disease exists must be avoided. Also, the utilization of survivors of CCV epizootics for broodstock is not recommended. The safest procedure to prevent reoccurence of the disease is to destroy the affected fish and the broodstock and disinfect the ponds with chlorine. New fish stocks should be acquired from a source that has no history of CCVD. An ethical attitude of the catfish grower is essential in limiting the continued spread of CCV.

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DISEASE IN FISH DUE TO THE PROTOZOAN Epistylis (CILIATA:PERITRICHA) IN THE SOUTHEASTERN U. S.*

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ABSTRACT

"Red-sore" disease of fishes caused by the stalked ciliate *Epistylis*, is very common and widespread in the Southeastern U. S. Epizootics occur most frequently during the winter and spring months. Research has shown that this species is not an obligate parasite but only uses the host fish as an attachment site. The disc-like attachment organelle, penetrating the skin of the fish, apparently secretes an enzyme that dissolves the fishes' scales or spines and produces pit-like inflamed lesions. Bacterial infections often occur secondarily to the *Epistylis* infestation. Observations of the life history have shown a formation of telotrochs which are characteristic of the order Peritricha. Preliminary laboratory tests show that a single treatment with potassium permanganate at a rate of 2 ppm or formalin at a rate of 15 ppm will control *Epistylis*.

INTRODUCTION

A characteristic "red-sore" disease of fish involving scale erosion and pit-like inflamed lesions is produced by the stalked ciliated protozoan *Epistylis*. This disease is very common in the Southeastern U. S. and cases of the disease have been reported to the Southeastern Cooperative Fish Disease Project Laboratory from virtually every state in the Southeast. Even though the disease is extremely common and appears to affect mainly species of sport fishes, no published reports of the occurrence of the disease are available in the U. S. other than that of Rogers

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(1970). The main problem with *Epistylis* infestation is not that of mortality of fish but of rejection by anglers because of the diseased appearance of the fish. The species of *Epistylis* reported in this paper is not an obligate parasite but apparently uses the host fish only as an attachment site.

THE ORGANISM

Epistylis is characterized by having an urn-shaped or elongate bell-shaped body attached to a dichotomously branched stalk (Fig. 1). A ring of cilia leading into the cytostome adorns the adoral end of the body. An elongated ribbon shaped macronucleus winds through the center of the body. The stalks are non-contractile and are attached to the skin of the host by a disc-like holdfast organ.

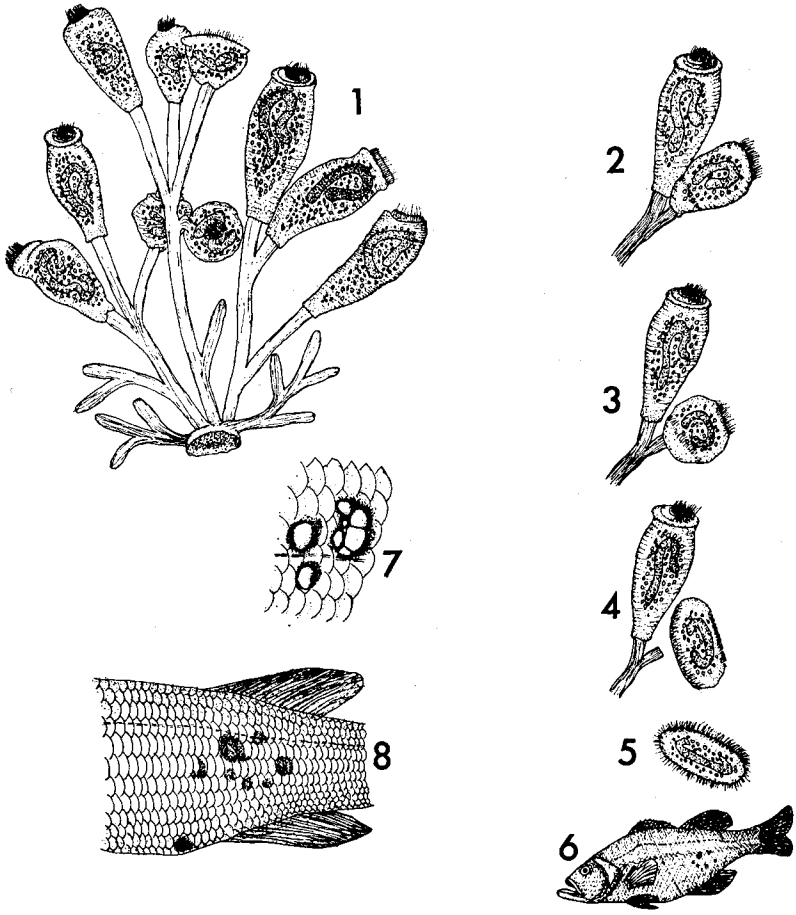

FIGURE 1. Colony of *Epistylis*. FIGURES 2-4. Formation of telotroch by individual *Epistylis*. FIGURE 5-8. Telotroch seeks new host and establishes new colony and characteristic pit-like lesions.

LIFE CYCLE

Epistylis is not an obligate parasite. Colonies of the organism were found to grow in the laboratory on food particles or other organic debris in fish holding tanks or attached to sides or bottoms of the tanks.

Observations of transmission of the organism showed the formation of telotrochs which are characteristic of the Peritricha. *Epistylis* is a primary invader and does not require breaks in the epithelium to become established. The telotroch developed in the following manner: the body of the organism contracted and rounded up and then a ring of cilia developed near the proximal end of the body (Fig. 2); the adoral ring of cilia was apparently re-absorbed into the body; the body then changed from a rounded to a dorsoventrally depressed, disc-like shape with a ring of cilia around the margin (Figs. 3-4); it then detached from the stalk and became a free-swimming telotroch (Fig. 4). The telotroch then seeks a new host or other attachment site, secretes a stalk and holdfast, elongates and divides by binary fission to produce a new colony and the characteristic lesions (Figs. 5-8).

PATHOLOGY

In transmission studies in the laboratory the teletroch almost always attached itself to the host at the end of spines or on epithelium overlying bones or spines. In severe infestations colonies were found all over the body.

The first detectable lesions on the fish were small protrusions of proliferated epithelium. Within this hyperplastic growth could be found one to several *Epistylis* cells. Apparently the telotroch would cause cell proliferation that would enclose the organism. The hyperplastic protrusions ranged in size from one to five millimeters in diameter. No hemmorhage was evident around the proliferated area at this stage. With subsequent colony development and formation of the disc-like holdfast, the epithelium would erode away from the top of the protrusion exposing the *Epistylis* colony.

Where colonies were overlying scales, spines, or bones erosion of these structures would become evident at this stage of colony development. The epidermis would be completely destroyed and the dermis would be hemorrhagic and inflamed. Bacteria were commonly associated with the lesions and rarely fungi were found. Extensive scale erosion was associated with the larger colonies and pit-like inflamed lesions ranging in size up to 2½ centimeters in diameter were observed. Rarely scale regeneration would begin within the center of the lesion. In some cases spines would be completely eroded away. It is though that enzymatic action caused erosion of spines and scales. Mortalities associated with *Epistylis* infestations were infrequent and were probably due to secondary bacterial infections.

OCCURRENCE

"Red-sore" disease due to *Epistylis* has been diagnosed at the Southeastern Cooperative Fish Disease Laboratory from virtually all the Southeastern states. It has been most commonly found in new reservoirs and on species of the family Centrarchidae. Apparently the organic enrichment present in new reservoirs enhances epizootics of *Epistylis*. The disease has been found every month of the year but is most prevalent during the winter and spring months.

CONTROL

Preliminary tests at our laboratory showed that a single treatment with potassium permanganate at a rate of 2 ppm or formalin at a rate of 15 ppm would control *Epistylis*. In a personal communication, H. R. Schmittou reported that field treatments with 15 ppm formalin gave control of *Epistylis* but it would recur within several weeks. Early laboratory tests by Dr. G. K. Krantz, formerly at our laboratory, showed that *Epistylis* had a high sensitivity to salt. Salt concentrations of 0.2 per cent caused complete mortality of *Epistylis* colonies within eight hours. A 2.0 per cent concentration gave complete mortality within five minutes. Based on this information a 2.0 per cent salt bath for five minutes should control *Epistylis*.

ACKNOWLEDGEMENTS

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FISH MORTALITIES ASSOCIATED WITH Goezia Sp. (Nematoda: Ascaroidea) in Central Florida [1]

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ABSTRACT

This is the first report of *Goezia sp.* from freshwater fish in North America. Extensive mortalities among striped bass *(Morone saxatilis)* resulted from the damage caused by these nematodes. A possible mode of infection is given and a discussion of the pathology associated with the worms is presented.

INTRODUCTION

The striped bass, *Morone saxatilis* (Walbaum), has in recent years enjoyed a come back in the Southeastern United States due to large scale stocking programs conducted by various states. In most cases the stocking is the basis for an extensive put-grow-and-take fishery. The state of Florida successfully stocked this fish in the summer of 1968 (Ware, 1970). Ware discussed the establishment of the striped bass and the growth of the fish during its first two years. He also discussed some of the difficulties caused by the nematode, *Geozia* sp., which caused large mortalities in the stocks of striped bass put into four Florida lakes. This nematode and its effects on the stocking program that will be discussed in this paper.

CASE HISTORY

The nematode, *Goezia* sp., appears to have been introduced into the striped bass populations in 1968 when, at Richloam State Hatchery, fry were fed ground up frozen marine herring. That this is the site of entry of the worm is evidenced by the facts that (1) the striped bass arrived at Richloam State Hatchery in the sac-fry stage and thus were not feeding; (2) the worm is known to infect marine herring (Yamaguti, 1961); (3) changes in the feeding procedures (namely, eliminating the raw fish meal), in subsequent years have prevented more recent stocks of striped bass from becoming infected at the hatchery, and (4) *Goezia* sp. can be found in adult striped bass on the Richloam Hatchery. These hatchery fish are part of the original stock of striped bass that were fed the raw herring in 1968.

There is precedence in the literature for this type of transmission for *Goezia* sp. Dollfus (1935) reported a very similar situation in which a three-year-old rainbow trout became infected with *Goezia ascaroides* by being fed raw fish meal made from marine fishes. This fish had been hatched and raised in an artificial environment.

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