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exist, certain of these might possibly be more resistant to inactivation than others.

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Trematodes of Passerine Birds from Chickasaw County, Iowa[1]

CHARLES J. ELLIS[1]

Abstract. One-hundred and twenty-five passerine birds were collected in Chickasaw County, Iowa, October, 1959. through August, 1960. Thirteen species of birds (19%) were infected with 14 genera of trematodes. The hosts, helminths and infection sites are tabulated.

Little is known concerning the trematode fauna of Iowa birds belonging to the order Passeriformes. Ward (1901) examined 33 Iowa passerines and reported only one bird harboring a trematode infection.

The present study concerns the trematodes of passerine birds collected October, 1959, through August, 1960, from the Goodale Conservation Area in northwest Chickasaw County, Iowa. This area encompasses approximately 21 acres and contains six major types of habitats: river, marsh, pond, thicket, deciduous woods and meadow.

Previous studies on trematodes of passerine birds indicate varying degrees of infection. In Czechoslovakia Ryšavy (1955a) studied 168 passerines (32 species) and found none of them infected with trematodes. Rankin (1946) as part of a larger helminth survey of birds and mammals in western Massachusetts examined five passerines and found none infected with trematodes. Sulgostowska (1958) examined 33 passerines in Poland and found two (6%) infected with trematodes. According to unpublished data from Iowa Lakeside Laboratory at Lake Okoboji, 161 passerine birds (27 species) have been examined and 59 (37%) were infected with trematodes. In the current study approximately 19% of the birds examined harbored adult trematodes.

Several studies on helminths of a single species of passerines

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have been published. Thus, Boyd (1951) examined 300 starlings (*Sturnus vulgaris*) collected from various eastern and midwestern states and found only four infected with trematodes. Boyd, et al, (1956) found a 37% trematode infection rate in blue jays (*Cyanocitta cristata*) from New England. Ryšavy (1955b) examined 79 blackbirds (*Turdus merula*) and found 30% infected with trematodes. Daly (1959) in a study on the intestinal helminths of 103 crows (*Corvus brachyrhynchus paulus*) in Virginia found trematodes in only 6%. Joszt (1958) found 9.5% of the 190 house sparrows (*Passer domesticus*) from Warsaw, Poland, infected with trematodes.

Trematodes recovered during the present study were fixed in A.F.A., stained in Semichon's aceto-carmine and mounted in synthetic resin. Many were counterstained with fast green.

Table 1 summarizes the 125 birds examined, 24 of which (19%) harbored adult trematodes. Of these birds (representing 14 families and 38 species) those belonging to the family Fringillidae were the most abundant. Seventeen percent of them harbored adult trematodes.

Table 1. Avian Families Examined

	No. examined	No. Infected
Alaudidae (larks)	6	0
Corvidae (crows, jays)	4	2
Fringillidae (sparrows)	46	8
Hirundinidae (swallows)	1	1
Icteridae (meadowlarks, red-wing)	35	11
Mimidae (thrashers)	2	1
Paridae (chickadees)	6	0
Parulidae (warblers)	7	0
Sittidae (nuthatches)	3	0
Sturnidae (starlings)	1	0
Sylvidae (kinglets)	3	0
Troglodytidae (wrens)	2	0
Turdidae (thrushes)	1	0
Tyrannidae (flycatchers)	8	1
Totals	**125**	**24**

The lowest degree of infection was seen among members of the families Paridae, Parulidae, Sylvidae and Sittidae, none of which harbored trematodes. The small number examined, however, does not permit valid conclusions to be drawn regarding their ability to serve as definitive hosts.

The genera of trematodes recovered are listed in Table 2. Of these, those genera belonging to the family Dicrocoeliidae are the most abundant. A summary of hosts, helminths and sites is given in Table 3.

Family Dicrocoeliidae

Of all the trematode genera represented in the collection, those belonging to the family Dicrocoeliidae were most abund-

Table 2. Genera of Trematodes Recovered and Their Hosts

DICROCOELIIDAE	
Brachylecithum	(fox sparrow, brown thrasher, swamp sparrow)
Conspicuum	(common grackle, fox sparrow, eastern meadowlark)
Lutztrema	(eastern meadowlark, blue jay)
Lyperosomum	(brown thrasher)
Zonorchis	(fox sparrow)
ECHINOSTOMATIDAE	
Echinostoma	(common grackle, blue jay, eastern meadowlark, western meadowlark)
EUCOTYLIDAE	
Tanaisia	(song sparrow)
LECITHODENDRIIDAE	
Ornithodendrium	(eastern kingbird)
OPISTHORCHIIDAE	
Opisthorchis	(white-throated sparrow)
PLAGIORCHIIDAE	
Plagiorchis	(red-wing)
Prosthogonimus	(white-throated sparrow)
STRIGEIDAE	
Strigea	(rusty blackbird)
STOMYLOTREMATIDAE	
Laterotrema	(blue jay)
Stomylotrema	(barn swallow)

Table 3. Summary of Helminths Recovered

Host	Helminth	Site
Eastern kingbird *(Tyrannus tyrannus)*	*Ornithodendrium* sp.	Intestine
Barn swallow *(Hirundo rustica)*	*Stomylotrema* sp.	Intestine
Brown thrasher *(Toxostoma rufum)*	*Brachylecithum exochocotyle*	Liver
	Lyperosomum oswaldoi	Liver
Blue jay *(Cyanocitta cristata)*	*Lutztrema microstomum*	Liver
	Echinostoma revolutum	Intestine
	Laterotrema sp.	Intestine
Eastern meadowlark *(Sturnella magna)*	*Conspicuum icteridorum*	G. bladder
	Brachylecithum sp.	Liver
	Lutztrema monenteron	G. bladder
	Echinostoma revolutum	Intestine
	Echinostoma sp.	Intestine
Western meadowlark *(Sturnella neglecta)*	*Echinostoma revolutum*	Intestine
Red-wing *(Agelaius phoeniceus)*	*Plagiorchis noblei*	Liver
Rusty blackbird *(Euphagus carolinus)*	*Strigea* sp.	Intestine
Common grackle *(Quiscalus quiscula)*	*Conspicuum icteridorum*	G. bladder
	Echinostoma sp.	Intestine
White-throated sparrow *(Zonotrichia albicollis)*	*Opisthorchis* sp.	Intestine
	Prosthogonimus sp.	Intestine
Fox sparrow *(Passerella iliaca)*	*Brachylecithum nanum*	Liver
	Conspicuum icteridorum	G. bladder
	Zonorchis sp.	G. bladder
Swamp sparrow *(Melospiza georgiana)*	*Brachylecithum* sp.	Liver
Song sparrow *(Melospiza melodia)*	*Tanaisia zarudnyi*	Ureter
	Zonorchis sp.	G. bladder

ant. Five genera are represented: *Conspicuum, Lutztrema, Lyperosomum, Brachylecithum* and *Zonorchis.* Dicrocoeliids parasitize the gall bladder, liver, bile ducts and sometimes the pancreatic ducts of their hosts.

The only specvies of the genus *Conspicuum* recovered was *C. icteridorum* located within the gall bladder of the common grackle (*Quiscalus quiscula*), fox sparrow (*Passerella iliaca*) and the eastern meadowlark (*Sturnella magna*).

Lutztrema monenteron was recovered from the gall bladder of an eastern meadowlark. Varying dimensions are reported for this species by Price and McIntosh (1935), Denton and Byrd (1951) and by Mettrick (1958). My specimens agree more closely with those reported by Mettrick.

Lutztrema microstomum was recovered from the liver of a blue jay during this survey. Only one of four blue jays examined harbored this parasite which, according to Denton and Byrd (1951), is differentiated from *L. monenteron* by the former's narrower and smaller body, relatively larger and more anteriorly situated acetabulum, relatively shorter cecum, more tandem testes, greater distance between the acetabulum and the testes, and the pattern of its uterus in the pre-testicular region.

Three specimens of *Lyperosomum oswaldoi* were recovered from the bile duct of the brown thrasher (*Toxostoma rufum*). This host also was parasitized by *Brachylecithum exochocotyle.* Denton and Byrd (1951) also report a double infection of the brown thrasher with *L. oswaldoi* and *B. exochocotyle.*

More than 20 specimens of *Brachylecithum nanum* were recovered from the liver of a fox sparrow, but due to their fragility many were broken in removal.

The sixth dicrocoeliid species recovered was *Brachylecithum exochocotyle* mentioned previously from the bile duct of a brown thrasher. Denton and Byrd (1951) examined 41 of these hosts and found only one infected with this species of trematode.

One swamp sparrow (*Melospiza georgiana*) was infected with an unidentified species of *Brachylecithum.* The gall bladder and the bile ducts of two fox sparrows and one song sparrow (*Melospiza melodia*) were infected with members of another dicrocoeliid genus, *Zonorchis.*

Family Echinostomatidae

Members of this family are noted for their apparent lack of host specificity both as adults and as larvae. These trematodes parasitize many kinds of vertebrates but particularly water birds. However, in this study, echinostomes were recovered from such birds as the eastern meadowlark, western meadow-

lark (*Sturnella neglecta*), common grackle and the blue jay, none of which is considered a water bird. In fact, all of these according to Bailey (1927) feed upon insects, grain and seeds. However, Pearson (1936) states that grackles also may eat salamanders, fish, crayfish and snails. The Goodale Conservation Area is marshy and includes numerous areas where birds could ingest those snails serving as intermediate hosts for the echinostome larvae.

All echinstomes found in this survey were taken from the intestine or cloaca. A double infection of *Echinostoma* sp. and *Lutztrema monenteron* was found in one eastern meadowlark.

Despite the fact that the genus *Echinostoma* seems to be one with a wide host specificity and a broad geographical range, the literature reveals few passerine hosts infected with these trematodes. Beaver (1937) refers to the species *E. revolutum* as being "as cosmopolitan in its choice of hosts as it is in geographical distribution. This lack of specificity in all of its parasitic stages is of course the most important reason for its wide distribution." Six of the 103 crows examined by Daly (1959) were infected with *E. revolutum.* Lumsden (1962) reports as a new host record *E. revolutum* from *Cassidix mesamexicanus* from Louisiana.

Family Eucotylidae

As indicated in Table 2, this family is represented by only one species, *Tanaisia zarudnyi.* Two specimens were recovered from the ureters of the song sparrow which also harbored a *Zonorchis* infection. The identification of *T. zarudnyi* is based upon studies of Byrd and Denton (1950).

Family Lecithodendriidae

Two specimens of the genus *Ornithodendrium* were recovered from the intestine of a single host, the eastern kingbird (*Tyrannus tyrannus*).

Family Opisthorchiidae

This family is represented in this survey by one specimen of the genus *Opisthorchis* recovered from the cloaca of a white-throated sparrow (*Zonotrichia albicollis*). This infection was accompanied by a prosthogonimid in the terminal portion of the host's intestine.

The presence of an opisthorchid in a sparrow is difficult to explain since fish normally serve as second intermediate hosts for many members of this family.

Family Plagiorchiidae

The same white-throated sparrow infected with *Opisthorchis* sp. was also infected with *Prosthogonimus* sp. The site of this

infection was the intestine despite the usual site for *Prosthogonimus* being in the oviduct or the bursa fabricius. Eight specimens of another member of this family, *Plagiorchis noblei*, were recovered from the cloaca of a red-winged blackbird (*Agelaius phoeniceus*).

Family Stomylotrematidae

One specimen of the genus *Stomylotrema* was recovered from the cloaca of a barn swallow (*Hirundo rustica*). Another stomylotrematid recovered belonged to the genus *Laterotrema* taken from the cloaca of a blue jay. However, its dimensions do not agree with those of previously described members of the genus.

Family Strigeidae

A single specimen belonging to the genus *Strigea* was recovered from the cloaca of a rusty blackbird (*Euphagus carolinus*).

The lack of uniformity shown by studies on trematode infections of passerines has already been noted. Such variation is undoubtedly due in a large measure to the food habits of the birds involved. Passerine birds inhabit a wide variety of terrestrial and semi-aquatic habitats. A more extensive trematode fauna is generally associated with semi-aquatic environments.

The present survey undertaken as a preliminary study on trematodes of Iowa passerines includes several species of avian hosts represented by only a single bird. Hence, any conclusions relative to dietary habits as indicative of degrees of trematode infection would be premature.

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The Effect of Temperature Change on the Reaction Time of *Helisoma trivolvis* (Say)

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Abstract. A study of reaction speed, at different temperatures, of fresh-water snails (*Helisoma trivolvis*) is reported. Organic response to mechanical stimuli shows a definite relationship of reaction speed to the environmental temperature. There is an increase in rate of reaction from 40°F to 98°F; and a subsequent leveling off trend from 98°F to 110°F. Snail size has no appreciable effect upon reaction speed. Learning by experience is suggested.

The purpose of this research is to study the speed of reaction of the fresh-water snail in relation to environment. The hypothesis of this study is that environmental temperature has a direct effect on the speed of reaction of the fresh-water snail. The availability and convenient size of *Helisoma trivolvis* makes observation and experimentation with them practical.

Preliminary observation showed that the gastropods withdrew into their shells after being stimulated mechanically. In a short time they would again emerge from their shells; first the foot,

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