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Studies on Schistosome Dermatitis ("Swimmer's Itch") in Minnesota

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ABSTRACT – A preliminary study was conducted to determine the causative agents of schistosome dermatitis ("swimmer's itch") in Minnesota and to determine the incidence schistosome infection in vector snails. A total of 1180 snails were collected from ten different localities, eight of which were sites of known schistosome activity. The incidence of schistosome infection in snails from individual areas was always less than 10 percent. Cercariae of *Trichobilharzia ocellata* from *Lymnaea stagnalis* were the most frequently-found schistosomes in our study.

"Swimmer's itch," a dermatitis produced by the penetration of non-human schistosomes into human skin, has long been recognized as a nuisance in Minnesota. Typically, swimmer's itch is characterized by a prickling sensation, experienced as the cercariae penetrate the skin, followed by the appearance of macules. As the itching becomes more intense, the area where penetration occurred becomes papular. Finally, the papules are transformed into pustules. Itching may persist for several days, but is most severe two to three days post-exposure. The dermatitis is a sensitization phenomenon which may build up to a severe reaction after repeated exposures.

Cercariae that cause swimmer's itch occur in both marine and freshwater habitats. The freshwater forms found in North America occur chiefly in Canada and in the northern states of the United States, especially in areas of Michigan, Minnesota, Wisconsin, and Iowa. Cort (1928) in Michigan was first to show that the eruption of papules on the skin of swimmers was due to the penetration of cercariae. Subsequently a series of papers by Dr. Cort and his colleagues working at Douglas Lake, Michigan implicated several species of avian and mammalian schistosomes as etiological agents of swimmer's itch. Other studies, notably those by McMullen and Brackett (1941) in Wisconsin, McLeod (1940) in Manitoba, and Howard and Walden (1965) in British Columbia have contributed to our knowledge of the biology of swimmer's itch. The subject was thoroughly reviewed in a paper by Cort (1950).

Despite the apparent widespread occurrence of dermatitis-producing cercariae in Minnesota, only three reports of swimmer's itch in this state appear in the literature. Christenson and Greene (1928) implicated *Cercaria elvae* as the causative agent of swimmer's itch in unnamed lakes in the vicinity of the Twin Cities. Elliott (1942) reported that *Trichobilharzia ocellata and T. stagnicolae* produced dermatitis in swimmers in Lake Bemidji and in Lake Grace. Zischke and Zischke (1968) observed a number of cases of dermatitis in bathers in Basswood Lake in northern Minnesota. Subsequently they noted that a high incidence of *T. ocellata* occurred in *Lymnaea stagnalis.*

Causative agents, distribution studied

The authors of this paper noted that the occurrence of swimmer's itch and a general awareness of the problem were widespread in northern Minnesota and began a survey in 1969 to determine the causative agents of swimmer's itch and the distribution of dermatitis-producing cercariae in Minnesota lakes.

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Snails of species known to harbor dermatitis-producing cercariae were collected from eight locations where swimmer's itch had been reported and from two additional sources (Table 1 and Fig. 1). Fully-grown or nearly-grown snails were collected, brought into the laboratory, air-dried (15 min.) and isolated in 50-ml beakers containing filtered lake water. The beakers were placed under a light source for 24-30 hours, after which time the water was examined for emerged cercariae. Line drawings for later study were made of the emerged schistosomes.

Specimens and locations

A total of 1,180 snails were examined for the emergence of dermatitis-producing cercariae. Sixty-nine of 738 (9.4%)

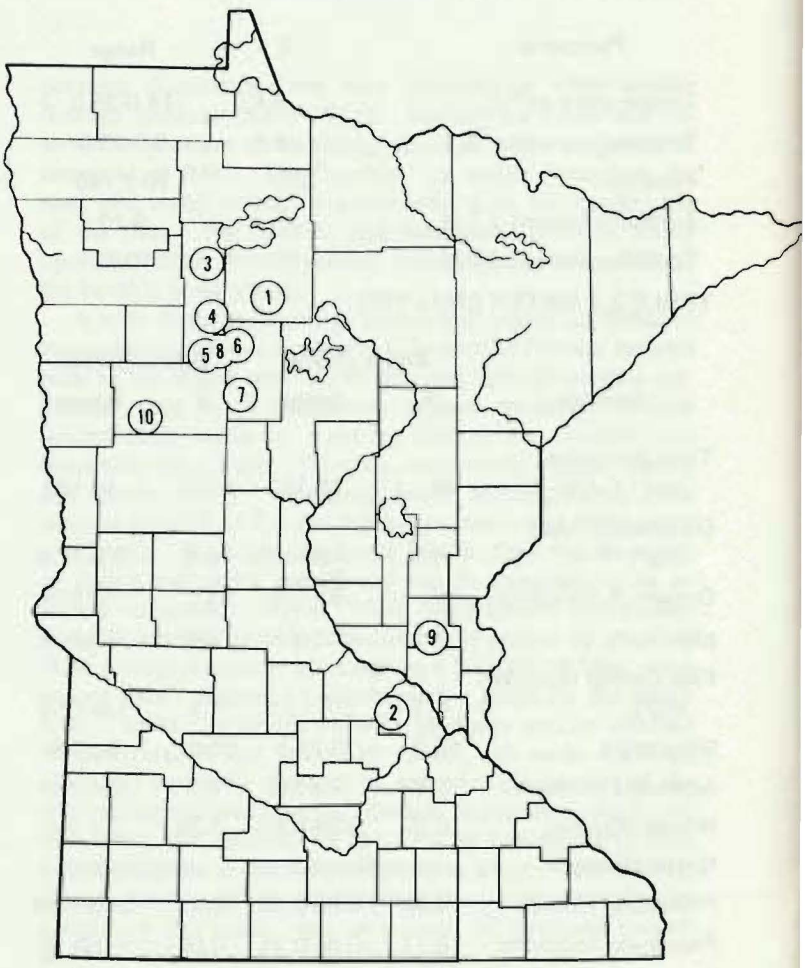

FIGURE 1. Localities from which snails were collected. Site numbers on map correspond with numbers in Table 1.

Lymnaea stagnalis shed schistosome cercariae, of which 65 (94.2%) were *Trichobilharzia ocellata* infections and four (5.8%) were *Schistosomatium douthitti* infections. Three hundred seventy nine *Lymnaea catascopium* were collected, of which three (0.8%) were positive for *Trichobilharzia stagnicolae*. No schistosomes emerged from 63 *Physa sp.*. Table 1 shows the results of the collections from individual locations.

The implication of cercariae of *Trichobilharzia ocellata* as etiological agents of swimmer's itch in Minnesota agrees with the findings of Elliott (1942) and Zischke and Zischke (1968). Also, *Cercaria elvae*, reported by Christenson and Greene (1928) to cause swimmer's itch, were subsequently shown to be cercariae of *T. ocellata* (McMullen and Beaver, 1945). The ubiquity of the snail host *(Lymnaea stagnalis)* of *T. ocellata* and the abundance of the definitive hosts (wild ducks) in northern Minnesota suggest that the parasite is widespread. The ideal habitat for *L. stagnalis* is a marshy area. i.e., an area not likely to be frequented by swimmers. Yet, cercariae that emerge in marshes and bays can well be carried great distances to swimming beaches. For example, we failed to collect any schistosome vector snails within 0.5 mile from a municipal swimming beach on the Fish-Hook River, but schistosome-infected *L. stagnalis* were rather abundant in a marshy inlet 0.6 mile upstream. The cercariae were carried more than a half mile in numbers great enough to cause several cases of dermatitis in swimmers at the beach.

The role of *Trichobilharzia stagnicolae* as a causative agent of swimmer's itch is not clear. Our finding of *T. stagnicolae* in *Lymnaea catascopium* from Lake Bemidji and Elliott's (1942) earlier finding of this parasite from the same lake are the only reports of this parasite in Minnesota. Yet the host snail is often abundant on the sandy bottoms of large lakes. McMullen and Brackett (1941) stated that *Cercaria stagnicolae* (= *T. stagnicolae)* is the most important cause of swimmer's itch in Michigan. Our investigations of *T. stagnicolae* were terminated when *L. catascopium* could not be found in Lake Bemidji in 1971 and 1972, possibly because the lake was treated with copper sulphate.

TABLE 1. Incidence of schistosome cercariae from snails collected from ten sites in Minnesota.

Location	Date(s)	Report of dermatitis	No. and species of snails	No. of infected snails Species of cercariae
1. Lake Bemidji Bemidji	7-1-69	Various reports of dermatitis among swimmers	331 *(Lymnaea catascopium)*	1 (unidentified)
	8-21-70	Various reports of dermatitis *among* swimmers	48 *(Lymnaea catascopium)*	3 *(Trichobilharzia stagnicolae)*
2. Lake Rebecca (Hennepin Co.)	6-23-73	Outbreak of dermatitis swimmers on 6-7-73	63 *(Physa sp.)*	0
3. Clearwater River Impoundment (Clearwater Co.)	8-12-71 to 8-22-71	Outbreak of dermatitis in workers at impoundment	112 *(Lymnaea stagnalis)*	12 *(Trichobilharzia ocellata)*
4. Upper Rice Lake (Clearwater Co.)	8-10-73 to 8-19-73	Two students developed dermatitis after wading	104 *(Lymnaea stagnalis)*	2 *(Trichobilharzia ocellata)*
5. Chambers Creek Itasca State Park (Clearwater Co.)	6-19-73	No dermatitis reported	152 *(Lymnaea stagnalis)*	0
	9-7-73	No dermatitis reported	28 *(Lymnaea stagnalis)*	2 *(Trichobilharzia) 1 (Schistosomatium douthitti)*
6. Lake Alice Bog (Hubbard Co.)	7-7-72	Two students developed dermatitis after swimming	26 *(Lymnaea stagnalis)*	1 *(Trichobilharzia ocellata)*
7. Fish-Hook River (Hubbard Co.)	6-28-72 to 7-6-72	Several cases of dermatitis at beach 0.6 miles downstream	141 *(Lymnaea stagnalis)*	44 *(Trichobilharzia ocellata)*
8. Lake Itasca (Clearwater Co.)	6-22-72	None	60 *(Lymnaea stagnalis)*	3 *(Trichobilharzia ocellata)*
9. Horseshoe Lake (Isanti Co.)	9-8-73	A student doing research on the lake developed dermatitis	31 *(Lymnaea stagnalis)*	1 *Trichobilharzia ocellata 3 (Schistomatium douthitti)*
10. Lake Detroit (Becker Co.)	7-8-72	Various reports of dermatitis among swimmers	84 *(Lymnaea stagnalis)*	0

* = *Stagnicola emarginata angulata*

Schistosomatium douthitti, the third species of schistosome found in this survey, commonly utilizes *L. stagnalis* as its intermediate host and thus it may be a problem in swampy areas. The cercaria of this parasite differs morphologically from the other two schistosomes, its tail being considerably shorter. A striking behavioral characteristic of *S. douthitti* is that after emergence it swims directly to the surface film. It is thought that, unlike other schistosome species, *S. douthitti* produces a relatively small number of cercariae which escape from the snail for but a short time (Cort, et al., 1944).

It is clear that the data gathered from Minnesota thus far are not adequate to provide a clear picture of the factors involved in swimmer's itch in this state. Particular effort is required to elucidate the various intermediate and definitive hosts involved and to understand the life history patterns of the parasites and their hosts.

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Effect of Feedlots on Water Quality

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ABSTRACT – The effect of feedlot runoff on water quality was examined. Samples were collected from river feedlots and offshore from lake feedlots and compared with samples from appropriate control sites. Bacterial contamination, as measured by the total coliform test over two successive summers, exhibited significant variation between feedlot and control sites. Coliform levels at lake sites adjacent to feedlots were double the levels at control sites; while in river systems average coliform levels downstream from feedlots were approximately 17 times the upstream controls.

The effects of feedlots on adjacent waters has long been of concern to environmentalists, farmers, and health officials. Feedlots, enclosed areas where large numbers of animals can be maintained efficiently and fed, presently occupy more than 100,000 acres of land in the United States (Swanson et al., 1971). Although effective in terms of productivity and convenience, feedlots often pose serious environmental problems, especially with regard to quality of nearby water.

It has been estimated that a single steer produces thirteen to sixteen times more fecal waste and ten times more liquid waste than a human (Reynolds, 1971). Therefore, a feedlot of one-hundred animals, common in southwestern Minnesota, is approximately equivalent to a community of 1,000 people. The potential deleterious environmental influence of even a small number of improperly constructed or poorly designed feedlots thus seems readily apparent.

Many factors influence the extent of feedlot runoff, including the number of animals contained, intensity and duration of precipitation, soil porosity, surrounding vegetation and topography (Loehr, 1970; Weber, 1971). Feedlot runoff can, however, be controlled by the construction of holding basins and by the location of feedlots in areas where drainage

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