



## ***Cryptobia iubilans* in Cichlids<sup>1</sup>**

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### **What is *Cryptobia*?**

*Cryptobia* is a flagellated protozoan, closely related to *Hexamita* and *Spironucleus*, but not nearly as well understood. Like *Hexamita* and *Spironucleus*, *Cryptobia* is a very tiny (single-celled) organism and, consequently, can be difficult to identify and study. There have been 52 species of *Cryptobia* identified in fish; however, because of its small size and difficult taxonomy, these may not all be separate species. Of the 52 species that have been identified, five are classified as ectoparasites that infect the gills and skin; seven are classified as enteric parasites that infect the gastrointestinal system; and 40 are classified as hemoflagellates which are found in the bloodstream. It has recently been proposed that the hemoflagellates be assigned to a subgenus called *Trypanoplasma*. The hemoflagellates have an indirect life cycle and are transmitted by leeches, whereas the gastrointestinal and ectoparasitic forms have direct life cycles.

### ***Cryptobia iubilans* and Cichlids**

*Cryptobia iubilans* was first recognized in cichlids some 20 years ago. The organism is typically associated with granulomas (a tissue reaction) in the

stomach, but systemic infections that involve the organism in blood and organ systems (including liver, gall bladder, kidney, ovary, brain, and eye) have been reported. It is not known how the organism is able to spread from the intestinal tract to other organs, or what causes the internal spread. Mortalities associated with the systemic form may exceed 50% of the infected population.

The gastrointestinal form of *Cryptobia* has been reported in East African and Central American cichlids, including: *Herichthys cyanoguttatus*, *Cichlasoma meeki*, *Cichlasoma nigrofasciatum*, and *Cichlasoma octofasciatum*. Our laboratories have found it in some additional species, but most of the work has been done with *Pseudotropheus zebra* (Department of Fisheries and Aquatic Sciences, Gainesville, FL) and *Symphysodon* spp. (Tropical Aquaculture Laboratory, Ruskin, FL).

In the summer of 1995, there was an outbreak of the systemic form of *Cryptobia iubilans* in cichlids at the Chicago Shedd Aquarium. The outbreak resulted in loss of 50% of the collection of East African cichlids including *Cyphotilapia frontosa*, *Dimidiochromis compressiceps*, and *Aulonocara stuartgranti*. The outbreak seemed to originate with

1. This document is VM104, one of a series of the Veterinary Medicine-Pathobiology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date January 1, 1999. Revised April 12, 2002. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.
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the *Aulonocara* that had been purchased from a midwest wholesaler. While the fish were in quarantine, the infection spread to *Cichlasoma meeki* and *C. nicaraguense* housed in the same tank. From there it spread to the *C. frontosa* and *D. compressiceps* that were housed in separate tanks but shared the same water due to a common filtration system. The sick fish went off feed for one to two days, becoming progressively more listless and withdrawing from contact with other fish. Just prior to death, they would move to the surface of the water and their respiration rate would increase dramatically, suggesting that they were hypoxic (suffering from low dissolved oxygen). Closer examination of fish at this stage of the disease revealed severe anemia, with packed cell volumes around 5% (normal should be greater than 30%). Death usually occurred within 24 hours of the development of severe anemia.

Veterinarians at Shedd aquarium wanted to see how many species in their collection carried the parasite so they sacrificed 60 apparently healthy fish, and found evidence of *Cryptobia iubilans* in all but one (98% prevalence). These fish had granulomatous gastritis (the tissue reaction in the stomach) but no evidence of the systemic disease. The affected species included *Haplochromis macula*, *Cichlasoma nicaraguense*, *Labeotropheus fuelleborni*, *Cichlasoma aureus*, *Pseudotropheus zebra* and *P. elongatus*. Since the 1995 epizootic (disease outbreak), Shedd Aquarium has instituted a new quarantine protocol for all cichlids. All incoming cichlids are subjected to a minimum 60-day mandatory quarantine. A number of animals are screened for the presence of *Cryptobia*; any infected cichlid is culled.

## Comparing *Cryptobia* and *Spironucleus* infections

### Clinical Disease:

Both *Cryptobia* and *Spironucleus* can result in similar disease scenarios on cichlid farms. Both parasites become more serious under conditions of crowding, poor sanitation, high organic load, and handling stress. Diet also may play a role in the development of the disease. It has been demonstrated in laboratory mice that changes in the intestinal bacterial flora, caused by changes in diet, can affect

the presence of intestinal flagellates, suggesting greater potential for clinical disease.

Enteric disease from either parasite may result in low level chronic mortality, "wasting" or poor growth. The effect of *Spironucleus* is more serious in fry and very young fish. It is not known if this is also true for *Cryptobia*, but there is some evidence that supports this belief. The impact of either disease on reproduction is not well understood; however, we believe that breeders heavily infected with *Spironucleus* produce poor quality eggs and weak fry.

### Diagnosis:

*Spironucleus* can be tentatively identified by observing the motile trophozoites in smears of intestinal contents or feces. Identifying the parasite to genus requires both transmission and scanning electron microscopy and therefore cannot be done on a routine basis. *Cryptobia* is most easily detected by identification of granulomas in thin wet mounts of stomach tissue (Figure 1). Because these granulomas are indistinguishable from the granulomas observed with *Mycobacterium*, an acid-fast stain (eg. Ziehl-Nielson) should be used to rule out that important disease (see IFAS Extension Fact Sheet No. VM-96). In most instances, motile forms of *Cryptobia* will not be seen on wet mounts that are examined with a light microscope. Electron microscopy is also required to confirm the identity of this organism.



**Figure 1.** Typical granuloma seen in a wet mount of stomach tissue from an African cichlid with *Cryptobia iubilans* infection. The section is unstained and is examined with a light microscope (100x)

### Transmission:

Both *Spiroucleus* and *Cryptobia* have direct life cycles. Infective forms are shed with feces, and ingestion of these forms is thought to result in infection. Both organisms can live in the water column for at least a few hours. Always remove carcasses as quickly as possible when they are found, since both parasites may be spread by ingestion of infected tissue.

### Treatment:

*Spiroucleus* usually responds well to metronidazole administered in feed or as a bath. The recommended dose in feed is 1% (4.5 grams active drug per pound of feed) fed daily for five consecutive days (see IFAS Extension Fact Sheet No. VM-67). The bath treatment is 6 mg/L (250 mg added to 10 gallons of water), followed by a water change four to eight hours after treatment, repeated daily for five days (see IFAS Extension Fact Sheet No. VM-67). These regimes have been very effective for control of *Spiroucleus* in cichlids for the past ten years.

Currently, there is no effective treatment for *Cryptobia*. Part of the difficulty may be that the parasite seems to have an intracellular stage. Parasites are occasionally seen in phagocytic cells, called macrophages, which are part of the immune system and are supposed to destroy foreign protein by engulfing it. *Cryptobia* seems to be able to live within these cells rather than being destroyed by them. This can make it difficult to treat *Cryptobia* because most drugs are not able to penetrate the cell wall of a macrophage. Some Florida farms have used a sulfa drug (sulfadimethoxine) that seems to help control mortalities in some cases, but has not eliminated the parasite. Experiments are in progress at the Tropical Aquaculture Laboratory (Ruskin, FL) to find an effective therapeutic agent.

### Summary

*Cryptobia iubilans* is not a new parasite of cichlids but has received significant attention in the past few years. It seems to be widespread in East African cichlids and has been found in *Pseudotropheus zebra* immediately following importation from Lake Malawi, suggesting that it

occurs naturally in wild fish. It has also been found in some South American cichlids, most notably, discus. The parasite usually causes a granulomatous gastritis and may be associated with chronic low-level mortality. A systemic form of the disease has been reported in captive East African and Central American cichlids. This form was associated with acute mortalities and loss of 50% of affected animals. Currently there is no effective treatment for *Cryptobia*. Water quality, stocking density and diet may all effect the severity of infection. Work is in progress at the University of Florida to learn more about this common, but important, cichlid parasite.