

A SURVEY OF CERCARIAE FROM AQUATIC SNAILS IN RUTHERFORD COUNTY, TENNESSEE

VITHOON VIYANANT AND MARY C. DUNN
 Middle Tennessee State University
 Murfreesboro, Tennessee 37130

Abstract

During the summer of 1973, a total of 12,840 snails belonging to the genera *Goniobasis*, *Pomatiopsis*, *Viviparus*, *Physa*, *Helisoma*, *Gyraulus*, *Lymnaea*, and *Somatogyrus* were collected from 24 locations in Rutherford County, Tennessee. Emergent mature cercariae were studied as living and mounted specimens. Cercariae of 20 species were found, 18 of which had never been reported in Tennessee. These species included 9 xiphidiocercariae, 4 monostome cercariae, 2 microcercous cercariae, 2 echinostome cercariae, 2 furcocercous cercariae, and 1 cystocercous cercaria. Trematodes parasitized approximately 1.8 percent of the collected snails.

INTRODUCTION

At the time of Cort's (1914) pioneer work on North American larval trematodes only 25 species of cercariae had been reported. Five years later Faust (1919) compiled a list of 81 species of cercariae which had been described in North America. McCoy (1928) estimated that approximately 100 described species had been reported in the United States; however, only four life cycles had been completed in the laboratory. Few workers have attempted to relate the cercariae from experimentally infected hosts to the previously reported forms. From 1928 to 1960, more than 150 species of cercariae had been reported from the United States.

Byrd (1940), Byrd and Reiber (1940) and Goodman (1951a, 1951b) reported 28 species of cercariae from Tennessee. The purpose of this study was to determine the species, distribution, and incidence of infection of cercariae in aquatic gastropods of Rutherford County, Tennessee.

MATERIALS AND METHODS

A total of 12,840 snails, collected from May through August, 1973, in various localities of Rutherford County, Tennessee, were examined for the emergence of cercariae (Figure 1). On the day of collection, snails transported to the laboratory were separated individually according to species in half-pint plastic cups containing a small amount of dechlorinated water. The specimens were left overnight under illumination from a 100 watt light bulb. The emergent cercariae were examined during the following day. After 48 hours, those snails which yielded no cercariae were discarded.

Cercariae were transferred to a microscope slide and examined under a compound microscope. Measurements and observations were made from living specimens under the gentle pressure of the cover glass in both the unstained condition and

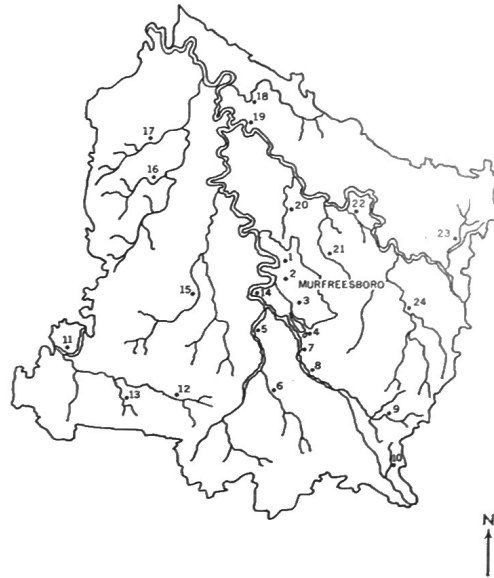


FIG. 1: Map of Rutherford County, showing localities where collections were made.

the condition after staining with *intra-vitam* neutral red. Although emphasis was placed on the living organisms, mounted specimens were used in this study. Cercariae were killed in warm water before fixing with half-strength Bouin's fluid. (This method of killing provided rapid fixation and prevented the shrinkage caused by fixing agents.) Specimens were then stained with Semichon's carmine.

The use of *intra-vitam* neutral red proved to be very helpful for studies of the penetration glands and the digestive system of the living specimens, while the reproductive organs could be seen clearly in the stained and mounted killed specimens. Since there is presently no efficient method to examine the flame-cell patterns, those structures were not included in this study.

INFECTION RECORDS AND DISCUSSION

Of the 20 species of cercariae recovered from the snails, only 2—*Cercaria brachystyla* and *Cercaria ramonae*—had been reported previously from Tennessee. An examination of Tables 1 and 2 shows that snails from Rutherford County were found to be heavily in-

TABLE 1: Species of Cercariae from Snails Taken at Various Localities in Rutherford County, Tennessee.

Localities	Cercariae
(1) Oakland Spring, Murfreesboro	<i>C. mesotyphla</i> (Miller, 1935) <i>C. urbanensis</i> (Cort, 1914)
(2) Town Creek, Murfreesboro	<i>C. wardi</i> (Miller, 1923) <i>C. tranoglandis</i> (Seitner, 1945)
(3) Pond in Murfreesboro	<i>C. diamondi</i> (Brooks, 1943)
(4) Todd's Lake	<i>C. wardi</i> (Miller, 1923)
(5) West Fork, Stones River, Barfield	<i>C. volgeri</i> (Cable, 1935) <i>C. macrostoma</i> (Faust, 1918) Cercaria of <i>Macravestibulum eversum</i> (Hsu, 1937)
(6) Christmas Creek	<i>C. wardi</i> (Miller, 1923) <i>C. macrostoma</i> (Faust, 1918) Echinostome cercariae
(7) Middle Fork, Stones River, Highway 231	<i>C. semicarinatae</i> (Cable and Wheeler, 1939) <i>C. wardi</i> (Miller, 1923)
(8) Middle Fork, Stones River, Elm Road	<i>C. semicarinatae</i> (Cable and Wheeler, 1939) <i>C. kentuckiensis</i> (Cable, 1935) <i>C. trichoderma</i> (Cable, 1935)
(9) Spring Creek	<i>C. urbanensis</i> (Cort, 1914) <i>C. pinguisoma</i> (Hall, 1960) Cercaria of <i>Pneumatophilus variabilis</i> (McCoy, 1928)
(10) Middle Fork, Stones River, Highway 41	<i>C. wardi</i> (Miller, 1923) <i>C. macrostoma</i> (Faust, 1918)
(11) Harpeth River Site	No cercariae found
(12) Concord Creek	<i>C. ramonae</i> (McCoy, 1928) <i>C. mesotyphla</i> (Miller, 1923) <i>C. brachystyla</i> (Byrd and Reiber, 1940) Cercaria of <i>Dasymetra conferta</i> (McCoy, 1928)
(13) Kelly Creek	<i>C. ramonae</i> (McCoy, 1928)
(14) West Fork, Stones River, Highway 99	<i>C. volgeri</i> (Cable, 1935) <i>C. macrostoma</i> (Faust, 1918)
(15) Puckett Creek	<i>C. wardi</i> (Miller, 1923) <i>C. semicarinatae</i> (Cable and Wheeler, 1939)
(16) Olive Brook	No cercariae found
(17) Rock Spring Brook	<i>C. mesotyphla</i> (Miller, 1935)
(18) Fall Creek	<i>C. ornatostoma</i> (Cable, 1935)
(19) East Fork, Stones River	No cercariae found
(20) Central Valley Road, Walter Hill	No cercariae found
(21) Bushnell Creek	<i>C. abbrevistyla</i> (Cable, 1939) <i>C. volgeri</i> (Cable, 1935) <i>C. macrostoma</i> (Faust, 1918) <i>C. ornatostoma</i> (Cable, 1935) <i>C. trichoderma</i> (Cable, 1935)
(22) Compton Creek	<i>C. volgeri</i> (Cable, 1935)
(23) McKnight Brook	<i>C. macrostoma</i> (Faust, 1918) <i>C. volgeri</i> (Cable, 1935) <i>C. notura</i> (Hall, 1960)
(24) Cripple Creek	<i>C. wardi</i> (Miller, 1923)

TABLE 2: Infection Records of Molluscan Hosts.

Localities	Molluscan Hosts	Number Examined	Number with Cercariae	Percent Infected
1	<i>Physa</i> sp.	28	2	7.1
	<i>Pomatopoma</i> sp.	257	0	0
2	<i>Physa</i> sp.	75	2	2.7
	<i>Helisoma</i> sp.	11	0	0
	<i>Goniobasis</i> sp.	32	1	3.1
	<i>Physastra</i> sp.	1	0	0
3	<i>Physa</i> sp.	172	3	1.7
	<i>Gyratilis</i> sp.	12	0	0
4	<i>Physa</i> sp.	137	1	0.7
	<i>Gyratilis</i> sp.	304	0	0
5	<i>Goniobasis</i> sp.	1125	12	1.1
	<i>Physa</i> sp.	14	2	14.2
	<i>Physastra</i> sp.	2	0	0
6	<i>Physa</i> sp.	48	3	6.2
	<i>Physa</i> sp.	139	8	5.7
7	<i>Goniobasis</i> sp.	35	1	2.9
	<i>Goniobasis</i> sp.	615	15	2.4
9	<i>Physa</i> sp.	612	24	3.9
	<i>Lymnaea</i> sp.	151	0	0
	<i>Goniobasis</i> sp.	318	11	3.5
10	<i>Physa</i> sp.	254	4	1.6
	<i>Goniobasis</i> sp.	932	18	1.9
11	<i>Physa</i> sp.	34	0	0
12	<i>Physa</i> sp.	816	18	2.2
13	<i>Physa</i> sp.	85	3	3.5
14	<i>Goniobasis</i> sp.	180	3	1.7
15	<i>Goniobasis</i> sp.	535	22	4.1
	<i>Physa</i> sp.	22	3	13.6
16	<i>Physa</i> sp.	42	0	0
	<i>Goniobasis</i> sp.	115	0	0
17	<i>Physa</i> sp.	222	2	0.9
18	<i>Goniobasis</i> sp.	4	0	0
	<i>Somatogyrus</i> sp.	2	1	50.0
19	<i>Physa</i> sp.	3	0	0
20	<i>Goniobasis</i> sp.	104	0	0
	<i>Physa</i> sp.	35	0	0
21	<i>Goniobasis</i> sp.	2665	39	1.5
	<i>Physa</i> sp.	12	0	0
22	<i>Goniobasis</i> sp.	424	3	0.7
23	<i>Physa</i> sp.	25	7	28.0
	<i>Goniobasis</i> sp.	1713	9	0.5
24	<i>Physa</i> sp.	318	16	5.0
Total		12,840	233	1.8

ected with many species of trematodes. Incidence of infection was found to be as high as 50 percent in some species of snails when a small number was collected; however, the average infection rate was only about 1.8 percent.

Cercaria wairii (Miller, 1923) and *Cercaria macrostoma* (Faust, 1918) were the most common species found in Rutherford County. *C. wairii* was collected from 7 of 24 localities, while *C. macrostoma* was found from 6 of the 24 localities.

Cercaria ornationis (Cable, 1935) was isolated from snails of the genera *Goniobasis* and *Somatogyrus* collected in two different localities. Reports of the same species of cercariae occurring in two different genera of the molluscan hosts is not unusual. *Cercaria trivolvis* (Cort, 1914) has been found in *Physa gyrina* and *Helisoma trivolvis*; *Cercaria pipis* (Faust, 1918) occurs in *Physa gyrina* and *Planorbis trivolvis*.

The following is a list of cercariae reported in Tennessee by former workers:

Echinostome cercariae

- Cercaria of Echinostomum revolutum* (Froelich, 1802)
- Cercaria reibstockii* (McCoy, 1929)
- Cercaria compactissima* (Byrd and Reiber, 1940)
- Cercaria oedematocauda* (Byrd and Reiber, 1940)
- Cercaria palegae* (Goodman, 1951)

Xiphidocercariae

- Cercaria ramonae* (McCoy, 1928)
- Cercaria macrostyla* (Byrd, 1940)
- Cercaria leiosoma* (Byrd, 1940)
- Cercaria macrostoma* (Byrd and Reiber, 1940)
- Cercaria brevicauda* (Byrd and Reiber, 1940)
- Cercaria insignata* (Byrd and Reiber, 1940)
- Cercaria simulata* (Byrd and Reiber, 1940)
- Cercaria brachystyla* (Byrd and Reiber, 1940)
- Cercaria of Dusymetra villicauda* (Byrd, 1935)
- Cercaria of Plagiorchis amciurensis* (McCoy, 1928)

Amphistome cercariae

- Cercaria cortii* (O'Roke, 1917)
- Cercaria of Allastostoma parvum* (Shunkard, 1916)

Furocercous cercariae

- Cercaria pteractinosa* (Miller, 1936)
- Cercaria reelfooti* (Byrd and Reiber, 1940)
- Cercaria dorsata* (Byrd and Reiber, 1940)
- Cercaria obiana* (Goodman, 1951)
- Cercaria byrdi* (Goodman, 1951)
- Cercaria fimbriata* (Goodman, 1951)
- Cercaria paralinearis* (Goodman, 1951)
- Cercaria samburgi* (Goodman, 1951)
- Cercaria paramelicellulata* (Goodman, 1951)
- Cercaria tomi* (Goodman, 1951)
- Cercaria yankepicensis* (Goodman, 1951)

Goodman (1951a, 1951b) mentioned many undescribed cercariae, including 2 echinostome cercariae and 10 xiphidocercariae.

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LITERATURE CITED

- Brooks, F. G. 1943. Larval trematodes of Northwest Iowa. I. Nine new xiphidocercariae. *J. Parasitol.* 29: 330-339.
- Byrd, E. E. 1940. Larval flukes from Tennessee. II. Studies on cercariae from *Physa gyrina* Say, with descriptions of two new species. *J. Tenn. Acad. Sci.* 15:124-131.
- and R. J. Reiber. 1940. Larval flukes from Tennessee. III. Studies on cercariae from *Helisoma trivolvis* Say, with descriptions of new species. *J. Tenn. Acad. Sci.* 15:132-156.
- Cable, R. M. 1935. Three new species of larval trematodes from Kentucky. (Abstr.) *J. Parasitol.* 21:436.
- 1939. Two new species of cotylomicrocercous cercariae from Indiana. *Trans. Am. Microscop. Soc.* 58:62-66.
- and N. C. Wheeler. 1939. Notes on three new species of cercariae belonging to the pleurolophocerca group. *J. Parasitol.* 25:35-42.
- Cort, W. W. 1914. Larval trematodes from North American freshwater snails. *J. Parasitol.* 1:65-84.
- Faust, E. C. 1918. Two new cystocercous cercariae from North America. *J. Parasitol.* 4:148-153.
- 1919. A biological survey of described cercariae in the United States. *Am. Naturalist* 53:85-92.
- Goodman, J. D. 1951a. Studies on trematode cercariae at Reelfoot Lake, Tennessee. I. *J. Tenn. Acad. Sci.* 26:22-25.
- 1951b. Studies on trematode cercariae at Reelfoot Lake, Tennessee. II. *J. Tenn. Acad. Sci.* 26: 55-72.
- Hall, J. E. 1960. Studies on virgulate xiphidocercariae from Indiana and Michigan. *Am. Midland Naturalist* 63:226-245.
- Hsu, D. Y. M. 1937. Life history and morphology of *Macrorostomum evermanni* sp. nov. (Pleurolophocercidae, Trematoda). *Trans. Am. Microscop. Soc.* 56:478-504.
- McCoy, O. R. 1928. Life history studies on trematodes from Missouri. *J. Parasitol.* 14:207-228.
- Miller, E. L. 1935. Studies on North American cercariae. *J. Parasitol.* 21:244-254.
- Miller, H. M. 1923. Notes on some furocercous larval trematodes. *J. Parasitol.* 10:35-46.
- Seitner, P. G. 1945. Studies on five new species of xiphidocercariae of the virgula type. *J. Parasitol.* 31:272-281.