

PARASITE 101



Tapeworms — Dealing with Zoonotic Issues

By Lora R. Ballweber, DVM, DEVPC

Owners may not recognize the importance of tapeworms, but veterinarians are well aware of the meaning of those little “rice grains” in the feces of dogs and cats. Although tapeworms are not uncommon in dogs and cats, they usually do not result in overt disease and, therefore, are not usually recognized as an issue by pet owners. For that reason, recognition of tapeworm infection may not occur, and treatment may be unnecessarily delayed.

The players

Two major groups of tapeworms can infect dogs

and cats: the cyclophyllideans and the pseudophyllideans. The cyclophyllideans include the commonly reported *Dipylidium caninum* and *Taenia* spp as well as *Echinococcus* and *Mesocestoides* spp, and the pseudophyllideans include *Spirometra* and *Diphyllobothrium* spp.

These organisms have indirect life cycles that require specific intermediate hosts for development (Figures 1 and 2; Table 1). Cats and dogs become infected after consuming the intermediate or paratenic host containing the larval cestode.¹⁻³ Therefore, most infections in pets occur

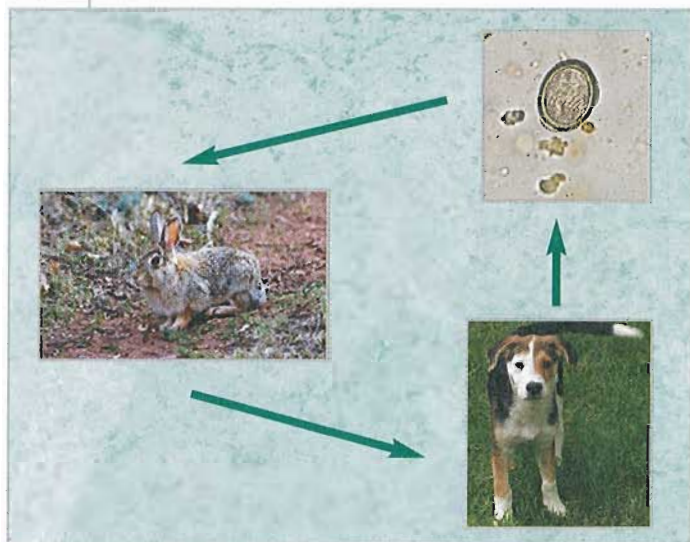


Figure 1. Basic *Taenia* life cycle. Proglottids are passed in the feces of the definitive host. Eggs are released and ingested by an intermediate host in which the larval cestode develops, and the mature cestode develops in the canine or feline definitive host after ingesting the intermediate host.

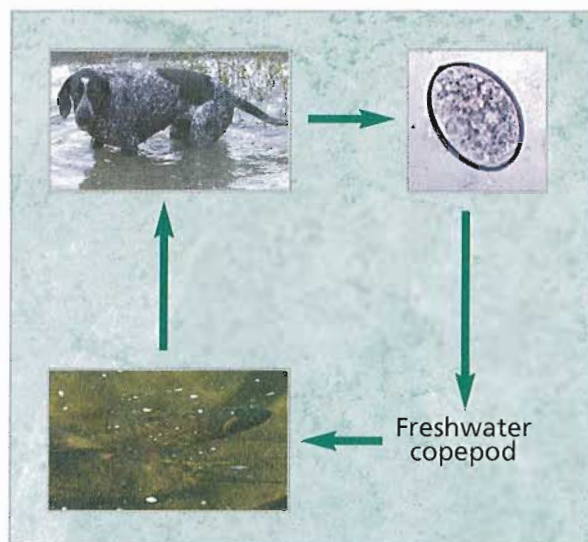


Figure 2. Life cycle of *Diphyllobothrium*. Operculated eggs are passed with feces, develop, and hatch in water. Sequential larval stages develop first in a freshwater copepod, followed by a variety of fish. Infection of the canine or feline definitive host occurs on ingestion of the fish host through scavenging or predation.

Protecting Pets and People from Parasites

The Companion Animal Parasite Council (CAPC) is an independent council of veterinarians and other animal health care professionals established to create guidelines for the optimal control of internal and external parasites that threaten the health of pets and people. It brings together broad expertise in parasitology, internal medicine, public health, veterinary law, private practice, and association leadership. Initially convened in 2002, the CAPC was formed with the expressed purpose of changing the way veterinary professionals and pet owners approach parasite management. The CAPC advocates best practices for protecting pets from parasitic infections and reducing the risk for zoonotic parasite transmission. Sponsoring the peer-reviewed Parasite 101 column is one more avenue for reaching veterinarians on important topics and issues related to the prevention of parasitic transmission and disease.



through predation or the ingestion of undercooked animal tissue.

Disease presentation

Mature cestodes live in the small intestine of cats and dogs. Although gastrointestinal upset — vomiting and/or diarrhea — and weight loss may be associated with infection by *Spirometra* and *Diphyllobothrium* spp, infections with mature *D. caninum*, *Taenia* spp, or *Echinococcus* spp tend to cause relatively few problems.

Infection with larval tapeworms can be problematic, however. For example, infection with larval *Mesocestoides* may result in canine peritoneal larval cestodiasis (CPLC), a potentially fatal disease characterized by masses of larval *Mesocestoides* residing within the peritoneal cavity. Because the complete life cycle of *Mesocestoides* tapeworms is unknown, how dogs acquire CPLC or what can be done to prevent it also is unclear.⁴ Likewise, infection with larval stages of *Taenia crassiceps* can result in fatal infection in both dogs and cats.^{5,6}

Diagnosis

Both *D. caninum* and *Taenia* spp release egg-laden proglottids that are eliminated in the feces and are, therefore, the tapeworms most commonly associated with the “rice grains” found in feces. The proglottids of *D. caninum* and *Taenia* are mobile and capable of migrating through the anal sphincter at times other than during the passage of feces. Therefore, proglottids also can be found on the animal’s fur or in areas where the animal has rested, which often can be a

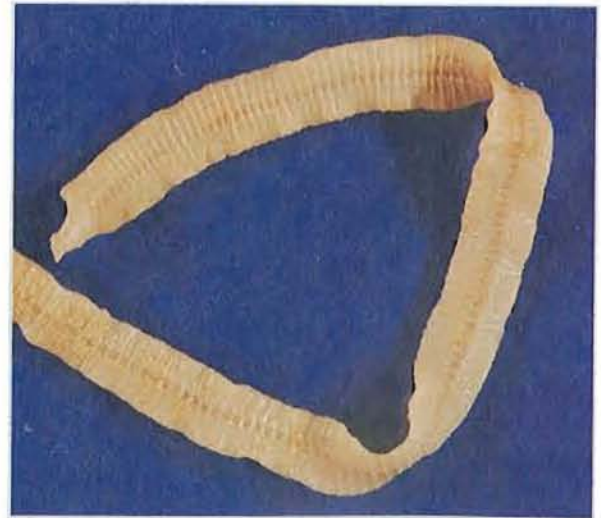


Figure 3. Segments of *Spirometra* found in the vomitus of a domestic cat. Note the midline genital pore (darker dot in the middle of each segment).

Table 1. Intermediate Hosts for Common Tapeworms of Dogs and Cats

Cestode	First Intermediate Hosts	Second Intermediate Hosts	Paratenic Hosts
<i>Dipylidium caninum</i>	Fleas, lice	None	None
<i>Taenia</i> spp	Ruminants, lagomorphs (dogs); rodents (cats)	None	None
<i>Echinococcus</i> spp	Ruminants (dogs); rodents (dogs, cats)	None	None
<i>Mesocestoides</i> spp	Unknown; possibly ants	Nonfish vertebrates	Unknown
<i>Spirometra</i> spp ^a	Freshwater copepod	Nonfish vertebrates	Nonfish vertebrates
<i>Diphyllobothrium</i> spp ^a	Freshwater copepod	Freshwater fish	Freshwater fish

^aMultiple intermediate and paratenic hosts are involved in the pseudophyllidean life cycle. Intermediate hosts are those in which preadult stages are found and are required for completion of the life cycle. When two intermediate hosts are involved, the host that occurs first in the life cycle is called the first intermediate host and the host that follows is called the second intermediate host. Paratenic hosts are those in which the preadult stage(s) may live, albeit with little to no development, and the host is not required for completion of the life cycle.

distressful discovery for the owner.

In contrast, *Echinococcus* tapeworms are quite small, measuring 2 to 7 mm long, which makes spotting individual proglottids impossible. Consequently, unless taeniid cestode eggs are found on fecal flotation, infection with *Echinococcus* spp in domestic dogs and cats may go unrecognized. Adding to the problem is the assumption that any taeniid egg found on fecal flotation belongs to a species of *Taenia*. This as-

sumption, however, may be false, as eggs produced by *Echinococcus* can be difficult to differentiate from those of *Taenia*. The eggs of *Spirometra* spp and *Diphyllobothrium* spp also can be readily detected on fecal flotation, particularly with higher specific gravity (e.g., ≥ 1.25) flotation medium. In addition, long chains of segments may be found in vomitus or feces and can be identified by the presence of a distinct medial genital pore (Figure 3).

Table 2. Treatment Options for Canine and Feline Tapeworm Infections^a

Tapeworm (Species)	Drug/Treatment Regimen
<i>Dipylidium caninum</i> (feline); <i>Taenia taeniaeformis</i> (feline)	Praziquantel, topical at 12 mg/kg, single treatment; praziquantel, oral at 5 mg/kg, single treatment; epsiprantel, oral at 1.25 mg/kg, single treatment
<i>Dipylidium caninum</i> (canine); <i>Taenia pisiformis</i> (canine)	Praziquantel, oral at 5 mg/kg, single treatment; epsiprantel, oral at 2.5 mg/kg, single treatment; fenbendazole, ^b oral at 50 mg/kg, single treatment
<i>Echinococcus</i> spp (canine)	Praziquantel, oral at 7 mg/kg, single treatment
<i>Spirometra</i> spp (canine, feline); <i>Diphyllobothrium</i> spp (canine, feline)	Praziquantel, ^c oral at 7.5 mg/kg (canine) or 20 to 30 mg/kg (feline), single treatment or daily for 2 days

^aDoses and treatment schedules should be verified on package inserts before use.
^bLabeled for *T. pisiformis* only.
^cExtra-label use; see Bowman DD, Hendrix CM, Lindsay DS, Barr SC. *Feline Clinical Parasitology*. Ames, Iowa: Iowa State University Press; 2002 and Kirkpatrick CE, Knochenhauer AW, Jacobson SI. Use of praziquantel for treatment of *Diphyllobothrium* sp infection in a dog. *JAVMA* 1987;190:557-558.

Zoonotic concerns

All the cestodes discussed here also can infect humans. In some cases, the eggs shed by an infected cat or dog are directly infectious to humans. In other cases, humans acquire infections by ingesting the intermediate host, and infected cats or dogs serve as a source of infection for these hosts.

Taenia and *Echinococcus* eggs shed in the feces of an infected cat or dog are immediately infectious when passed. Ingestion by humans can result in the development of larval tapeworm cysts, the treatment of which often requires surgical removal or extended chemotherapy.⁷

Humans are definitive hosts for *D. caninum*; infections in children who have accidentally ingested infected fleas have been reported. Intestinal upset may occur, and although these infections are easily treated, the presence of infection in a family member can be upsetting.

Occasional human infections with *Mesocostoides* spp and *T. crassiceps* have been reported in North America but appear to be relatively rare.^{8,9} Humans also are normal definitive hosts for *Diphyllobothrium* spp, acquiring infections through the ingestion of raw fish. Humans also can be infected with larval *Spirometra* through accidental ingestion of larval cestodes in either the first or second intermediate hosts.

Tapeworm infections are easily treated in cats and dogs (Table 2), although treating the infected animal is only part of the overall control program. For example, implementing a flea or louse control program is integral in controlling infections of *D. caninum*. Preventing predation or scavenging is key to controlling infections with

the other species of cestodes. Without such programs, reinfections are probable.

Although modern insecticides have helped control flea infestations, entirely eliminating scavenging or predation is considerably more difficult. Consequently, routine deworming with a cestocidal anthelmintic may be needed. YF

References

1. Padgett KA, Boyce WM. Ants as first intermediate hosts of *Mesocostoides* on San Miguel Island, USA. *J Parasitol* 2005;79:67-73.
2. Bowman DB. Helminths. In: *Georgis' Parasitology for Veterinarians*, ed 8. Philadelphia: WB Saunders; 2003:115-243.
3. Ballweber LR. Introduction to the endoparasites. In: *Veterinary Parasitology*. Boston, Ma.: Butterworth-Heinemann; 2001:53-76.
4. Crosbie PC, Padgett KA, Boyce WM. *Mesocostoides* spp. tapeworm infections in dogs in California. *California Vet* 2000;54:15-16, 27-28.
5. Hoberg EP, Ebinger W, Render AJ. Fatal cysticercosis by *Taenia crassiceps* (Cyclophyllidae: Taeniidae) in a presumed immunocompromised canine host. *J Parasitol* 1999;85:1174-1178.
6. Wünschmann A, Garlie V, Averbek G, et al. Cerebral cysticercosis by *Taenia crassiceps* in a domestic cat. *J Vet Diagn Invest* 2003;15:484-488.
7. Kazacos KR. Cystic and alveolar hydatid disease caused by *Echinococcus* species in the contiguous United States. *Compend Contin Educ Pract Vet* 2003;suppl25:16-20.
8. Fuentes MV, Galán-Puchades MT, Malone JB. A new case report of human *Mesocostoides* infection in the United States. *Am J Trop Med Hyg* 2003;68:566-567.
9. Aghamohammadi S, Yoken J, Lauer AK, et al. Intraocular cysticercosis by *Taenia crassiceps*. *Retinal Cases Brief Rep* 2008;2:61-64.

Dr. Ballweber reported no potential conflict of interest relevant to this article. The CAPC receives financial support from pharmaceutical companies.

Dr. Ballweber is associate professor in the department of microbiology, immunology and pathology, College of Veterinary Medicine & Biomedical Sciences, Colorado State University, Fort Collins.