Hunters, trappers, wildlife rehabilitators, and wildlife control professionals that handle large numbers of raccoons should take precautions such as wearing gloves and washing hands, and avoiding raccoon fecal material when necessary. Children should be taught to avoid fecal material, and to wash their hands after playing outside. Young children should be watched carefully if playing in wooded areas. When picnicking or eating outside, avoid areas that might be contaminated with raccoon feces. When taking children to an outdoor park or playground, inspect the area for possible raccoon feces.

Precautions to take at home include removing outside pet food, removing unnecessary woodpiles, and removing trash that might be accessible to raccoons. Homeowners should look for latrines while checking gutters or roofs. Latrines that occur on roofs may be easily missed, but also may be important for residents. Because residents are unaware of the latrine, rooftop latrines are often large with considerable fecal material, which then wash down the gutter to the ground, thereby becoming more accessible to residents. This type of contamination has been implicated in at least one serious human infection in California.

In some cases where raccoon densities are extremely high, it may be necessary for municipalities or landowners to reduce the population. Before doing so, it is important to consult with the Division of Wildlife regarding pertinent regulations. If removal is necessary, it is important to remember that removal is temporary as other raccoons will soon occupy the vacated area unless other preventive measures are employed as discussed above. Also, it only takes one raccoon to make a latrine, so removal by itself is not always successful in reducing possible exposure to raccoon roundworm.

## Keep it in perspective

Although the disease is frightful, it is important to remember that common sense is the best prevention. Despite the tremendous adaptations of the parasite, such as a high reproductive rate and resistant eggs, few people have been diagnosed with an infection. Trappers, biologists, and others have handled raccoons for decades without complications, and people use habitats every day that contain many raccoons. People should continue to enjoy raccoons, whether as a furbearer or as an animal to be watched. Simply being aware of the roundworm and avoiding raccoon latrines is probably the most important approach to avoiding infections of this parasite.

## Sources

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### **Points to remember:**

- Don't keep raccoons as pets.
- Avoid feeding raccoons.
- When sweeping dry raccoon feces from attics, basements, barns, etc., wear disposable gloves and a protective mask.
- Don't use raccoon feces as a garden fertilizer.
- Screen/cap chimneys appropriately, block holes and access to attics, under sheds, porches, decks, and other buildings.
- Hunters/trappers should wash hands after handling raccoons.
- Use caution with firewood that raccoons may have used as latrines.
- Cover children's sandboxes to keep animals from using them as latrines.

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