(Copy) Copy for Mr. Ruhl

August 6, 1938

REPORT NO. 488

SCHISTOSOMA DERMATITIS ("SWIMMERS ITCH") INVESTIGATION

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The present major outbreak of "swimmers itch" in Michigan includes the territory north of Houghton Lake into the southern part of the Upper Peninsula. Cases are not confined to the inland lakes but have been prevalent along the shores of Lake Michigan from Ludington to the Straits.

The high incidence this year is probably due to a favorable season which is reflected in a large snail population. There is no question but what this parasite occurs each season but usually in less abundance. Part of the present notice is the result of advertising and recognition of this disease.

The life history of this schistosome is fairly well known except for a knowledge of all possible final hosts. These, however, probably always occur in some aquatic bird as the gull or duck. The eggs from the adult schistosome reach the water through the feces of these birds and hatch into miracidia or small motile larvae which penetrate into certain snails. In the snail these larvae undergo changes giving rise to sporocysts (sac like reproductive stages), which in turn produce millions of cercariae (another motile larva) which penetrate from the snail out into the water.

It is the cercaria which produces the "itch" by penetrating the skin of human beings. In order to complete its life history cercariae must penetrate into the duck or gull.

Since man is not a favorable final host the larvae die soon after penetration. The itching results, first from substances secreted by the penetrating larvae and second from the body's reaction to the dead organism in the skin.

As yet no satisfactory treatment is known. Often relief may be had by keeping infected parts of the body cool and by application of lotions which temporarily relieve the itching. It takes several days to recover from these penetrations.

According to Dr. W. W. Cort, all people are not susceptible to these attacks. About 20 per cent of those subjected to the parasite experimentally failed to show any reaction.

Biological Information

1. Five different kinds of cercariae are known to produce dermatitis in man.
2. These cercariae use the following species of snails for intermediate hosts. Others may be discovered later.

   Lymnaea stagnalis appressa

   Lymnaea stagnalis perampla

   Lymnaea reflexa

   Lymnaea palustris

   Lymnaea (stagnicola) emarginata angulata

   Lymnaea (stagnicola) emarginata canadensis

   Physa gyrina elliptica

   Physa parkerii

3. While six different kinds of snails carry the dermatitis producing cercariae, only two of them are commonly found on bathing beaches. These are Lymnaea (stagnicola) emarginata angulata and canadensis. The habitat of these two snails is almost identical with the desirable bathing beaches in upper Michigan.
4. The relationship between the parasite and the snail is one of long standing and of such a nature as to produce huge numbers of cercariae without serious damage to the snail.
5. Individual snails shed cercariae over a period of from 2-5 weeks, insuring the presence of parasites in the water each day during late June to middle August and often later.
6. Dr. Cort found that most cercariae emerge from the snails early in the morning, i.e., between 4 and 7 a.m. Thus early bathers are generally most often affected.
7. The cercariae when once shed only survive for a period of 24 hours or less so that a new crop is produced each day.
8. The habit of bathers to dry off in the sun aids the larvae in penetrating. They have an added opportunity for penetration by pushing against the surface film. Many bad cases could be avoided by instructing bathers to wipe dry immediately after coming out of the water.

Control Measures

Any control measure which is to be of consequence must be toward the local eradication of one of the essential hosts. Since it would not be practical to attempt the destruction of aquatic birds the only alternative is in the control of snails inhabiting the bathing beaches.

Very little information is available concerning possible snail control. In very limited areas a considerable reduction can be attained by hand picking. This is next to impossible over large areas.

The effects of copper sulphate on aquatic life has been studied under certain limited conditions. It is known that 1 ppm. of $CuSO_4$ will kill snails when this concentration is maintained for several hours. It is likewise known that aquatic plants (both algae and flowering plants) are killed by similar copper sulphate treatments. Fish and fish food organisms are likewise very sensitive to poisoning by these treatments.

It is not known whether aquatic animals exhibit a degree of sensitivity to copper sulphate poisoning and if so whether or not it would be possible to poison one form of organism without destroying the others.

An experiment was undertaken at Interlochen State Park on Duck Lake during the first week of August 1938 to test out the feasibility of poisoning snails by copper sulphate.

The bathing beach in this area is very extensive, being several thousand feet in length and the present experiment had necessarily to be confined to 500 feet of the beach adjacent to the main dock.

The beach was examined to determine the abundance and extent of the host snail - Lymnaea (stagnicola) emarginata angulata. It was found to be extremely abundant and inhabited the shoal out to about 5 feet in depth or a distance of about 250 feet.

This shoal was also inhabited by many midges, burrowing mayflies and clams.

Several schools of minnows and a considerable number of 2-inch bass were observed around the dock.

A few pounds of copper sulphate crystals were scattered over a small area near the dock. The wind was along shore and carried most of the solution away. We waited until the following morning when the lake was perfectly calm and then added the 400 pounds of crystals (size range 1/4 to 3/4 inch) over a length of 500 feet.

The concentration in parts per million was computed as follows:

Length of shore line treated = 500 feet

Width of shoal treated = 250 feet

Average depth = 2 1/2 feet

500 x 250 x 2 1/2 = 312,500 cu. ft. of water in area treated.

312,500 x 62.5 = 19,531,250 lbs. of water.

Four hundred pounds of copper sulphate were used. This would be approximately 20 parts per million by weight. This is assuming no dilution from surrounding water or the removal by organic matter which must have rapidly decreased the concentration. Please note this figure is different from the one I gave you in the office. Mr. John Miller figured it at 10 ppm. and I didn't figure against him. Am I right or is he?

Results of Above Treatment

1. Most of the snails contracted far into their shells soon after the application of the copper sulphate. As a result the subsequent action of the waves caused them to be collected in pockets near shore. Considerable slime was secreted by the snails which collected sand grains and debris. After 6-8 hours a considerable number of snails were dead and after 24 hours approximately 75 per cent of the snails appeared dead. Many others while still alive were inactive and slow to contract. A subsequent check is being made to see how complete the kill actually was.

The algae in this area and adjoining beach was completely destroyed. Likewise many midges and mayflies were found drifiting toward shore. A number of minnows in a live box anchored to the dock died soon after the first small application of the first day. A few other dead minnows were observed along shore following the final application.

Twenty-four hours after application schools of minnows were observed again at the dock. Their reactions were normal in every respect.

Conclusions

The above experiment was carried out without proper knowledge of conditions. My opinion is that while most of the snails may be destroyed on a limited part of the beach on lakes without doing serious damage to the fish and their food organisms, it may under certain conditions be seriously dangerous to allow extensive treatment.

It also appears logical at present that no treatments should be applied during late spring and early summer when small and large fish are concentrated on the shoals.

All poisoning should be done under supervision and by permit, especially for the first year or so in order to avoid the expected damage to fish.

INSTITUTE FOR FISHERIES RESEARCH

Proposed Investigation to Determine What Methods Should be Used in Snail Eradication

C. J. D. Brown

I. Laboratory Experiments

A. A series of tests should be carried out under controlled conditions to ascertain exactly what concentrations are needed to kill snails.

1. These tests should be made with copper sulphate and other toxic substances to see which is the most effective and the least expensive.

2. Ascertain whether or not a concentration can be maintained in waters containing even small amounts of organic matter. All of the snail infested beaches have some organic matter present.

3. Determine whether or not copper sulphate irritates a fish in the poisoning process. If so, do fish swim away from local concentrations? Tests could be set up in aquaria.

4. Are large or small crystals more effective or would it be desirable to dissolve the salt first? Some method should be used to test the concentration at intervals subsequent to the applications of poisons.

5. Are several doses of less concentration more effective than one strong application. Copper sulphate is an accumulative poison to fish. Exposure to strong concentrations for short intervals does not kill the fish.

Trout died in a stream at a concentration of 2 ppm. when exposed to it for 24 hours.

II. Field Experiments

With a knowledge of the reactions of aquatic organisms to $CuSO_4$ and other poisons under controlled conditions, some intelligent application can them be carried out in the field.

A. The application of known concentrations to snail infested beaches. Subsequent tests should be made to see how long a concentration can be maintained on a section of beach.

B. By thoroughly surveying a beach for fish and other aquatic life before the application of poison, during the application of poison and after the application of poison, some idea of the effects of such a treatment and its relation to fish life can be secured. One of our survey parties might be detailed to do this.

APPENDIX TO REPORT 488

August 17, 1938

REPORT ON SCHISTOSOMA DERMATITIS CONFERENCE

AT DOUGLAS LAKE, AUGUST 9, 1938

In the afternoon of August 9, a conference was held at the University of Michigan Biological Station to determine the most advisable method of approach to the control of the schistosome causing "swimmers itch." The State Health Department was represented by Col. Rich and Mr. John Miller; the Conservation Department by C. J. D. Brown, and the Biological Station by Drs. LaRue, Cort and McMullen.

Dr. Cort took the lead in the discussion and pointed out the present status of knowledge concerning this parasite. He said that the Biological Station had received many inquiries concerning remedial measures for its control. This he lays to the fact that they have exhibited specimens to camp visitors each year and undertaken to acquaint the public with it. He says that in a few instances he recommended copper sulphate without realizing it was illegal for laymen to use this chemical except by permission.

Col. Rich indicated that the Health Department was willing to take the lead in the development of control methods and stated that part of Mr. John Miller's time could be devoted to this investigation. A discussion followed and it was decided that, first, a man trained in biology would be more satisfactory and second, that if such a man could be made available, he should devote his entire time to the investigation. Col. Rich promised to attempt the appointment of such a man at the earliest date.

It was the opinion of the group that the Department of Conservation should be represented by a biologist to look after the fisheries interests. This man should work full time in cooperation with the biologist appointed by the Health Department.

Some of the suggested methods of attack were as follows:

1. Thorough laboratory tests with several likely chemicals to determine their effect on snails, fish and fish food organisms. Dr. McMullen called the group's attention to recent work in starfish control by the use of calcium oxide and said that he had some experiments underway to test its effect on snails.
2. Experiments on limited areas of beaches applying the knowledge gained by laboratory experiments.
3. Experiment with the practicability of certain mechanical methods of snail removal.

The conference adjourned the same afternoon. Col. Rich said that he thought the Department of Conservation was giving the thing too much publicity, indicating that the last mentioned department "lived on publicity anyhow."

INSTITUTE FOR FISHERIES RESEARCH
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