Worm Parasites
Cause Variety of Problems

By Edward L. Roberson

Ascarids of dogs, commonly called "roundworms" and scientifically named *Toxocara canis*, are large worms which reach 4 to 8 inches in length when mature. As egg-laying adults, they live in the small intestine of young dogs less than 6 months old.

Probably 75 percent of pups and young dogs in the United States are infected with this parasite which passes eggs in the dog’s feces (excrement). The adult worm is seen only rarely in older dogs because these dogs develop resistance to the adult worm. Older dogs, however, can harbor the small larval stage of this parasite.

The major means of infection of dogs with *T. canis* is by ingestion (eating) of infective ascarid eggs or transmission of infective larvae from a mother dog to her unborn or nursing pups. Ascarid eggs which are passed in the feces of a dog harboring adult worms are not immediately infective to another dog; they require a couple of weeks of warm temperature to develop a larval stage in the egg which is infective to any age dog.

If a young dog ingests the infective egg, the small larva which hatches in the dog’s stomach will grow to a large adult worm which begins to produce eggs about 4 weeks after the infective stage was originally ingested.

When an older dog, however, ingests an infective egg, the hatched larval stage does not grow to an adult worm in the intestine. Instead, the larva migrates to the adult

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dog's musculature and there remains inactive. A dog throughout its life can acquire hundreds or even thousands of such quiescent larvae in its musculature.

**Migrate to Fetus**

In male dogs these ascarid larvae have no escape. In female dogs which become pregnant, however, the larvae become active and migrate via the umbilical cord to the liver of the fetuses during the final third of pregnancy (after the 42nd day). Thus newborn pups can be infected with *T. canis* ascarids from the start.

From the pup’s liver the larvae make their way to the lungs, are coughed up, swallowed, and in the intestine will grow to large egg-laying adults in 4 weeks. While this intrauterine route of transmission is by far the most prevalent means of bitch-to-pup transmission of *T. canis* larvae, the parasites also can pass to pups through the mother dog's milk. Less than 5 percent of larvae, however, are transmitted by the latter route.

If the mother dog’s initial supply of quiescent larvae is large, she can infect three successive litters of pups even in the absence of acquiring additional larvae in her musculature.

**Clinical signs** of *Toxocara* infection in pups depend on
the number of larvae the pups have acquired from their mother or on the number of infective eggs ingested from contaminated environment where the pups live.

With but a few worms (10 or so), there may be no clinical evidence of infection. However, if the pup has several hundred worms which are growing to mature adults, the worm mass will distend the abdomen and give the pup a potbellied appearance. These worms deprive the pup of nutrients so that heavily infected pups are malnourished and slow growers. The pup's feces often are loose and frothy.

Diagnosis of ascarid infection is made by the above clinical signs and by microscopic examination of the feces for ascarid eggs. A veterinarian uses a salt or sugar flotation procedure to isolate the eggs from the feces.

**Treat Pups Early.** It is important to treat pups so that ascarids are expelled before they become egg-laying adults, that is, before pups are 4 weeks of age. Preferably pups should be treated at 2, 4, 6, and 8 weeks of age. The initial treatment will expel intrauterine acquired ascarids. Subsequent treatments will expel ascarids acquired through the mother's milk.

Two drugs are available to veterinarians for treating young pups. They are pyrantel pamoate (Nemex) and fenbendazole (Panacur). Both are in suspension form and thus easy to administer to pups not yet eating solid food. The drugs also are effective in treating hookworms which are discussed below.

Treatment of the mother dog to destroy the larval ascarids in her musculature before the pups are born is difficult but possible. Only one drug, fenbendazole (Panacur), has been extensively tested for this purpose. It reduced ascarid burdens by 90 percent in pups born to treated bitches while pups born to unmedicated control bitches harbored an average of 400 worms each.

The regimen of treatment for the pregnant bitch must begin, however, about the 40th day of pregnancy and continue daily until 2 weeks after whelping—that is, about 37 consecutive days.

**Hookworms of Dogs**

Hookworms are bloodsucking parasites. The most common species is *Ancylostoma caninum*. While the adult worm is only about an inch in length, it has a large mouth
by which it attaches to the wall of the small intestine and digests a plug of tissue. This causes a small bleeding site. When 50 to several hundred worms are present, the total loss of blood can be dangerous even to an older dog but especially to small pups.

Dogs with heavy hookworm infections become anemic. The loss of blood into the intestine results in dark tarry-colored feces. Gums of the animal will be blanched white instead of pink and the animal is weak. These clinical signs plus a fecal examination for eggs give a positive diagnosis of hookworm infection.

Both young and adult dogs can have infections with adult hookworms which shed eggs in the dog’s feces. Once passed in the feces, hookworm eggs develop an infective larval form which hatches from the egg shell and can infect dogs either by penetrating the skin when dogs lie down in damp contaminated places or by being ingested with the dog’s contaminated food or water.

Thus, dog food should never be placed directly on the ground. Use of food and water bowls which are cleaned daily will help minimize a yard-confined dog’s exposure to infective hookworm larvae.

Older dogs, besides harboring adult hookworms in their intestines, also accumulate the immature larval stage of *A. caninum* in their body tissues (muscles, mammary glands). These larvae do not infect the fetuses of a pregnant dog as did *Toxocara* larvae, but they do pass in the milk of the mother to her nursing pups. About 60 percent of the larvae which do so will pass during the first week of nursing, but some larvae are transmitted every week as long as the mother dog is lactating.

These larvae will grow to egg-laying adult hookworms about 2 weeks after infecting the pup. So a pup as young as 2 weeks old can be contaminating the environment with hookworm eggs. The milk-borne route is the principal means by which young pups become infected with *A. caninum* hookworms.

If the number of hookworms is great, pups will begin showing clinical signs of anemia about 2 weeks of age and may die before 3 weeks of age.

**Treatment.** The regimen of treating pups for ascarids at 2, 4, 6, and 8 weeks of age is also ideal for eliminating hookworms as they are constantly acquired through the
mother's milk. The two drugs, pyrantel pamoate and fenbendazole, mentioned earlier for use against ascarids, are effective also for hookworms of nursing pups.

Several additional drugs are available for treatment of hookworms in older dogs. Older dogs generally are given a single 1-day deworming once or twice per year as the owner seeks routine veterinary care. These treatments eliminate only the parasites which occur in the digestive tract.

Treatment of the pregnant bitch to kill larval hookworms and to prevent heavy mammary transmission of hookworms to her pups can be done as described earlier for ascarid larvae—that is, treatment with fenbendazole daily from the 40th day of pregnancy until 2 weeks after whelping.

**Worms in Cats**

Cats also can be infected with ascarids and hookworms but the common species in cats are not the same species of parasites which occur in dogs. The common ascarid (Toxocara cati) and hookworm (Ancylostoma tubaeforme) of cats do not infect dogs and vice versa.

Ascarids and hookworms do not occur as frequently in cats as they do in dogs. This is probably related to the cat's burying its feces (excrement) while feces from dogs remain on the ground surface where ascarid eggs and hookworm larvae can be scattered more readily by rainwater, thus contaminating a wider area.

Cats acquire ascarid infections from ingesting infective eggs which have been passed in the feces of a cat harboring adult worms. Both young and older cats may harbor such infections. Nursing kittens may also acquire ascarid larvae through the milk of the mother cat, but intrauterine infection of the fetus during pregnancy is not known to occur.

Feline hookworm infections evidently are acquired by the larvae penetrating the skin or by larvae being ingested orally (contaminated food or water). The milk-borne route which is important in bitch-to-pup transmission apparently does not occur in cats.

Clinical signs of ascarid or hookworm infections in cats are like those described for the dog but seldom occur because cats usually have only light inapparent infections. In general, the same drugs used for deworming dogs can be used to deworm cats.
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**Human Infections**

Both ascarids and hookworms of dogs and cats can infect human beings. These worms do not grow to the adult intestine-dwelling stage in people. They remain in the infective larval form but occasionally are able to cause serious consequences.

Larvae from accidentally ingested ascarid eggs migrate in the human body and can cause enlarged liver, elevation in numbers of eosinophils (a specific type of white blood cell), and damage to the retina of the eye with consequent impaired vision.

Larvae of canine and feline hookworms sometimes penetrate the outer layer of the human skin. They cannot completely penetrate the human skin, however. The result is that the larvae migrate aimlessly within the skin for a month or more creating an itching, tortuous tract if not treated.

The best way to insure against human exposure to parasites of pets is to have pets dewormed when they first enter the household and to submit a fecal sample to a
veterinarian at least twice each year for parasite examination.

**Whipworms of Dogs**

Whipworms (*Trichuris vulpis*) live in the lower digestive tract of dogs, specifically in the cecum which is comparable to the human appendix. The adult worm is indeed shaped like a whip, broad at one end, long and narrow at the other end. It is about 2.5 inches long.

These worms thread their narrow end into the lining of the cecum to hold on. They produce football-shaped eggs which are passed in the feces of infected dogs. After passing, the eggs develop an infective larval stage which, protected by the thick egg shell, can live in the soil for several years.

Heavy infections most often occur in dogs which are confined to a small yard pen where the ground is continuously being contaminated with eggs and the dog is continuously reinfecting itself.

**Signs.** Presence or absence of clinical signs depends on the number of worms. With a light infection (less than 50 whipworms), a dog may show no apparent signs. With heavy infection (several hundred worms), the irritation to the gut lining causes a loss of tissue fluids which results in a watery feces that is usually red-tinged with blood.

After several days of fluid loss, a dog may become dangerously dehydrated. In such cases, intravenous replacement of body fluids is essential as well as immediate deworming of the dog.

Several drugs are available to veterinarians for removal of whipworms. These include dichlorvos (Task), butamisole HCl (Styquin), mebendazole (Telmintic), and fenbendazole (Panacur).

If a dog has to be returned to the same infected yard pen, it is important that it be retreated at 3-month intervals thereafter. Treatment at this frequency will eliminate newly acquired worms before they begin to lay eggs and, therefore, will prevent further contamination of the ground. Of course, selecting a new site for the pen would be of greater advantage to the dog and should prevent the necessity of 3-month treatments.

Eggs of the canine whipworm are not infective to human beings. The human race has its own species of whipworm, however, which is transmitted from one person to another.
**Dog, Cat Tapeworms**

Tapeworms are flat segmented worms, usually a foot or more in length, which live in the small intestine of animals. One species of tapeworms, *Dipylidium caninum*, infects about 30 percent of dogs and 15 percent of cats in the southern part of the United States. Less frequently, dogs are infected with *Taenia pisiformis* and cats with *Taenia taeniaeformis*.

All three of the above tapeworms shed their egg-filled terminal segment in feces of the infected animal. Such segments are about the size of a grain of rice and may be seen crawling on the surface of the feces.

An initial host is required for development of the young tapeworm to a stage that will be infective for dogs or cats. In the case of *Dipylidium*, fleas serve as the initial host in which the ingested tapeworm egg develops to a small larval stage that is infective for either dogs or cats which may accidentally (or intentionally) swallow the flea.

For *Taenia* tapeworms of dogs, wild rabbits serve as the initial host; for *Taenia* of cats, rats or mice serve as the initial host. Dogs or cats become infected with *Taenia* tapeworms by eating the respective initial host. The larval tapeworm then develops to a large adult worm in the small intestine of the dog or cat.

None of these tapeworms are known to be harmful to the dog or cat. Nevertheless, pet owners want their pets rid of tapeworms. Fortunately, a fairly new drug, praziquantel (Droncit), available now to veterinarians, is 100 percent effective in treating tapeworm infections.

One must also control fleas, however, to prevent reinfection with *Dipylidium*. Preventing rural dogs from eating wild rabbits or cats from eating rats and mice may not be practical as a preventive measure for *Taenia* infections.

Only a few cases of human infection with *Dipylidium* are documented. These occurred because of accidental swallowing of an infected flea. These infections were not harmful to the children involved and were easily treated by a physician. The species of *Taenia* which infect the dog or cat are not able to infect humans.

**Heartworms of Dogs**

Heartworms, scientifically known as *Dirofilaria immitis*, indeed live in the heart of dogs or in the major artery
(the anterior vena cava) which carries blood from the heart to the lungs. The adult worms are shoestring thin but quite long, 8 to 13 inches.

Mature adult female worms, rather than laying eggs, produce thousands of larval forms, called microfilariae, which are shed into the blood and circulate throughout the dog’s body. When mosquitoes feed on the blood of dogs the microfilariae are ingested with the blood.

In certain species of mosquitoes, these heartworm microfilariae can survive and develop in the mosquito to an advanced larval stage that is infective to a dog. When the mosquito again feeds on the same or another dog the infective heartworm larvae are transmitted.

Beneath the skin of the dog these infective larvae will grow from less than \( \frac{1}{8} \) inch to about 2 inches during the first 3 months. Then they move into the heart to complete their development to adult worms in another 3 months.

**Earliest signs** of heartworm infection are coughing and tiring during exercise. In general, a small dog with but a few worms may show these
signs when a larger dog with the same number of worms may not. As the larger dog acquires greater numbers of worms, however, it also will develop clinical signs.

As the disease progresses, a chronic cough develops and a dog has difficulty breathing when exercised. In advanced cases, the legs and abdominal cavity become swollen with fluid, an indication that the heart is failing to function properly.

Diagnosis of infection with heartworms is usually made by finding microfilariae in a sample of the dog’s blood. However, in 5 to 10 percent of heartworm cases, microfilariae do not occur (the adult worms may be all males or all females, for example). In such cases, radiographic examination of the heart or a special serology test may help a veterinarian establish a diagnosis of heartworm infection.

Treatment for heartworm infection in dogs involves several steps. First, a drug must be given to get rid of the adult worms. The only available drug for this purpose is an arsenic-containing drug, thiacetarsamide sodium, which is given intravenously twice a day for 2 days.

The adult worms are gradually killed during the following week and are swept with the blood flow into the lungs where they eventually decompose and are cleared away by natural body defenses. During this 1-month period following treatment, a dog should be confined to prevent any exercising which would overly exert its heart and lungs.

About 6 weeks after treatment for adult worms, treatment can be administered to destroy the microfilarial stage. One of three drugs can be used. Dithiazanine iodide (Dizan) or levamisole (Levasole) are given orally for 7 to 10 days; fenthion (Spot-On) is applied to the surface of the skin or is injected subcutaneously.

All three drugs occasionally cause vomiting and diarrhea. A dog which becomes ill while taking one of the drugs may tolerate another without sickness.

Prevention of heartworm infections is more desirable than having to treat a heartworm-infected dog. Diethylcarbamazine, abbreviated DEC, destroys the infective larval stage that is transmitted from mosquitoes to dogs.

If DEC is given every day throughout the mosquito season (and for 2 months after mosquito season), heartworm infection in a dog can be pre-
Heartworms can be prevented by giving your pet the prescribed drug every day throughout the mosquito season and for two months afterwards.

vented. Daily administration of the drug, however, is essential since mosquito transmission may occur at any time. In warmer states like Florida, the mosquito season is nearly year-round; thus, DEC should be given year-round. Dogs that are already positive for heartworm microfilariae should not be given DEC because of a potential adverse reaction. Such dogs should first be treated to get rid of adult worms, then treated to get rid of microfilariae—before they are started on the preventive DEC.

In areas of the country where heartworm infection is prevalent (Atlantic and Gulf coasts, states along the Mississippi River), pups should be started on DEC as soon as they are weaned. Several commercial formulations are available—syrup, wafers, tablet. Any of these not only serve as a preventive for heartworms but also will prevent intestinal ascarid infection.

A particular syrup formulation, Styrid-Caricide, combines DEC and another drug, styrylpyridinium Cl, and serves as a preventive also for intestinal hookworm infection of dogs when administered daily for the dog’s entire life.