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Treating Fish for CAMALLANUS and Other NEMATODES

By Diana Walstad
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I have dealt with Camallanus roundworms three times over the years. Each infestation started shortly after the purchase of new guppies. Around 1985, the worms first appeared in fancy guppies that I bought from the breeder. All my little home remedies failed, such as simply growing out the babies in a separate tank. Discouraged, I eventually tore down the tanks and stopped keeping fish for awhile.

Camallanus worms dangling from the this catfish's anus constantly release eggs and live larva into the tank. Transmission occurs when fish pick at the substrate and ingest the wriggling larva.

When the adult worms are visible on the outside like this, it means the fish is heavily infested. (Many infected fish show no symptoms.)

When I started up again with new guppies, my old nemesis reappeared in 1998. This time, I sought professional help.[1] Diagnosis: The fish had Camallanus worms. The juvenile fish were primarily infected and their growth stunted. Treatment involved my preparing a fishfood containing Fenbendazole, a potent wormer. The vets gave me a recipe and a liquid solution of Fenbendazole. I prepared the medicated food according to instructions and fed it to the fish twice a day for a week and then repeated the treatment three weeks later. This worming procedure cured the fish permanently without problems.

After a long sojourn raising other types of fish, I started back up again with guppies in 2017. I wasn't all that surprised to see Camallanus worms in some of the new guppies. There had been no sign of the worms when I bought two female guppies from a pet store. The fish appeared very robust and subsequently produced a large number of babies over the next 2 months. I first spotted the worms when I brought the females in from their summer tub and got a closer look. One female had a couple red bristles sticking out of her anus by just 1/16" (~2 mm). They were barely noticeable, but hey, I had been here before. Now alerted, I soon noticed the tell-tale presence of the worms in another female guppy. I had to face the fact that all my fish and tanks were now—or soon would be—infected with Camallanus worms.

Camallanus cotti

The adult worms shown here are about ½ inch (1.2 cm) in length and have pointed ends.

Photo kindly provided by Charles Harrison

I decided that I would try to treat the fish on my own rather than go back to the vet school. Later, I will tell the treatment story, but first a little bit about the worms themselves.

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[1] I consulted with Greg Lewbart (DVM), a fish specialist at the vet school of North Carolina State University (Raleigh, NC). Dr. Lewbart is teamed up with Edward Noga (DVM), also an expert on fish diseases [1].

Camallanus Worms

Camallanus are intestinal parasites (i.e., roundworms, nematodes) associated with guppies and other livebearers, but to which all fish are susceptible. Various *Camallanus* species occur widely in the natural environment in native and game fish. For example, *C. oxycephalus* was found in catfish, Longear Sunfish, Bluegill, White Crappie, Largemouth Bass, etc., all residents of an Oklahoma reservoir [2]. The same parasite species was found in the Green Sunfish, Bluegill, and White Bass of an Ohio lake [3] and in the Bluegill, Black Crappie, Largemouth Bass, etc of an Arkansas reservoir [4]. Meanwhile, investigators found that various Camallans afflict the pike, perch and stickleback of northern Germany [5] and the native fish of central China [6]

C. cotti was first discovered in freshwater fish in Japan in 1927 but has since spread to every continent and threatens native fish species. This nasty nematode is now entrenched in feral livebearers in Hawaiian streams [7] and the wild guppies of South Africa's Crocodile River [8]. Because it transmits directly from fish-to-fish [9], *C. cotti* is particularly problematic for the aquarium trade. (Other *Camallanus* species require the presence of an intermediate host, usually a bird or crustacean; disease transmission to uninfected fish is blocked once fish are transferred to an export holding center or an aquarium where the intermediate hosts are absent.)

Infection with *C. cotti* seems to be relatively common in imported guppies. For example, Australian investigators sampled 37 shipments of imported fish. (Ten fish were sampled from each shipment of 2,000 to 6,000 fish.) Out of 8 guppy shipments from Singapore, three were infected with *C. cotti*. In contrast, there was no *C. cotti* in 29 shipments of Platies, Neon Tetras, Cardinal Tetras, etc [10].

A separate survey of 8 Korean fish farms identified *C. cotti* in 14% of the 153 guppies examined; it was not found in Angelfish, Black Tetras, Mollies, Platies, Swordtails, etc [11]. Guppy mortality on one Korean farm reached almost 30% [12]. Evidence suggests that the original infection source was guppies imported from Indonesia.

The most common and effective wormers for Camallanus worms are the drugs Fenbendazole and Levamisole [13]. Fenbendazole is added to the food; Levamisole can be added to either the food or the water. Both chemicals are specific for killing their roundworm target and have a wide safety margin.

Levamisole HCl[2]

Once infected fish have stopped eating, water treatment is the only real treatment option. Fish readily absorb Levamisole from their skin and gills into the blood stream. Camallanus worms feeding on the fish's blood take in the Levamisole. The drug paralyzes the worms such that they are released from the fish's intestine. The concentration recommended for treating aquariums ranges from 2 to 13 ppm (mg/liter) [1,13,14].

Levamisole's lethal concentration (LC_{50}/24 hours) was 250 ppm when tested in eels [15]. Thus, for most fish, there is little chance of overdosing. However, aquarium shrimp or loaches are apparently sensitive to this drug at doses greater than 2 ppm [16]. And higher doses may be unnecessary [17].

In the USA, Levamisole is difficult to obtain. Currently, one nematode expert (Charles Harrison) provides Levamisole HCl at a reasonable price along with detailed instructions for its use by aquarium hobbyists [18]. Levamisole is a convenient and effective drug for ridding fish of Camallanus. When heavily infested fish have stopped eating, it may be the only choice.

[2] Levamisole HCl (the hydrochloride salt of Levamisole) is the *water-soluble* form of the drug—and the one relevant to fish treatment. Levamisole HCl is also relatively stable in water, irrespective of pH.

Preparing a Fenbendazole Fishfood

I lean towards a slow and steady removal of Camallanus worms rather than a quick kill. If all the worms in the fish's intestine are suddenly killed, they could rot in the gut and endanger the fish. Also, my tanks have a soil underlayer containing a population of harmless nematodes that would be killed if I were to add Levamisole to the water (*See* 'Discussion'). Their sudden death would release toxins into the water, necessitating massive water changes and tank cleaning.

I found recipes for incorporating wormers into fishfood more applicable for aquaculture farms than aquarium hobbyists. (Often, dosage is expressed in mg per day per pound of fish body weight.) In this article, I show exactly how I incorporated Fenbendazole into a fishfood that rid my fish of Camallanus worms.

Guppy with Camallanus Worm I used this infected female guppy to tell whether my Fenbendazole fish food was working. She expelled the worm that is hanging out of her anus a few days after starting treatment—and about 5 hours after taking this photo—and recovered nicely.

Since the expelled worms contain live larva impervious to the drug, I removed substrate debris afterwards.

When the Camallanus problem popped up again in 2017, I no longer had the liquid Fenbendazole provided by the vet school.

In my first attempt, I used a powdered dog wormer (Safeguard®) containing Fenbendazole. (Fenbendazole is used to kill a range of gastrointestinal worms in dogs and farm livestock.)

Fish Bendazole

In Sept. 2017, I purchased this product from RevivalAnimalHealth.com. Jar contains 10 packets with 250 mg of Fenbendazole powder per packet. Fish Bendazole is available from several internet vendors.

My first fishfood preparation did not work. After 6 days, I could still see the live Camallanus worms hanging from the female guppy. Apparently, 221 mg of Fenbendazole (one packet) was not enough, nor I had thoroughly mixed the insoluble powder into the fish food. Indeed, when I examined the fishfood later, I found white chunks of Fenbendazole scattered throughout it. For a dog, you sprinkle the powdered drug on the food and the dog eats his food and gets a full dose. Feeding fish requires that this insoluble powder be thoroughly mixed in with the fishfood.

I started over using another source of Fenbendazole ("Fish Bendazole") but stuck with the recipe that the vet school had provided me with in 1998. It is a good one. The fish love it, and the canned sardines provide very nutritious omega-3 oils. The oil also helps get the Fenbendazole powder mixed in better.

During the initial 1998 treatment, I noted that the fish started releasing worms 3 days after feeding the medicated food. Now, in 2017, that was my benchmark to monitor treatment efficacy.

Preparing the fishfood takes about an hour. Making sure that the Fenbendazole powder gets thoroughly mixed with the other ingredients in the blender is critical.

Treatment consists of feeding the fish the medicated food at least once a day for a week, and then repeating the treatment 2-3 weeks later. I cleaned the tank bottom and siphoned off debris, because the drug does not kill larva inside the dead worms. I wanted to get rid of as many live larva as possible. Free-living, infectious larva can live at least 3 weeks outside a host [9].

Fish Flake Food Ingredient (2 oz)

Fenbendazole Fishfood

In a kitchen blender, prepare a thick slurry:

- 2 oz. flake fish food (~1 cup)
- ¼ cup water
- 1 T. oil
- liquid from a tin (3.75 oz size) of sardines *packed in oil*

Then, add:

- 750 mg of Fenbendazole powder
- sardines and rest of oily juice from tin
- 2 T. of pureed spinach/peas (baby food)

Blend powder into the slurry thoroughly by pulsing, scraping the sides, pulsing…Repeat for at least 3 minutes

Using the microwave, heat ½ cup of water in a bowl to near boiling. Sprinkle hot water with:

- one packet (7 grams) of Knox gelatin

Stir water and gelatin, microwave a few seconds, repeat a few times until most of the gelatin is dissolved. Try not to boil it.

Incorporate the Fenbendazole slurry into the heated gelatin solution. Mix well and refrigerate. This fishfood preparation can later be frozen.

Other Ingredients—sardines packed in oil, oil, spinach & peas baby food, and gelatin.

The fishfood is very nutritious and won't hurt the fish. (However, it is—and was—toxic to the snails [1].) After I finished the treatment schedule, I continued feeding the medicated food until I used it all up. Thus, I was sure that if some fish, particular baby guppies that did not eat the food when I started the treatment, they would—as juveniles—eventually eat it and get de-wormed somewhere down the line. In this manner, I eventually got all of my fish and tanks successfully de-wormed.

Illustrated Steps in Preparation

1. Thick Slurry from the Blender contains water, oil, fish flake food, sardines, Fenbendazole, and pureed spinach/peas.

2. Preparing Gelatin Solution

3. Gelatin Dissolved in Hot Water

4. Slurry Mixed with Gelatin Binder

5. Dividing up the Medicated Food

I put the divided-up mix into the refrigerator to chill and solidify. Next day, I popped the cubes out of the ice cube tray and froze them for long-term feeding. I pulled out a frozen cube and kept it in the refrigerator for two weeks of feeding. Then, I discarded it and pulled out another cube for the next two weeks.

Discussion

My Fenbendazole Fishfood
Here, I have smeared it out on a cutting board before feeding the fish. This paste may not look appetizing to us, but the fish love it.

Capillaria is another nematode group that causes problems for aquarists. Both *C. cotti* and Capallaria transmit directly from fish-to-fish without having to go through a bird, copepod, or snail. Unlike Camallanus, however, Capillaria is more often found in Discus, Angelfish, Catfish, Danios, Gouramis, etc. [1].

Diagnosis and treatment is not so straightforward as with Camallanus, which produce live young—no eggs. Moreover, Camallanus has a short, defined life cycle of about 21 days. A Capillaria infection is not as easy to detect. (No bright red worms dangling from the fish.) A microscope and fecal exam is required to recognize the brown, barrel-shaped eggs distinctive of Capillaria.

For treating fish with Capillaria, Fenbendazole and Levamisole will kill the adult worms but not their eggs. The eggs of *Capillaria pterophylli* take about three weeks—at 68–73°F—before they develop enough to infect when ingested by fish. It may take a further 3 months for the ingested egg/embryos to become adults [13]. Thus, treatment can be lengthy. The long-term feeding of a fishfood containing Fenbendazole—in my opinion—seems like a reasonable treatment option.

Another possibility…. The potent wormer drug Flubendazole will kill nematode eggs and is very safe for fish and their fry [19]. For treatment, it is added to the tank water, not fishfood. It will kill snails (at 2 ppm) [1] and is very insoluble in water. Flubendazole is not readily available in the U.S. For obtaining and using this drug, I would contact Charles Harrison [18].

Many aquarium fish offered for sale were raised in outdoor ponds in the tropics where they can become infected with *C. cotti* and other nematodes from infected crustaceans, birds, etc. In the natural environment and ponds, fish typically carry a plethora of parasites, including nematodes [2,3,4]. Infections are often light in intensity[3], and the parasite's impact on the fish population may be negligible. However, in the aquarium where fish are confined, crowded and sometimes stressed, the nematode population can build up to cause severe problems.

To prevent infections from nematodes that require an intermediate host, one should avoid feeding live foods that are suspected of carrying nematode larva. Tubifex worms, crustaceans, and live (or frozen) fish are all potential sources of parasitic nematodes [1].

If adult fish are infected, one should assume that all fry and juveniles are infected as well. Investigators found abundant *C. cotti* in fry and juvenile guppies within infected colonies of guppies [6]. Although it is associated with female guppies, investigators found that it was equally prevalent in males and females of infected guppy colonies [12].

Not all nematodes are fish parasites. Indeed, microworms (various *Panagrillus* sp.) and vinegar eels (*Turbatrix aceti*) are excellent live foods for aquarium fry. One would expect such tiny, "free-living" roundworms to be present in many aquariums. They feed on bacteria, fungi, plant roots, protozoa, etc. Nematodes are considered a major component of the invertebrate population of natural sediments. Under good conditions, they can reach densities of 750 worms per liter of substrate surface [20].

[3] For example, a full 28% of Longear Sunfish sampled (n=26) in a reservoir were infected with *Camallanus oxycephalus,* but the average number of Camallanus per fish (i.e., 'mean intensity') was only 1.2 [2].

Potent wormers like Levamisole added to the water would kill not just the targeted fish parasites but "free-living" nematodes in established aquariums. The sudden death of these worms could cause problems for the fish. This may explain why some hobbyists have observed water cloudiness, ammonia spikes, etc following the addition of wormer drugs to the tank water.

When I first encountered Camallanus worms around 1985, I was devastated. Now, I realize that worming fish is no big deal. Removing parasites has become a routine part of keeping dogs and livestock healthy. As aquarium hobbyists, we are lucky to have drugs to rid our fish of these pests.

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Diana Walstad is the author of *Ecology of the Planted Aquarium* (2013). For more information about her books, see: http://dianawalstad.com.