

PARASITE PROTOCOLS FOR YOUR PRACTICE

FELINE HELMINTHS



Recommendations from the Companion Animal Parasite Council

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The mission of the **Companion Animal Parasite Council (CAPC)** is to foster animal and human health, while preserving the human–animal bond, through recommendations for the diagnosis, treatment, prevention, and control of parasitic infections. For more information, including detailed parasite control recommendations, please visit capcvet.org.



Helminth infection in cats is remarkably common. Recent surveys have documented helminths in more than $\frac{2}{3}$ of adult cats examined in animal shelters in some areas.¹ The most common nematode of cats, *Toxocara cati*, also has zoonotic potential, making control particularly important.

The high prevalence of infection is often surprising to both veterinarians and parasitologists, in part because fecal flotation may fail to reveal the presence of helminths. An absence of helminth eggs on fecal flotation is especially true for tapeworms; a recent study showed that, in 87% of cats with tapeworms confirmed in the small intestine, eggs were not detected on fecal flotation.¹

Dirofilaria immitis (heartworm) also infects and causes disease in cats, although diagnostic test results can be difficult to interpret.²

Broad-spectrum anthelmintic products are widely available to protect and treat cats, but their use and acceptance remain limited. To protect feline health and limit environmental contamination with zoonotic parasites, CAPC recommends use of year-round parasite control products in cats throughout all areas of the United States.³

FELINE GASTROINTESTINAL HELMINTHS

Nematodes

The most common gastrointestinal nematodes among continental North American cats are ascarids (*T cati* and *Toxascaris leonina*) and hookworms (*Ancylostoma tubaeforme*). Other nematodes occasionally seen include *Physaloptera* species, *Strongyloides* species, and *Ollulanus tricuspis*.

Ascarids. Cats acquire infection with ascarids by ingestion of larvated eggs from the environment or ingestion of rodents or birds that have ingested eggs. In some surveys, *T cati* eggs are identified by fecal flotation in as many as 35% of cats, and necropsy surveys place the prevalence even higher.^{4,5}

Kittens infected with *T cati* may have a pot-bellied appearance and general ill thrift; adult cats also commonly harbor infection. Migration of adult *T cati* into the stomach irritates the mucosa, resulting in vomiting, and *T cati* are commonly found in feline vomitus. The other feline ascarid, *T leonina*, is less common than *T cati* and not thought to be associated with clinical disease.³

Hookworms. The hookworm, *A tubaeforme*, is found in the small intestine of cats and has been associated with anemia and weight loss; *Ancylostoma braziliense* also occurs but is much less common in the United States.

Cats become infected with hookworms upon ingestion of larvae or ingestion of rodent paratenic hosts; unlike with dogs and *Ancylostoma caninum*, transmammmary transmission with *A tubaeforme* is not known to occur.³

Diagnosis. Infection with ascarids and hookworms can often be diagnosed by fecal flotation. To ensure adequate sensitivity to allow detection, CAPC recommends that fecal flotation be performed by centrifugation, using an adequate sample size. However, eggs cannot be detected if only a single sex of worm is present or the nematodes are immature and, thus, prepatent.

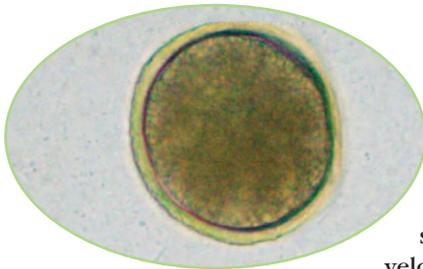


Figure 1. Egg of *Toxocara cati*; note the pitted shell and dark appearance.

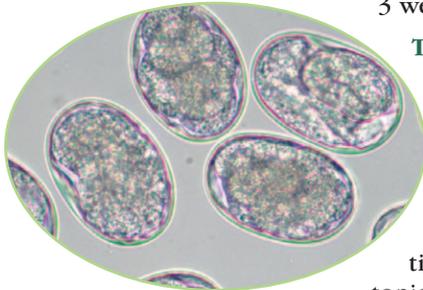


Figure 2. Thin-shelled oval egg of *Ancylostoma tubaeforme*.

Eggs of *T cati* are spherical and surrounded by a thick, roughly pitted shell (**Figure 1**), while eggs of *A tubaeforme* are oval and smooth shelled and contain a developing embryo (**Figure 2**). The prepatent period for *T cati* is 4 to 5 weeks, while that of *A tubaeforme* is 2 to 3 weeks.

Treatment. Both ascariids and hookworms are readily treated with several different anthelmintics, including pyrantel, emodepside, milbemycin, moxidectin, and selamectin; the topical formulation of some of these compounds facilitates administration to cats.³

Cestodes

Historically, adult tapeworms in the intestinal tract have not been thought to cause significant clinical disease in cats. However:

- Intestinal impactions with *Taenia taeniaeformis* necessitating surgical removal have been reported⁶
- *Spirometra* species, a common cestode of cats in some coastal and swampy areas, can cause diarrhea, vomiting, and weight loss.⁷

Feline intestinal infections with *Mesocestoides* species are usually asymptomatic, but organisms in extraintestinal stages (tetrathyridia) that multiply asexually in the abdominal cavity can cause severe clinical sequelae, including death, in some cats.

Life Cycle & Transmission. All of these cestodes have an indirect life cycle, requiring 1 or more intermediate hosts:

- *T taeniaeformis* and *Dipylidium caninum* use rodents and fleas, respectively.
- *Spirometra* species require a copepod first intermediate host and then use many different vertebrates as second intermediate hosts.
- The life cycle of *Mesocestoides* species has not yet been determined, but ingestion of vertebrate intermediate hosts containing tetrathyridia is considered the most likely route of intestinal infection.⁸

Diagnosis. Diagnosis of cestode infection is challenging. Fecal flotation is recommended, and, when identified, eggs definitively confirm the presence of tapeworms. However, in most cats with cestodes, eggs from the small intestine are not recovered on fecal flotation,¹ but owner reports of proglottids are helpful in reaching a diagnosis.

Treatment. In cats that commonly ingest prey species, infections are likely, and presumptive treatment may be war-

ranted. Praziquantel and epsiprantel are label-approved as effective against *T taeniaeformis* and *D caninum*, and can be used off-label for treatment of intestinal *Mesocestoides* species.

Effective treatment of *Spirometra* species is more difficult, requiring administration of an elevated, off-label dose of praziquantel (25 mg/kg PO Q 24 H) for 2 consecutive days.⁷

Trematodes

Gastrointestinal trematode infection in cats is rare compared with nematode and cestode infection. However, occasional infections with *Alaria* species or *Nanophyetus salmincola* are seen in certain geographic areas.

Life Cycle & Transmission. *Alaria* species infections are acquired when cats prey on intermediate or paratenic hosts, such as frogs and snakes, that harbor the metacercariae. Migration of immature *Alaria* species through the lungs can lead to pulmonary damage, with focal areas of hemorrhage evident.³

Feline infection with *N salmincola* occurs when cats ingest metacercariae in salmonid fish. Although trematodes develop in the small intestine, classic “salmon poisoning” disease due to *Neorickettsia helminthoeca* infection has not been described in cats.³

Diagnosis. Diagnosis of infection with *Alaria* species, *N salmincola*, and other trematodes usually requires concentrating eggs by sedimentation, because the eggs do not readily float in the specific gravity of many flotation solutions.

Identity of trematode eggs can usually be confirmed by the presence and shape of the operculum, general egg morphology, and size. For example, eggs of *Alaria* species are approximately 120 microns × 70 microns, are operculate, and contain an undifferentiated embryo when shed (**Figure 3**).

Treatment. Although no products are label-approved for trematode treatment in cats, praziquantel is expected to be effective.³

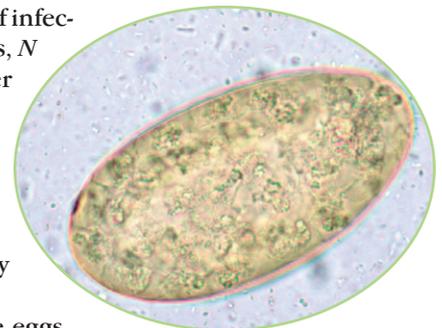


Figure 3. Large eggs of *Alaria* species recovered from infected cat.

FELINE EXTRAINTESTINAL HELMINTHS

Nematodes

The 2 most common extraintestinal nematodes infecting cats in North America are heartworms (*D immitis*) and feline lungworms (*Aelurostrongylus abstrusus*).³ Both parasites can cause respiratory disease in cats due to pulmonary damage.

The death of developing *D immitis* may lead to pulmonary, bronchial, and alveolar disease in cats collectively referred to as heartworm-associated respiratory disease;

adult heartworms in the pulmonary artery are associated with sudden death.

Life Cycle & Transmission. *D immitis* is transmitted by mosquitoes, and dogs are considered the main reservoir host. Microfilariae rarely persist in cats long enough for them to serve as a source of infection to mosquitoes.⁹

Snails and slugs are required intermediate hosts for *A abstrusus*, but infections are most common in cats allowed to prey on rodent, avian, or lizard paratenic hosts.

Clinical Signs. Vomiting is often present in cats infected with *D immitis*, while some cats infected with *A abstrusus* develop chronic cough, dyspnea, and anorexia.

Diagnosis. Diagnosis of heartworm infection in cats is complicated by the low number of worms present and the robust immune response of the feline host.

In cats with respiratory disease or other clinical signs suggestive of heartworm infection, both antigen and antibody tests should be performed (see **Feline Heartworm: Antigen Versus Antibody Tests**). Heat treating serum prior to antigen testing destroys immune complexes, revealing antigen for detection.² Radiography and echocardiography can also be helpful in assessing disease status and confirming infection.

Diagnosis of *A abstrusus* depends on identification of first-stage larvae in fecal samples (**Figure 4**). Procedures that allow recovery of *A abstrusus* larvae include direct smear, centrifugal fecal flotation, and Baermann examination.

Treatment. Adulticide treatment is not recommended for cats with heartworm. However, cats with dyspnea or respiratory distress should receive supportive



Figure 4. Larvae of *Aelurostrongylus abstrusus* detected on fecal examination of infected cat.

Feline Heartworm: Antigen Versus Antibody Tests

Both antigen and antibody tests are available to identify feline heartworms.

Antigen tests are very sensitive and specific, but cats with heartworm often harbor a low number of worms, and antigen levels are correspondingly low.⁹ In addition, the strong immune response appears to result in antigen-antibody complex formation, preventing detection of antigen on commercial tests.²

Antibody test results can be similarly problematic to interpret. Many cats in endemic areas may be antibody positive, indicating that a past or current infection has likely occurred, but the cat is clinically healthy and infection free.

care, such as corticosteroids, oxygen therapy, or bronchodilators. Preventive use is also recommended to limit additional infections.⁹

There are no label-approved treatments for *A abstrusus* infection, but efficacy has been documented with topical moxidectin and topical emodepside.^{10,11}

Cestodes

Mesocestoides species may establish both intestinal infections (described earlier) and, rarely, extraintestinal infections in cats.

Clinical Signs & Transmission. Cats with peritoneal mesocestodiasis develop vomiting, diarrhea, weight loss, and ascites due to asexual replication of tetrathyridia (immature forms) of *Mesocestoides* species in the peritoneal cavity, but some clinically silent infections are discovered during routine laparotomy and ovariohysterectomy. The route of exposure responsible for the peritoneal form is not known.

Diagnosis. Diagnosis may be suspected at ultrasonography and is confirmed by cytology or laparoscopic examination. Calcareous corpuscles in cytologic fluid help confirm the presence of a cestode.

Treatment. Treatment is difficult, requiring peritoneal lavage followed by long-term administration of fenbendazole. Prognosis for cats with peritoneal mesocestodiasis is guarded.⁸

Trematodes

Feline infection with systemic trematodes, including *Paragonimus kellicotti* in the lungs and *Platynosomum fastosum* in the liver, is also relatively uncommon. However, because of the severe disease that develops in infected cats, these parasites are important in certain endemic areas.

Life Cycle & Transmission. *P kellicotti* adults develop in cysts in the lungs of cats; infection with *P kellicotti* occurs when cats ingest crayfish intermediate hosts from fresh water rivers and streams.

P fastosum is a fluke of the bile ducts of cats in Florida, the coastal southeastern U.S., and Hawaii; infections are also common on several Caribbean islands. The condition is commonly called *lizard poisoning* because cats usually acquire infection following predation on lizards and other reptile paratenic hosts.

Clinical Signs. *P kellicotti* infections may be asymptomatic or can lead to respiratory disease characterized by dyspnea, pneumothorax, and hemoptysis.

Cats infected with *P fastosum* develop hepatic insufficiency and ultimately liver failure, with enlarged bile ducts and biliary epithelial hyperplasia evident; infection also has been associated with metastatic feline cholangiocarcinoma.¹²

Diagnosis. *P kellicotti* infections often result in large pulmonary cysts that are visible on radiographs, and the characteristic large, operculate eggs may be identified on trans-

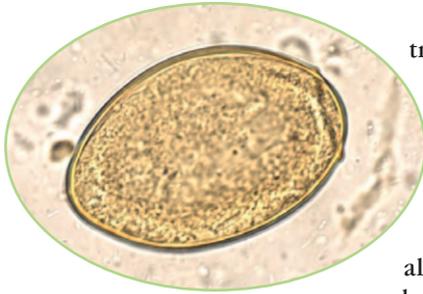


Figure 5. *Paragonimus kellicotti* egg, with distinct operculum, on fecal sedimentation.

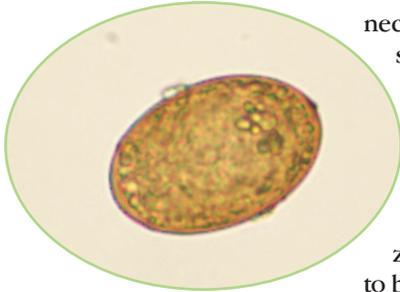


Figure 6. Egg of *Platynosomum fastosum* recovered on fecal sedimentation from infected cat.

tracheal wash or fecal sedimentation (Figure 5).

P fastosum diagnosis can be supported by ultrasonography, which reveals dilated bile ducts and, occasionally, trematodes. Eggs may be detected on fecal sedimentation (Figure 6), but when biliary hyperplasia is severe, liver biopsy may be necessary to achieve a diagnosis because cholestasis prevents egress of eggs.

Treatment. For *P kellicotti* infections, repeated treatment is often necessary, but both fenbendazole and praziquantel have been reported to be effective.^{13,14}

For *P fastosum* infections, praziquantel is the recommended treatment, although, in severe cases with liver failure, the prognosis is guarded.¹⁵

PUBLIC HEALTH CONSIDERATIONS

Many feline helminths are zoonotic, underscoring the importance of their control.

T cati is associated with visceral and ocular larva migrans in humans who ingest larvated eggs from contaminated soil. *T cati* adults have also been recovered from humans, usually children, but these infections are generally attributed to ingestion of adult worms from feline vomit.¹⁶

The zoonotic potential of *A tubaeforme* is considered low, but cutaneous larva migrans is reported and is commonly seen in humans exposed to *A braziliense* contaminated soil.³

The literature also contains many reports of *D caninum* infections in children following ingestion of infected fleas.¹⁷

Other feline helminths may occasionally infect humans, but cats are not considered the primary source. For example, human infection with *P kellicotti* has been reported following ingestion of raw crayfish,¹⁸ and *Mesocestoides* species, *Alaria* species, *Spirometra* species, and *N salmincola* infections have all been described following ingestion of, or contact with, tissues from infected intermediate or paratenic hosts.^{3,7,19,20}

SUMMARY

Although not always appreciated by cat owners or veterinarians, infection with helminths is common in many

TABLE. Common Helminths of Domestic Cats in North America

HELMINTH	SPECIES	INTERMEDIATE HOSTS	PARATENIC HOSTS	RESERVOIR HOSTS	ZOONOTIC
Gastrointestinal					
Nematodes	<i>Ancylostoma tubaeforme</i>	None	None	Cat	Yes
	<i>Toxocara cati</i>	None	Rodents, birds	Cat	Yes
	<i>Toxascaris leonina</i>	None	None	Cat, dog	No
Cestodes	<i>Dipylidium caninum</i>	Flea, louse	None	Cat, dog	Yes
	<i>Mesocestoides</i> species	Unknown; then many vertebrates	Unknown	Wild carnivores	Yes
	<i>Spirometra</i> species	Copepod; then many nonfish vertebrates	Most vertebrates	Cat, dog, wild carnivores	Yes
	<i>Taenia taeniaeformis</i>	Rodent	None	Cat	No
Trematodes	<i>Alaria</i> species	Snail, then tadpole	Frogs, reptiles, small mammals, birds	Opossums, wild carnivores	Yes
	<i>Nanophyetus salmincola</i>	Snail, then salmonid fish	None	Many mammals and birds	Yes
Extraintestinal					
Nematodes	<i>Aelurostrongylus abstrusus</i>	Snail, slug	Many vertebrates	Cat	No
	<i>Dirofilaria immitis</i>	Mosquito	None	Dog	Yes
Cestodes	<i>Mesocestoides</i> species	Unknown; then many vertebrates	Unknown	Wild carnivores	Yes
Trematodes	<i>Paragonimus kellicotti</i>	Snail; then crayfish	Many vertebrates	Wild carnivores	Yes
	<i>Platynosomum fastosum</i>	Snail; then lizards	Many vertebrates	Cats	No

cats. Cats with outdoor access or those that hunt are at increased risk, but indoor cats are not free of parasites.

Helminths can cause disease in both cats and, potentially, their human families. Reducing parasitism in cats serves both feline and public health. CAPC offers specific strategies to protect cats from parasites year-round through the recommendations published at capcvet.org. ■

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