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## CONTROL OF *Epistylis* ON CHANNEL CATFISH IN RACEWAYS

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**Abstract:** An *Epistylis* outbreak occurred on channel catfish in raceways during two growing seasons. Bioassays of potential control chemicals were conducted. Based on the bioassay results, salt (NaCl) plus formalin and salt alone were the most effective treatment chemicals.

The feasibility of using heated water discharges from a steam generating plant for high-density raceway production of channel catfish is being evaluated in a joint project by the Tennessee valley Authority (TVA) and Cal-Maine Foods, Inc., of Jackson, Mississippi. *Epistylis*, a peritrichous ciliate, has been a problem in the experimental raceways at the TVA steam generating plant near Gallatin, Tennessee, during the last two growing seasons.

*Epistylis* first appeared on the tips of both dorsal and pectoral fin spines. When untreated, *Epistylis* colonies spread down the spines, eroding flesh and bone as they spread, and eventually covered much of the anterior region of the body. Catfish mortality occurred when large portions of the body surfaces were covered and eroded away by the parasite. The *Epistylis* colony attaches to the fish by means of a disc-like attachment organelle (scopula) at the distal end of long, dichotomously branched stalks. Epithelial tissue and underlying bone are eroded away at the site of attachment. Fischthal<sup>2</sup> and Rogers<sup>4</sup> have described the morphology, life cycle, and pathology of *Epistylis* on fish in the United States. Species determinations were not made by these authors or the present ones; it is possible that the species attacking trout is different from the one reported here. Photographs of *Epistylis* from channel catfish in the heated water

raceways at Gallatin, Tennessee, are presented in Figures 1 and 2.

On March 7 and 10, 1973, some 150,000 channel catfish fingerlings, 15.4-20.5 cm in length were stocked into the ten concrete raceways. Each raceway measures 15.2 m long, 1.2 m wide, and 1.2 m deep. The fingerlings were stocked at densities of 10,000; 15,000; and 20,000 fish per raceway.

The steam plant effluent used in the raceways is 6.6 C warmer than the intake water from the Cumberland River. Water temperatures in excess of 15.5 C are maintained for approximately 8 months a year within the raceways. The maximum water temperature is approximately 29.6 C. A flow rate of 1.0-1.2 klpm is maintained through each raceway.

Predelivery and postdelivery inspections revealed the presence of *Epistylis* on a few fish. Biweekly examinations for external parasites revealed no significant levels of *Epistylis* infestation until early May, when approximately 75% of all fish had *Epistylis* at the tip of the dorsal and pectoral spines.

A literature review on the prevalence and control of *Epistylis* on hatchery raised fish revealed that previous effort to control *Epistylis* had been inconsistent.<sup>1,3,5,6</sup> To determine an effective control for *Epistylis* within the experimental catfish raceways, bioassays of potential control chemicals were conducted.



FIGURE 1. *Epistylis* from the channel catfish in the experimental raceways at Gallatin, Tennessee. (200 X)

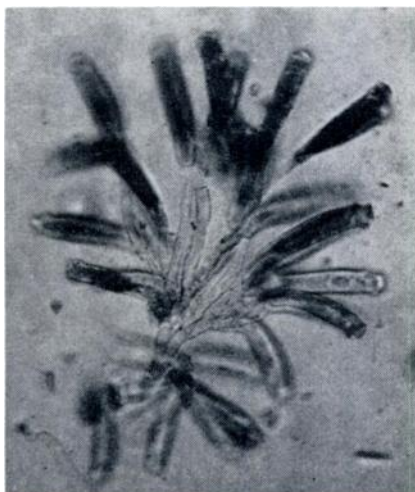


FIGURE 2. Typical *Epistylis* colony with dichotomously branched stalks. (50 X)

#### BIOASSAY METHODS

Plastic trash cans with 35 l capacities and lined with polyethylene bags were utilized as the bioassay vessels. Each vessel was filled with 25 l of water from the raceways. A single air stone was used for aeration. Five *Epistylis*-infected fish were placed in each container. Initially, two replicates were set up for each bioassay. When the bioassay results indicated potential control, further replications were conducted. No attempt was made to evaluate the possible effect of organic compounds from the plastic on either *Epistylis* or the treatment chemicals.

Evaluation of a treatment's effect was made by removing some of the *Epistylis* colony from the fish using forceps, placing the *Epistylis* on a microscope slide with a drop of water and cover slip, and examining the organisms for movement or change in body shape.

#### BIOASSAY RESULTS

When exposed to effective chemical treatments, *Epistylis* contracted into a "ball" shape, ciliary movement ceased, and body contractions stopped. With exposure to very high concentrations of toxic chemicals, *Epistylis* broke from its stalk and became distorted into irregular shapes.

By microscopic examination it was impossible to determine if the treatment had killed the *Epistylis* or effected a dormant state. Evaluation of treatment effect is based on the degree of ciliary activity and the appearance of *Epistylis* at the end of the bioassay period. Depending on the treatment, its concentration, and the length of exposure, many completely inactive colonies were found to have numerous, actively feeding, "healthy" *Epistylis* after 1-12 h when re-introduced into fresh water.

Pertinent physical and chemical parameters of the bioassay water taken from the raceways were:

Methyl orange	
alkalinity	85 mg/l (85 ppm)

Total hardness	103 mg/l	Results of the bioassays using formalin (commercial formalin containing 37-40% formaldehyde), salt (NaCl), copper sulphate, potassium permanganate, and acetic acid are presented in Tables 1 and 2.
Carbon dioxide	15-20 mg/l	
Ammonia	0.2-0.5 mg/l	
Oxygen	4.0-6.5 mg/l	
pH	7:5-7.7	
Temperature	21-23 C	

TABLE 1. Results of bioassays on formalin and salt treatments for *Epistylis* on catfish in raceways.

Treatment	% Survival of Catfish	Effect on <i>Epistylis</i>
Formalin for 1 h		
100 mg/l	100	Contractile movement
150 mg/l	100	Some contractile movement
200 mg/l	100	Very slight movement
250 mg/l	90-100	Very slight movement
Formalin for 2½ h		
100 mg/l	100	Completely inactive
150 mg/l	100	Completely inactive
Formalin for 3 h		
50 mg/l	100	Some contractile movement
Salt (NaCl) for 1 h		
1.5%	100	Completely inactive
3%	60	Completely inactive
Salt (NaCl) plus formalin for 1 h		
1.5% + 50 mg/l	100	Completely inactive
1.5% + 100 mg/l	100	Completely inactive
1.5% + 150 mg/l	90	Inactive, slightly desiccated
1.5% + 250 mg/l	80	Inactive, severely desiccated

TABLE 2. Results of bioassays on less promising chemical treatments for *Epistylis* in raceways.

Treatment	% Survival of Catfish	Effect on <i>Epistylis</i>
Copper sulfate for 2 h		
20 mg/l	100	No visible effect
30 mg/l	100	Contractile movement
40 mg/l	100	Completely inactive
Potassium pemanganate for 3 h		
2 mg/l	100	No visible effect
4 mg/l	100	No visible effect
Acetic acid dip for 1 min		
1:500	100	Completely inactive

### DISCUSSION

Based on the bioassay results, the following 1-h raceway treatments for *Epistylis* are listed in their order of effectiveness:

1. 1.5% salt plus 100 mg/l (100 ppm) formalin
2. 1.5% salt plus 50 mg/l formalin
3. 1.5% salt
4. 200 mg/l formalin

Due to the high chemical oxygen demand of formalin, the dissolved oxygen levels

in the raceways could be lowered significantly. Considering the oxygen demand of formalin and the slight difference in effectiveness of the above treatments, the most desirable treatment for the channel catfish in the Gallatin raceways is 1.5% salt. Body movement occurred in .30% salt for up to 10 min and in 1.5% salt for up to 30 min. Salt at 1.5% killed the majority of *Epistylis* in 1 h.

The 1.5% salt treatment is deemed effective for control of *Epistylis* in the Gallatin raceways.

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