Parental care combats saprolegniasis in convict cichlid eggs

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Abstract:
The aim of this project was to determine the effectiveness of convict cichlid parental care at preventing the spread of saprolegniasis across egg clutches. Infection rates were measured and compared across two clutch treatments: one with parental care and one without. The number of infected eggs after six days was significantly higher in non-parental care treatments than in the parental care treatments. The results suggest that parental care behaviors in convict cichlids are effective in preventing the spread of saprolegniasis.

Introduction:
Water molds are a group of fungus-like stramenopiles ubiquitous to freshwater systems. The parasitic properties of these organisms have sweeping economic and ecological impacts. In addition to vastly important plant diseases such as potato blight and sudden oak death, water mold infections are responsible for the fish disease saprolegniasis [1,2]. It is estimated that 10% of all farmed salmon succumb to the disease resulting in financial loses in the tens of millions of USD each year [3]. Saprolegniasis has also been observed to infect the eggs and fry of natural freshwater fish populations [4]. The disease process begins with a saprotrophic primary zoospore. The zoospore encysts in dead tissue and germinates hyphae that are able to infect surrounding live tissue.
Fish exhibit diverse parental care behaviors aimed at increasing the survival of their offspring [5]. Cichlids display extensive clutch maintenance behaviors such as fanning, mouthing, and selective egg consumption [6,7]. These behaviors are thought to facilitate gas exchange and keep the clutches free of debris [8]. Considering water mold's dependence on dead tissue to encyst I hypothesized that these behaviors reduce the spread of saprolegniasis. To test this hypothesis I compared infection rates across parental care and non-parental care treatments.

**Methods:**

Convict cichlids were mated in 10, 15, and 20-gallon aquariums at temperatures ranging from 18-25 degrees Celsius. Their clutches were removed and 10 eggs were punctured with a needle to insure that each treatment had a nutrient source for the primary zoospore. In half of the treatments the parents were removed and placed in cages out of reach of the eggs. Pictures of the clutch were taken before, during, and after a six-day incubation period then analyzed to determine the spread of the saprolegniasis.

**Results:**

Across all tank sizes and temperatures, significantly more eggs showed signs of saprolegniasis in non-parental care treatments than in parental care treatments. The parents in the parental care treatments removed all of the punctured eggs.

**Discussion:**

The results of this experiment suggest that parental care may have evolved in part to combat infectious diseases such as saprolegniasis. A qualitative analysis of the data supports the assumption that most of the eggs died due to saprolegniasis and not the lack of parental care. Most dead eggs were covered in the water mold’s mycelium mat, which radiated out from the
site of the punctured eggs. This indicated that the eggs succumbed to the spreading disease. In addition, both treatments contained healthy fertilized eggs that hatched into fry by the sixth day of incubation. The fact that the parents removed all the punctured eggs shortly after returning the clutch to the tank is strong evidence that these fish selectively remove eggs that may threaten the health of the clutch. This also implies an awareness of egg viability on the part of the parent, which has interesting implications for theories on parental investment. The exact species of water mold involved in this experiment was unknown. Molecular analysis in future experiments would add specificity to these findings. Further analysis is also needed to determine how the hyphae germinating from the primary zoospore are able to infect healthy tissue. It is my hope that this experiment has shed some light on the topic of parental care ecology.

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Works Cited:


