

**UNWELCOME GUESTS**  
Dogs can become infected with tapeworms by ingesting fleas or lice containing infectious cysticercoids.

PARASITOLOGY

# Canine Tapeworms

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Several species of tapeworms can live as adults in the small intestines of dogs. In the United States, infections with tapeworms such as *Dipylidium caninum* and *Taenia pisiformis* are very common, while infections with tapeworms in the genera *Mesocostoides*, *Echinococcus*, *Dibothriocephalus*, and *Spirometra* are less common. This article discusses *D. caninum* and *T. pisiformis* in detail, with a brief mention of the rarer tapeworms.

*D. caninum*—known as the flea tapeworm, double-pored tapeworm, or cucumber-seed tapeworm—is found in dogs and cats in the United States. Two distinct host-associated genotypes of *D. caninum* have been demonstrated: the “feline genotype” and the “canine genotype.”<sup>1</sup>

Several species of *Taenia* tapeworms can be found as adults in the small intestines of dogs. They are acquired when dogs ingest the infective stages in intermediate-host “prey” animals. The most common *Taenia* species in dogs in the United States is *T. pisiformis*, which uses rabbits as the intermediate host.

## LIFE CYCLE AND TRANSMISSION

Canine tapeworms typically use a predator and prey to

complete their life cycle. Adult tapeworms are chains of flattened, progressively maturing segments (called proglottids) beginning anteriorly at the scolex and ending terminally as mature, gravid proglottids. Both *Dipylidium* and *Taenia* tapeworms shed segments into the intestines that are passed out in the feces of dogs. The segments are white and resemble rice grains. They may show motility on the dog’s perineum, feces, or bedding or house furniture where the dog has been resting. This can cause disgust and severe distress to pet owners.

In the case of *D. caninum*, terminal proglottids passed into the feces break down to release egg packets into the environment (FIGURE 1). The egg packets are ingested by flea larvae or immature stages of lice developing in the same environment and mature to infectious cysticercoids in these intermediate hosts. Dogs become infected by ingesting fleas or lice containing infectious cysticercoids. *D. caninum* obligately uses fleas (*Ctenocephalides felis*, *Pulex irritans*) or lice (*Trichodectes canis*) in its life cycle. In the absence of arthropods, the life cycle cannot be completed. Oral transmission through the ingestion of infected insects is the only recorded route of infection in dogs and humans, primarily children. The prepatent period (i.e., the time from ingestion of infected fleas to



the time that *Dipylidium* segments or egg packets can be detected in feces) can be as short as 17 to 18 days.<sup>2</sup>

In the case of *T. pisiformis*, terminal proglottids that are shed into feces break down to release single taeniid-type eggs (FIGURE 2). Eggs in contaminated yards, parks, or wildernesses may be ingested by rabbits, in which the intermediate stages, called cysticerci, develop in the visceral organs. Cysticerci in rabbit viscera must be ingested by a dog for the life cycle to be completed. *T. pisiformis* is not zoonotic; however, other *Taenia* species that infect dogs, such as *Taenia serialis* and *Taenia multiceps*, may cause human infections. The prepatent period is 42 to 56 days.

### DISTRIBUTION AND PREVALENCE

Both *D. caninum* and *Taenia* species are found globally and infect all age groups of dogs.<sup>3</sup> *D. caninum* is the most common tapeworm found in dogs in the United States, and *Taenia* species are the second most common. No seasonality has been observed with either infection. A survey of nontreated shelter dogs in Oklahoma revealed that 49.5% were infected with *D. caninum* while 7.2% were infected with *Taenia* species.<sup>4</sup> Client-owned dogs in a different study had a lower prevalence, with 0.84% having *D. caninum* proglottids or egg packets and 0.47% having *Taenia* proglottids or eggs.<sup>3</sup>

The prevalence of *T. pisiformis* cysticerci in rabbit populations is unknown, as studies to evaluate prevalence of infection in intermediate hosts is lacking. One study in Kentucky found 53% of rabbits to be harboring cysticerci.<sup>5</sup>

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### CLINICAL PRESENTATION

Canine tapeworms are generally well tolerated by the infected animal, with few or no clinical signs. Released tapeworm segments may be actively motile and cause anal pruritus and scooting behavior in a few infected animals. Adult *D. caninum* and *Taenia* tapeworms in the intestine are well tolerated even in large numbers.<sup>4</sup>

Very rarely, companion animals may become intermediate hosts for *Taenia* species. *Taenia crassiceps* has been reported to be the cause of subcutaneous cysticercosis in a dog.<sup>6</sup>

### DIAGNOSIS

The life stages of tapeworms that are useful in diagnosing infection are (a) the proglottids shed into the intestines by adult worms, which can be recovered from feces or the perineal regions of the infected dog, and (b) eggs or egg packets that are released by degrading proglottids.



FIGURE 1. Egg packet of *Dipylidium caninum*.

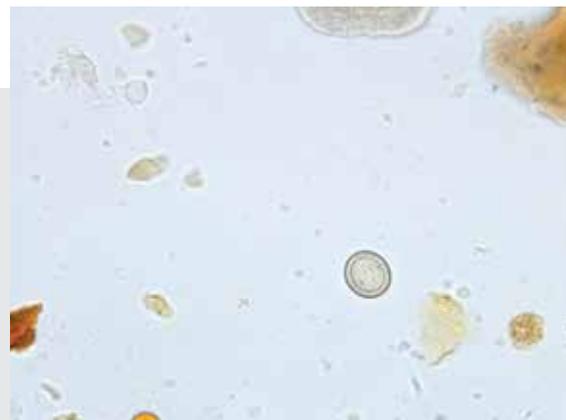


FIGURE 2. Egg of *Taenia* species.

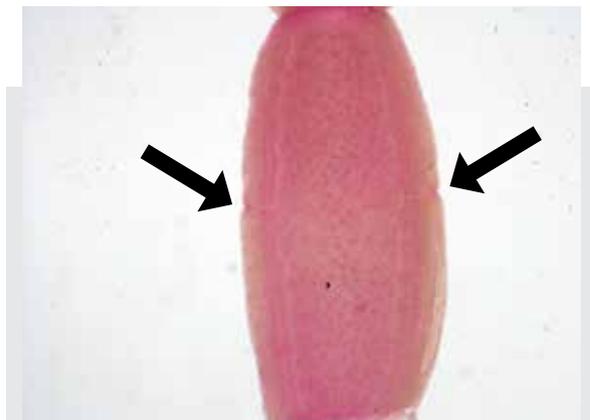
## Examination of Segments

Segments (proglottids) recovered from the perineal regions of the dog or from furniture/bedding are frequently brought to veterinarians for identification. They typically look like small, white, cooked rice grains when fresh but may be submitted dehydrated. If dehydrated, they may be soaked in water or saline prior to examination. Examination of morphological characteristics of proglottids is facilitated using a microscope.

*D. caninum* segments may be oval to cucumber-seed shaped and have distinctive bilateral genital pores (FIGURE 3). Crushing the proglottids between 2 glass slides with a few drops of saline releases characteristic egg packets that measure 120 to 200 microns and contain 2 to 30 eggs.

*Taenia* segments are roughly rectangular and have a single lateral pore (FIGURE 4). Crushing *Taenia* proglottids releases “taeniid-type” eggs (also known as “taeniid” eggs). The eggs are brown and thick-shelled with radial striations, measure 25 to 40 microns, and contain a hexacanth embryo. Taeniid-type eggs are produced by both *Taenia* and *Echinococcus* species and cannot be differentiated morphologically.

If all the eggs or egg packets have been completely released by the proglottid, the finding of single or double laterally placed genital pores should provide clues to the identification of the proglottid as *Taenia* or *Dipylidium*, respectively.



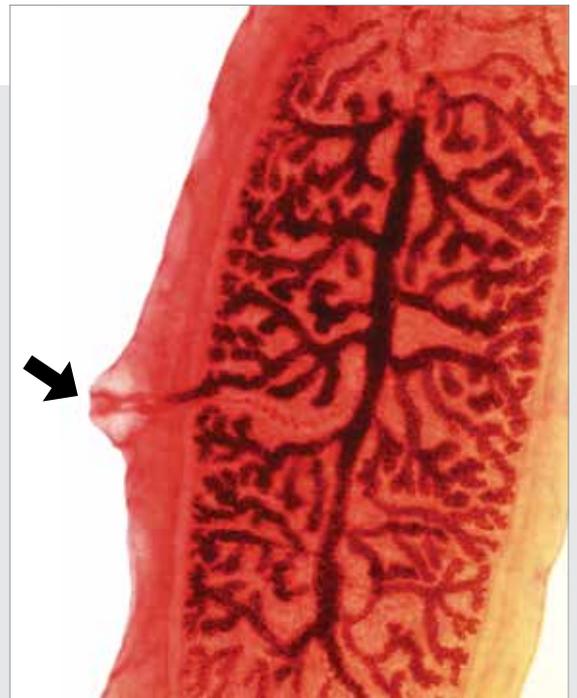
**FIGURE 3.** Terminal segment of *Dipylidium caninum* stained with acetocarmine, which renders the proglottid pink. **Arrows** point to the bilateral pores.

## Fecal Examination

*D. caninum* egg packets can sometimes be demonstrated using centrifugal fecal flotation. However, the sensitivity of fecal flotation is extremely low because the proglottids must break down in the fecal sample for egg packets to become detectable on flotation or sedimentation.<sup>4</sup>

Taeniid eggs have a high specific gravity (1.2251) and cannot be easily recovered in fecal flotation.<sup>7</sup> Centrifugal fecal flotation techniques have more sensitivity than passive fecal flotation for taeniid egg diagnosis, but are not 100% sensitive.<sup>4</sup> Fecal sedimentation techniques may also be used to identify taeniid eggs in infected animal feces. A slide scanning algorithmic system that has recently been made available can also identify taeniid eggs (VETSCAN IMAGYST; Zoetis, [zoetisus.com](http://zoetisus.com)).<sup>8</sup>

Since eggs of *Taenia* cannot be differentiated from zoonotic *Echinococcus* species eggs, gloves must be worn while handling feces of infected animals and slides, cups, and coverslips used in the diagnostic procedure, which all must be properly disposed of with other biohazardous materials.



**FIGURE 4.** Terminal segment of *Taenia* species stained with acetocarmine, which renders the proglottid pink. **Arrow** points to the lateral genital pore.



## Polymerase Chain Reaction

A multiplex polymerase chain reaction (PCR) test to simultaneously detect and differentiate *Dipylidium* from *Taenia* species found in dogs has been developed.<sup>9</sup> PCR tests to distinguish *Taenia* from *Echinococcus* species are also available.

## TREATMENT

Praziquantel given orally or by subcutaneous or intramuscular injection is approved by the U.S. Food and Drug Administration (FDA) for use against *D. caninum* and *T. pisiformis* in dogs. Since several products and combinations are available, veterinarians should refer to the label of the product before prescribing.

Praziquantel resistance in *D. caninum* has been reported.<sup>10</sup> However, practitioners should make every effort to rule out reinfection before declaring an infection praziquantel resistant.

Epsiprantel is FDA approved for oral use against *D. caninum* and *T. pisiformis* in dogs. Fenbendazole is FDA approved for oral use against *T. pisiformis* in dogs.

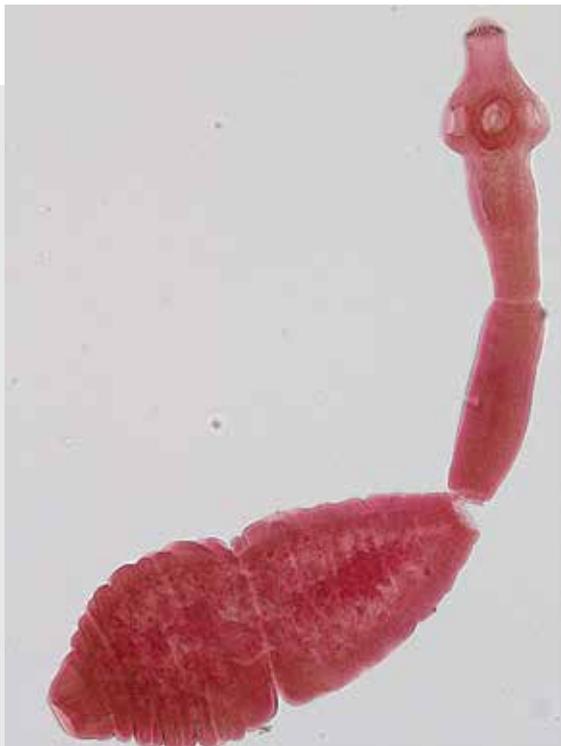


FIGURE 5. Adult worm of *Echinococcus* species.

## PREVENTION AND CONTROL

Flea control must be instituted to prevent reinfections and break the life cycle of *D. caninum*. Fleas can be killed using products approved by the FDA or Environmental Protection Agency. Hunting of rabbits and/or scavenging rabbit carcasses by dogs must be prevented to break the life cycle of *T. pisiformis*.

## RARER TAPEWORMS AND EMERGING INFECTIONS

### *Echinococcus*

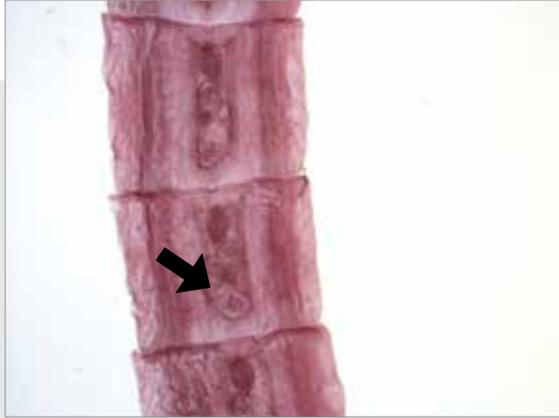
Known for many years to exist in wild canids,<sup>11,12</sup> *Echinococcus multilocularis* has been recently recorded in dogs in the contiguous United States.<sup>13</sup> Adult worms are less than 1 cm in length and consist of 3 to 5 proglottids (FIGURE 5). Terminal proglottids are shed and contain infective taeniid-type eggs. Typically, rodents serve as intermediate hosts, but humans can accidentally acquire the infection through ingestion of the eggs. Alveolar echinococcosis results in proliferative invasion of tissues of the intermediate host that can lead to death.

Coproantigen enzyme-linked immunosorbent assays (ELISAs) and copro-PCR tests are useful diagnostic tests to help differentiate *Echinococcus* from *Taenia*.<sup>14,15</sup> Praziquantel is FDA approved for use in dogs against *Echinococcus* adults. Since taeniid-type eggs cannot be differentiated, veterinarians must be aware of the exposure risk they pose to clients, clinic staff, and the general public and advocate for the safe handling of dog feces.

### *Mesocestoides*

*Mesocestoides* species may use dogs as definitive hosts or as second intermediate hosts. Adult worms live in the small intestine. Terminal proglottids are shed and contain a characteristic, medially located parauterine organ (FIGURE 6). Eggs do not possess the thick shell seen in taeniid-type eggs, are colorless with a hexacanth embryo, and are 30 to 40 microns in size. *Mesocestoides* species use an insect as the first intermediate host and a vertebrate as the second intermediate host. Dogs may become accidental second intermediate hosts and suffer from peritoneal and/or pleural infections with larval stages of the parasite (tetrathyridia).

Treatment of the larval infection in dogs requires prolonged use of high doses of fenbendazole. Treatment



**FIGURE 6.** Nonterminal segment of *Mesocoeloides* species stained with acetocarmine, which renders the proglottid pink. **Arrow** points to the parauterine organ, which is larger, rounded, and well developed in terminal gravid segments.

of adult infections should be treatable with either praziquantel or epsiprantel.

*Dibothriocephalus* and *Spirometra* *Dibothriocephalus* (formerly *Diphyllobothrium*) and *Spirometra* tapeworms, which are associated with aquatic intermediate hosts, can infect dogs, humans, and other mammals. In the United States, *Dibothriocephalus* is found in the Great Lakes region, while *Spirometra* is found in eastern and Gulf Coast states. *Dibothriocephalus* is acquired when dogs and humans ingest larval tapeworm stages (plerocercoids) found in fish tissue. Adult *Spirometra* are acquired when hosts ingest larval tapeworm stages found in the tissues of frogs, snakes, birds, or mammals. Adult tapeworms develop in the small intestines and may be passed out as complete worms in the vomitus or feces.

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Single eggs, not proglottids, are released and are detectable in fecal sedimentations. Infection is tolerated with minimal gastrointestinal signs of diarrhea, vomiting, weight loss and, in the case of *Dibothriocephalus*, pernicious anemia.

Although not FDA approved, praziquantel has been successfully used in treatment. Repeated treatments at higher doses may be necessary to achieve complete cure. Additionally, dogs may experience sparganosis should they become intermediate hosts of *Spirometra* by ingesting copepods with larval stages (procercooids) or through the entry of larvae via open wounds. These may cause nonpainful swellings or even death depending on the organ involved. **TVP**

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