Host Specificity of *Posthodiplostomum minimum (Trematoda): Strigeida*

With Twelve Species of Fish and Two Sunfish Hybrids

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ABSTRACT

Parasite-free snails of the genus *Physa* were experimentally infected with the miracidia of *Posthodiplostomum minimum*, the metacercariae of which were originally obtained from bluegills, *Lepomis macrochirus*. Twelve species of fish representing 5 families (Cyprinidae, Cichlidae, Centrarchidae, Poeciliidae and Ictaluridae) were exposed to cercariae from the infected snails. Two sunfish hybrids (female green sunfish, *L. cyanellus* X male redear sunfish, *L. microlophus;* and female bluegill X male redear) were also exposed to cercariae of *P. minimum*. Only members of the family Centrarchidae became infected. Moreover, only the bluegill and its hybrid contained metacercariae in substantial numbers.

INTRODUCTION

Host specificity of *Posthodiplostomum minimum* in fish was proposed by Klak (1939). He observed that the largemouth and smallmouth bass, *Micropterus salmoides* and *M. dolomieui*, (Centrarchidae) were uninfected in a pond where 4 of 5 species of minnows (Cyprinidae) were heavily infected with metacercariae. This finding seemed contradictory since *P. minimum* had been reported in both groups of fish. In other host specificity work, Ferguson (1943) infected 2 groups of blacklcrowend night herons *(Nycticorax nycticorax)*, one group with metacercariae from centrarchid hosts and one group with metacercariae from cyprinid hosts. He then infected laboratory-reared snails with the resulting miracidia. When cyprinid fish were exposed to cercariae of both strains, they became infected only with cercariae originating from cyprinid fish. Similarly, centrarchid fish, when exposed to both lines of cercariae, became infected only with cercariae from the centrarchid strain. Similar findings on the host specificity of *P. minimum* by Hunter and Hunter (1940), Miller (1954) and Hoffman (1958) corroborated Ferguson's work. Hoffman (1958) suggested that there may be physiological strains or subspecies of *P. minimum* which are morphologically similar. He proposed that the minnow line be called *P. minimum minimum* and the sunfish line *P. minimum centrarchi.*

The metacercaria of *P. minimum* has been reported from many species of fish. Hunter and Hunter (1940) reported that 23 species of fish representing 6 families in the eastern United States harbored the metacercaria of *P. minimum.* Hoffman (1958) reported that the metacercaria of *P. minimum* had been recorded from 97 species of 18 families of freshwater fish. However, Ferguson (1943), Hunter

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and Hunter (1940) and Hoffman (1958) were unable to infect some of the species of fish reported as hosts of *P. minimum.*

This study was conducted to obtain information on the host specificity of *P. minimum* with 12 species of fish and 2 sunfish hybrids.

MATERIALS AND METHODS

Experimental Animals

Day-old, unfed baby chicks were force-fed the viscera of bluegills, *Lepomis macrochirus,* infected with metacercariae of *P. minimum.* Parasite eggs were collected in a pan of dechlorinated water. Laboratory-reared snails of the genus *Physa* were exposed to the resulting miracidia and the infected snails began shedding cercariae in 34 days.

The 12 species of fish used in experimental infections were obtained from local sources. Samples of each species were examined to determine if they harbored metacercariae. All were negative. The hybrid sunfish were produced under laboratory conditions. Female green sunfish, *L. cyanellus,* were crossed with male redear sunfish, *L. microlophus;* and female bluegills were crossed with male redear. The crosses were made by stripping and artificial fertilization as described by Smitherman and Hester (1962). The hybrid fry were reared in cercariae-free water in plastic-lined pools.

Experimental Infections

All experimental infections were done in 40-liter aquaria. Thirty days after the fish were exposed to cercariae, the heart, liver and kidney of each fish were examined for metacercariae. Previous experiments revealed that these 3 organs contained approximately 79 per cent of the total metacercariae. Each organ was placed in a 10 ml test tube containing 0.25 per cent pepsin solution in 1 per cent HCL and digested at 37°C. for 20 minutes, thus freeing the metacercariae from the tissues for counting. This method is similar to the one described by Hoffman (1955). Metacercariae freed from fish tissue, were counted with the aid of a dissecting microscope and grid petri dish.

Nine species of fish (goldfish, *Carassius auratus;* fathead minnow, *Pimephales promelas;* nile tilapia, *Tilapia nilotica;* congo tilapia, *T. melanopleura;* java tilapia, *T. mossambica;* warmouth, *Chaenobryttus gulosus;* guppy, *Lebistes reticulatus;* white catfish, *Ictalurus catus;* and channel catfish, *I. punctatus)* were exposed to cercariae from snails infected with *P. minimum.* Four fish of each species were exposed to approximately 3000 cercariae. Three replications of each treatment were used along with controls receiving no cercariae.

In a second experiment, 4 green sunfish X redear hybrids were stocked into an aquarium with equal numbers of each parent species. Bluegill X redear hybrids were stocked into aquaria in a like manner. Four replications of each treatment were used. Approximately 1,000 cercariae were introduced into each aquarium daily for 3 days. Controls receiving no cercariae were maintained.

RESULTS

All of the warmouth died within 24 hours after the experimental infection and therefore must be discounted. None were lost in the control group. Of the remaining 8 species of fish all were negative for metacercariae of *P. minimum.*

In the experiment with the hybrids, the bluegill X redear cross was vulnerable as a host for *P. minimum* to a degree intermediate between its parent species, but tended toward its maternal parent, the bluegill, in susceptibility (Table 1). The redear harbored the parasite only occasionally, while the bluegill was most susceptible to infection with *P. minimum*. Only one fish of the 8 green sunfish X redear cross contained metacercariae. It contained 4, 26 and 7 in the heart, liver and kidney respectively. None of the 8 green sunfish were infected.

TABLE 1

Average Number of Parasites Per Fish in the Heart, Liver and Kidney of Fish 30 Days After Exposure to 1000 Cercariae of *P. minimum* Daily for 3 Days.

Species of Fish	Number Examined	Heart	Liver	Kidney	3 Organs Combined
Bluegill	16	8.3	60.9	51.9	121.1
Bluegill X Redear Sunfish	11	5.2	64.9	27.9	97.8
Redear Sunfish	16	0.6	0.3	0.2	1.2
Green Sunfish X Redear Sunfish	8	0.5	3.3	0.9	4.6
Green Sunfish	8	0.0	0.0	0.0	0.0

DISCUSSION

Fish used in this study were exposed to cercariae of the bluegill strain of *P. minimum*. All 12 species of fish and the 2 sunfish hybrids, when exposed to cercariae, exhibited signs of extreme, immediate discomfort by swimming erratically in attempts to scrape themselves against the sides and bottom of the aquarium. Yet only numbers of the family Centrarchidae became infected with the metacercariae. Furthermore, only the bluegill and its hybrid contained encysted parasites in substantial numbers. Thus, it appears that the centrarchid strain of *P. minimum* is host specific for this particular family and that varying degrees of susceptibility exist among its members.

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BIOLOGICAL CONTROL OF A TREMATODE PARASITE OF BLUEGILL

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ABSTRACT

An investigation was begun July 1, 1962 to determine the potential of snails infected with cercariae of *Posthodiplostomum minimum* to produce infection in bluegills, *Lepomis macrochirus*. Infected snails, in aluminum wire baskets, were stocked into plastic-lined pools at rates of 1 or 5 per pool. Bluegills of 2 sizes, 1-inch or 3-inch, were stocked into the pools. All bluegills were exposed to cercariae for 24 days at which time the experiment was terminated. One month later counts were made of the parasites found in each fish. One-inch bluegills contained an average of 20 parasites per fish when exposed to cercariae from 1 infected snail and 37 parasites per fish when exposed to cercariae from 5 infected snails. Three-inch bluegills contained an average of 110 parasites per fish when exposed to cercariae from 1 infected snail and 200 parasites per fish when exposed to cercariae from 5 infected snails. Comparison of treatment means revealed that the intensity of infection was related more to the size of the fish than to the number of infected snails to which the bluegills were exposed.

An investigation was begun October 10, 1962 to determine the effectiveness of the redear sunfish, *L. microlophus*, in reducing infection of *P. minimum* in bluegills through the destruction of the snail host. Infected snails were stocked free into plastic-lined pools at rates of 1, 5, or 10 per pool. Parasite-free snails were also stocked into all of the pools so that each pool contained a combined total of 100 snails. Bluegills were stocked into all of the pools. Some pools were stocked with redear, while others received no redear and were held as controls. One-half of the pools which received redear contained vegetation. All bluegills were exposed to cercariae for 37 days at which time the experiment was terminated. One month later counts were made of the parasites found in each fish.

When stocked alone with 1, 5 or 10 infected snails, bluegills averaged 38, 83, and 114 parasites per fish respectively. In pools stocked with redear, bluegills contained an average of 16, 16 and 48 parasites per fish. In the presence of redear and vegetation, bluegills