

# Spironucleus Infestations (Spironucleosis) in Freshwater Aquarium Fish<sup>1</sup>

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## Introduction

*Spironucleus* species, a group of single-celled parasites with flagella (whip-like structures used for movement), are a significant cause of disease in aquacultured and captive species of fish. Found in cold, temperate, and tropical climates, *Spironucleus* species can infect a variety of freshwater and marine ornamental and food fish, as well as crustaceans and shellfish.

For many years, some *Spironucleus* species were incorrectly identified as *Hexamita*, but current research has determined that *Spironucleus* is the predominant pathogenic group found in fish. True *Hexamita* species are mostly free-living, non-parasitic organisms living in the environment.

Five species of *Spironucleus* are currently recognized: *S. salmonicida*, *S. barkhaus*, and *S. torosa* can infest marine organisms, while *S. salmonis* and *S. vortens* can infest freshwater ornamental fish. This publication focuses on *S. vortens* and its effects on ornamental cichlids.

## Susceptible Species and Predisposing Factors

Many members of the cichlid family, which includes angelfish, oscars, and discus, are highly susceptible to

*Spironucleus* infestations. *Spironucleus vortens* has been identified as the cause of spironucleosis in these fishes.

*Spironucleus* has been found in many other fish species, including aquarium fish (kissing gouramis, tetras, several families of catfish, and clownfish), food fish (including salmonids and tilapia), and wild fish; however, *Spironucleus* appears to be more pathogenic in captive settings. Stress from malnutrition, shipping, over-crowding, concurrent infections, and poor water quality may lead to immunosuppression and rapid reproduction of the parasite, resulting in disease.

However, in wild fish and some captive situations, *Spironucleus* may be considered a commensal organism, i.e., it lives in fish without necessarily causing disease.

## Identification of *Spironucleus*

The live, active *Spironucleus* stages (known as trophozoites) can only be identified with a microscope (Figure 1). They are small, approximately 12.5–20.5µm long (20 µm = 1/50<sup>th</sup> of a millimeter) and 5.0–11.2 µm wide. Their eight flagella are each approximately 1.5–2 times the body length. Compared to another internal flagellate, *Cryptobia iubilans*, which is long and thin, *Spironucleus* tends to be ovoid to pear-shaped, but may become more spherical (rounded) during reproduction. Because of their small size,

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*Spironucleus* may be overlooked or confused with other small organisms, including bacteria, by those not trained to identify them. If you are unsure, contact a fish-health professional to assist you with diagnostics.

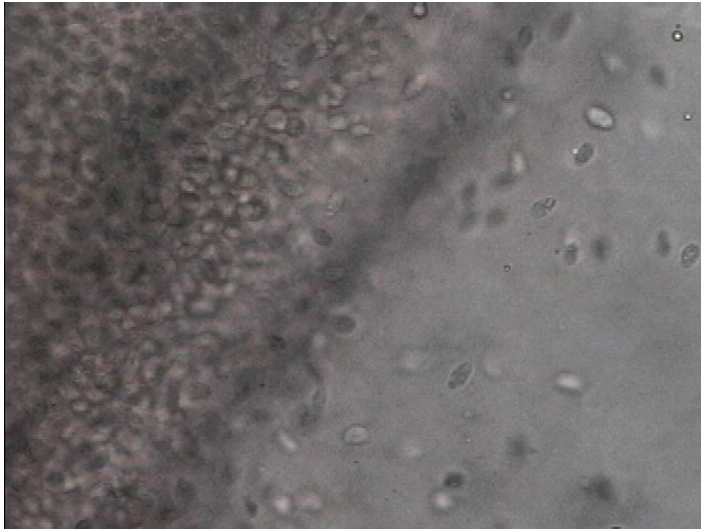


Figure 1. *Spironucleus* organisms seen under 400x microscopy.  
Credits: Roy Yanong, Tropical Aquaculture Laboratory

## Life Cycle and Transmission of *Spironucleus*

The active trophozoite, or feeding stage, is most easily observed and can be found swimming freely in the intestinal or cecal fluids of fish. The intestinal tract is believed to be the natural habitat for this group, but it may occasionally be found on lesions on the skin or systemically in internal organs. *Spironucleus* reproduces by dividing into two (binary fission). Prior to dividing, the parasite may appear more rounded.

Although a protected, non-motile cyst stage has been reported for other closely related flagellates, researchers have been unable to find cysts or induce cyst formation for *Spironucleus vortens*.

*Spironucleus* is most likely spread by ingestion of trophozoites found in contaminated fecal material. It has also been suggested that the parasite may enter the intestinal tract through the rectum.

Under normal circumstances, the organism may be present in small numbers without causing disease; however, if the fish is exposed to stressful conditions, the organism may reproduce rapidly, resulting in massive infestation and disease. In one study in the scientific literature, the life cycle occurred in just under 2 hours at 25°C. Another study also demonstrated that *Spironucleus vortens* trophozoites survived for 36 days in angelfish feces.

## Signs and Pathology caused by *Spironucleosis*

Some researchers think that *Spironucleus* species are commensal (they may normally be present in low numbers in some species without causing disease) and are opportunistic pathogens (cause disease when the fish is weakened). Weak or stressed fish, which most likely are immunocompromised, seem to be most susceptible to heavy infestation. Physical signs of spironucleosis include weight loss, darkening of the skin, decreased activity, and refusal of food. Severely infected angelfish with spironucleosis may float horizontally on the surface of the water and have visibly distended body cavities. White or pale, stringy feces (fecal casts) may also be seen. Angelfish may remain in this condition for several days before death. However, it is important to note that these signs may be caused by other diseases and further diagnostics are necessary to confirm the cause of these signs.

Necropsies of fish infected with *Spironucleus* often reveal increased mucus in the intestines, as well as inflammation in the intestines and gall bladder. Damage to these organs may result in poor digestion and absorption of nutrients. Less commonly, fish may have systemic infections, in which *Spironucleus* is found in multiple organs (including the heart, liver, and kidney). Although *Spironucleus* does not tend to cause formation of granulomas (a chronic tissue reaction resulting in development of small nodules) in the intestine, a systemic infection may lead to granuloma formation in other tissues.

Infestations in adult breeding angelfish may be associated with decreased hatchability of eggs or death of young fry.

## Confirming *Spironucleus* Infestation

*Spironucleus* infestation is easily confirmed by making a fresh-tissue squash preparation of the intestine and examining it with a light microscope at 200 and 400x magnification. The flagellates have a distinctive, ovoid to pyriform (“pear”) shape (see Figure 1) and rapid, erratic movement. They are most easily seen in areas where the mucosa is broken and are often concentrated in the mid to posterior intestine. If the infestation is severe, the flagellates will be numerous and can easily be found throughout the intestinal tract, in other organs, and even within the blood vessels.

If fish cannot be sacrificed, microscopic evaluation of fresh feces in a drop of water can provide a fairly good approximation of intestinal parasite load.

## Management of *Spiroucleus* Infestation

Currently, there are no FDA-approved drugs for the treatment of spironucleosis in food fish. In aquarium fish, experiments have proven that metronidazole is the treatment of choice for *Spiroucleus*. It is administered in a medicated food or, if the fish are not eating, in a bath treatment. Metronidazole can be administered orally in feed at a dosage of 50 mg/kg body weight (or 10 mg/g feed) for 5 consecutive days. If mixing the medication with a dry, commercial diet, fish oil or canola may be used as a binding agent. The drug may also be mixed into a gelatin-based feed and should be added when the gelatinized mixture has cooled but has not yet set. Either the dry or gelatinized medicated food can then be frozen for storage. During the 5-day treatment regime, feed only the medicated food to the fish. If medication is to be administered in a gelatinized diet, gradually introduce non-medicated gelatinized food to healthy fish to train them to accept this diet; sick fish are difficult to train because they do not eat well and may completely refuse unfamiliar food.

If fish are already sick and will not eat, metronidazole can be administered in a bath at a concentration of 5 mg/l (18.9 mg/gallon) every day for five treatments. Make water changes (70–100%) each day before re-dosing. This treatment is effective, but in some cases it may not clear the organism from the fish's intestinal tract as effectively as the medicated food does.

Another way to treat fish that will not eat is to use the bath treatment for 1–2 days until fish begin to eat again and then to switch them to a medicated feed for the remaining time period (a total of 5 days under treatment).

Though other drugs like mebendazole and dimetridazole have been tested experimentally with some positive results, metronidazole is much easier to obtain and widely used.

## Prevention

Quarantine, diagnose, and treat all new incoming fish before mixing them with farm stocks to reduce the potential spread of disease to your facility. Because *Spiroucleus* can survive in laboratory media and fecal materials and organics, one should assume that it lives in any aquaria where organic materials have accumulated. Vacuum, clean,

and rinse gravel and filter materials to eliminate most of the detritus and organisms from the environment. Periodically check broodstock for subclinical spironucleosis infections for best results. Evaluate wet mounts of fresh fecal material (must be taken as soon as the fish defecates) to identify infection without sacrificing the fish.

Low levels of the parasite may not result in clinically diseased fish, but they may have an adverse effect on reproductive performance, and a low-level infestation may flare up under stressful conditions and cause disease. These low-level infestations can be easily treated with a medicated feed before real problems develop.

## Summary

*Spiroucleus* is a flagellated single-celled parasite that can be found in the intestines of healthy and sick fish. Cichlids, including many South American species such as angelfish, oscars, discus, as well as African Rift Lake species, are most commonly infected. Stressors, especially poor water quality, inadequate nutrition, or other infectious organisms, may increase the number of flagellates in the gut and lead to clinical disease. Elimination or reduction of stress and improvement of husbandry will help correct an outbreak of spironucleosis. Metronidazole provided as a medicated feed or a bath is an effective treatment for spironucleosis, and even severely affected fish often respond to therapy. Commercial producers of ornamental cichlids should periodically check fish for *Spiroucleus* infestations, treat any infected fish, and routinely clean systems appropriately to reduce organics and feces.

## Additional Reading

Sangmaneedet, S. 1999. “*Spiroucleus vortens* of the Freshwater Angelfish (*Pterophyllum scalare*): Growth Requirements, Chemotherapeutants, Pathogenesis, and Immunity.” PhD Dissertation, Virginia Polytechnic Institute and State University 203. <http://scholar.lib.vt.edu/theses/available/etd-120399-140825/unrestricted/ANGEL.PDF>

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