2015

Helminth Parasites of the Blackspotted Topminnow, *Fundulus olivaceus* (Cyprinodontiformes: Fundulidae), from the Interior Highlands of Arkansas

C. T. McAllister

Eastern Oklahoma State College, cmcallister@se.edu

C. R. Bursey

Pennsylvania State University

T. J. Fayton

University of Southern Mississippi

W. F. Font

Southeastern Louisiana University

H. W. Robison

Follow this and additional works at: <https://scholarworks.uark.edu/jaas>

Part of the [Zoology Commons](#)
See next page for additional authors

Recommended Citation

McAllister, C. T.; Bursey, C. R.; Fayton, T. J.; Font, W. F.; Robison, H. W.; Connior, M. B.; and Cloutman, D. G. (2015) "Helminth Parasites of the Blackspotted Topminnow, *Fundulus olivaceus* (Cyprinodontiformes: Fundulidae), from the Interior Highlands of Arkansas," *Journal of the Arkansas Academy of Science*: Vol. 69 , Article 26.

DOI: <https://doi.org/10.54119/jaas.2015.6920>

Available at: <https://scholarworks.uark.edu/jaas/vol69/iss1/26>

This article is available for use under the Creative Commons license: Attribution-NoDerivatives 4.0 International (CC BY-ND 4.0). Users are able to read, download, copy, print, distribute, search, link to the full texts of these articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author.

This General Note is brought to you for free and open access by ScholarWorks@UARK. It has been accepted for inclusion in *Journal of the Arkansas Academy of Science* by an authorized editor of ScholarWorks@UARK. For more information, please contact scholar@uark.edu.

Helminth Parasites of the Blackspotted Topminnow, *Fundulus olivaceus* (Cyprinodontiformes: Fundulidae), from the Interior Highlands of Arkansas

Authors

C. T. McAllister, C. R. Bursey, T. J. Fayton, W. F. Font, H. W. Robison, M. B. Connior, and D. G. Cloutman

Helminth Parasites of the Blackspotted Topminnow, *Fundulus olivaceus* (Cyprinodontiformes: Fundulidae), from the Interior Highlands of Arkansas

C.T. McAllister^{1*}, C.R. Bursey², T.J. Fayton³, W.F. Font⁴, H.W. Robison⁵, M.B. Connior⁶
and D.G. Cloutman⁷

¹Science and Mathematics Division, Eastern Oklahoma State College, Idabel, OK 74745

²Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, PA 16146

³Gulf Coast Research Laboratory, University of Southern Mississippi, 703 E. Beach Drive, Ocean Springs, MS 39564

⁴Department of Biological Sciences, Southeastern Louisiana University, Hammond, LA 70402

⁵9717 Wild Mountain Drive, Sherwood, AR 72120

⁶Life Sciences, Northwest Arkansas Community College, Bentonville, AR 72712

⁷P. O. Box 197, Burdett, KS 67523

*Correspondence: cmcallister@se.edu

Running Title: Helminths of *Fundulus olivaceus*

The Blackspotted Topminnow, *Fundulus olivaceus* (Storer) is a medium-sized fish that ranges in the Mississippi River basin from eastern Tennessee, western Kentucky, southern Illinois, and central Missouri south through eastern Oklahoma and Texas, Arkansas, Mississippi, and Alabama to the Gulf of Mexico (Page and Burr 2011). In Arkansas it is one of the most common and widespread fishes, occurring in all river drainages with a statewide distribution (Robison and Buchanan 1988). This fish prefers lentic habitats, is typically found in lower order streams, prefers areas near the land/stream margin, and is a surface feeder on insects and small crustaceans (Rice 1942).

Although information is available on the ecology of *F. olivaceus* (see Etnier and Starnes 1993, Pflieger 1997), little is known about its helminth parasites. As far as we can determine, only a single monogene, *Gyrodactylus megacanthus* Wellborn and Rogers, from Alabama, Arkansas and Mississippi and an acanthocephalan, *Neoechinorhynchus cylindratus* (Van Cleave) Van Cleave, have been reported from this topminnow (Wellborn and Rogers 1967, Hoffman 1999). Herein, we report four new host records as well as two new geographic locality records for parasites collected from *F. olivaceus*.

Between May 2014 and June 2015, 44 juvenile and adult *F. olivaceus* (mean $\pm$ 1SD, range = 56.2 $\pm$ 14.0, 31–83 mm total length [TL]) were collected using a backpack electroshocker, a dipnet, or 6.1 m seine (3.2 cm mesh), from the Ouachita River drainage of Middle Fork of Saline River and Bear, Mill and Walnut creeks, Garland County (n = 38), the Caddo River, Clark County (n = 4), and the White River drainage of

Crooked Creek, Boone County (n = 2). Specimens were placed in containers with cool aerated water from their collection site and necropsied within 24 hr. We followed accepted guidelines for the use of fish in research (AFS 2004); specimens were overdosed by immersion in a concentrated chlorotone solution and a mid-ventral incision was made to expose the gastrointestinal tract and internal viscera. Monogenes were removed with minuten nadeln from the gills of select fish (n = 17) preserved in 10% formalin from Bear Creek, and mounted in Gray and Wess medium stained with Gomori's trichrome. Digeneans from the intestine were fixed in near boiling tap water without coverslip pressure, transferred to 70-95% v/v ethanol, stained with acetocarmine and mounted in Canada balsam. Nematodes were placed on a glass slide in a drop of undiluted glycerol for identification. Voucher specimens of parasites were deposited in the Harold W. Manter Laboratory of Parasitology (HWML), Lincoln, Nebraska. Host voucher specimens were deposited in the Henderson State University (HSU) fish collection, Arkadelphia, Arkansas. Prevalence, mean intensity $\pm$ 1SD, and range of infection are provided and are in accordance with terminology given in Bush et al. (1997).

Thirty-one of 44 (70%) of the *F. olivaceus* harbored one of three helminths, including 29 (66%) with the digenean, *Creptotremas* sp. in the intestines, one (2%) with the nematode, *Eustrongylides* sp. in the mesentery, and one (2%) with the nematode, *Rhabdochona cascadiella* in the intestines. In addition, 2 of 17 (12%) from one site in the Ouachitas harbored the monogene, *Salsuginus umbraensis*. Of the sites collected, only Bear and Crooked creeks provided

positive hosts. The following is an annotated list of data as follows: host total length (TL, mean $\pm$ 1SD, range), prevalence, intensity (mean $\pm$ 1SD), collection site, collection date(s), HWML accession number.

Monogeneoidea: Dactylogyrida: Ancyrocephalidae: *Salsuginus umbraensis* (Mizelle, 1938) Murith and Beverley-Burton, 1985 (Fig. 1)

65.0 $\pm$ 4.2, 62–68 mm TL, 2/17 (12%), 1.0 $\pm$ 0.0, range 1, Bear Creek at Bear, Garland Co. (34.535034°N, 93.286517°W). 30 May 2014, HWML 75372.

Figure 1. *Salsuginus umbraensis* from *Fundulus olivaceus*. Note hamuli. Scale bar = 20 μ m.

Based on the size and shape of the hamuli (Fig. 1) (dorsal and ventral hamuli 18–19 and 19–21 μ m long, respectively; angle of superficial/deep root notch about 60°; deep root forming a distinct thumb-like projection; blades long and thin, smoothly curved, thinner in dorsal hamulus), our specimens closely resemble the description of *S. umbraensis* provided by Mizelle (1938) and Murith and Beverley-Burton (1985) from Blackstripe Topminnow, *Fundulus notatus*. In addition, *S. umbraensis* has been reported from *F. notatus* from Illinois (Mizelle 1938, Murith and Beverley-Burton 1985), Louisiana (Duobinis-Gray and Corkum 1985) and Kentucky (Kozel and Whitaker 1985). This is the first report of *S. umbraensis* from *F. olivaceus* and Arkansas.

In spite of the high host specificity of species of *Salsuginus* (Murith and Beverley-Burton 1985), the very close phylogenetic relationship of *F. notatus* and

F. olivaceus (Cashner et al. 1992) may enhance the ability of *S. umbraensis* to parasitize both species of hosts. Alternatively, the two specimens observed in this study may represent a cryptic undescribed species warranting further study with additional specimens.

Digenea: Plagiorchiida: Allocreadiidae: *Creptotrema* sp. (Fig. 2)

53.5 $\pm$ 11.8, 33–73 mm TL, 29/44 (66%) overall, 10.1 $\pm$ 14.3, range 1–68, 29/36 (81%) Bear Creek at Bear, Garland Co. (34.535034°N, 93.286517°W). 21 May, 2 Jul., 6 Sept., 16 Oct., 25 Nov., 2014, 20 May, 8 Jun., 2015, HWML 75384–86.

Figure 2. *Creptotrema* sp. from *Fundulus olivaceus*. A. Entire specimen showing ovary (O) and testes (T). Scale bar = 300 μ m. B. Higher magnification of another specimen showing irregular margins on testes (T). Scale bar = 100 μ m.

Interestingly, the highest intensity of infection of *Creptotrema* sp. was 68 adult and immature worms observed in a 63 mm TL specimen of *F. olivaceus* collected on 8 June 2015 from our Bear Creek site. In addition, one of the smallest juvenile *F. olivaceus* (33 mm TL) examined harbored 15 worms, also from Bear Creek.

Species of *Creptotrema* have been reported from esocids, fundulids, gasterosteids and percids in Arkansas, Florida, Mississippi, New York and Ohio, USA, and Manitoba, Nova Scotia and Ontario, Canada (Hoffman 1999, Curran et al. 2012, McAllister et al. 2016). Recently in Arkansas, McAllister et al. (2016) reported *Creptotrema* sp. from Northern Studfish, *Fundulus catenatus* from a stream within the Bear Creek watershed that cannot be morphologically

Helminths of *Fundulus olivaceus*

differentiated from our specimens from *F. olivaceus*. Comparison of our specimens of *Creptotrema* sp. ($n = 10$) to the description of *Creptotrema funduli* Mueller, 1934 from Banded Killifish, *Fundulus diaphanus* from Oneida Lake, New York, show significant morphological differences as follows: (1) the testes in our specimens (Fig. 2A) have irregular margins versus those of Mueller's which have smooth margins; (2) *Creptotrema* sp. from Arkansas attain a greater body length (up to 1,300 μm as opposed to a maximum length of 1,000 μm in *C. funduli*); and (3) our specimens possess a longer cirrus sac representing 47–54% of body length, BL (cirrus sac measured along middle of sac throughout its length) with more pronounced coiling than that of *C. funduli* from New York that measures in length only 28% BL (Mueller's line drawing) (Mueller 1934). Our specimens most closely resemble those of the *C. funduli* reported by Curran et al. (2012) from *F. notatus* from Mississippi that also have similar testes and a long cirrus sac (42% of BL in line drawing of Curran et al [2012]). However, *Creptotrema* sp. from Arkansas can be readily differentiated from both *C. funduli* from Mississippi and *C. funduli* from New York in having oral sucker-to-ventral sucker-width ratios ranging from 1:1.0–1.1 as opposed to those of *C. funduli* from Mississippi and New York that respectively range from 1:1.2–1.4 and from 1:1.2–1.5 (Curran et al. 2012). Therefore, we think that our *Creptotrema* sp. is new and will describe it in a forthcoming publication that will include comparison of rDNA sequences and tegument ultrastructure (through SEM) with congeners from North America. This digenean is reported for the second time from Arkansas and *F. olivaceus* is a new host.

Nematoda: Dioctophymatoidea: Dioctophymatidae: *Eustrongylides* sp. (4th stage larvae) (Fig. 3)

60 mm TL, 1/44 (2%) overall, 1/2 (50%) Boone Co., one worm, Crooked Creek at Harmon, Boone Co. (36.233894°N, 92.922276°W), 23 Jul., 2014, HWML 64766.

Eustrongylides spp. are found as adults in the proventriculus of piscivorous wading birds, with larvae encysted in the body cavity and musculature of fishes (Hoffman 1999). Specific identification of *Eustrongylides* requires rearing larvae in an avian host or DNA sequencing and our study did not include these techniques. This large, red-colored nematode (130 mm TL) was found encapsulated in the mesentery (Fig. 3A). McAllister et al. (2016) previously reported *Eustrongylides* from *F. catenatus* from Crooked Creek,

Figure 3. *Eustrongylides* sp. from *Fundulus olivaceus*. A. Encapsulated larvae from mesenteries. B. Individual worm teased from encapsulation. Scale bars = 2.5 mm.

Marion County. Therefore, we report, for the first time, *Eustrongylides* sp. from *F. olivaceus*.

Spirurida: Rhabdochonidae: *Rhabdochona cascadilla* Wigdor, 1918

55 mm TL, 1/44 (2%) overall, 1/2 (50%) Boone Co., two (one male, one female) worms, Crooked Creek at Harmon, Boone Co., (36.233894°N, 92.922276°W), 23 July 2014, HWML 64767.

In Arkansas, Cloutman (1976) reported *R. cascadilla* from Stonerollers, *Camptostoma* spp., from the White River, Washington Co., and, more recently, McAllister et al. (2016) found this nematode commonly in *F. catenatus*, from Crooked Creek, Marion Co. Intermediate hosts of *Rhabdochona* spp. are primarily mayflies but caddisflies and stoneflies also serve (Gustafson 1939, Barger and Janovy 1994, Moravec 1995). This is the second time *R. cascadilla* has been reported from any member of the family Fundulidae, and *F. olivaceus* is a new host. This nematode shows little host specificity as it has been previously reported from at least 38 genera within 13 families of freshwater fishes in Canada and the USA (see Hoffman 1999, Moravec 2007, 2010).

In conclusion, the information provided herein serves to supplement the known information regarding parasites of non-game fishes in Arkansas. With additional surveys, more new host and distributional records will be expected as well as description of new species.

Acknowledgments

The Arkansas Game and Fish Commission issued Scientific Collecting Permits to CTM, HWR and MBC. Drs. S. L. Gardner (HWML) and R. Tumilson (HSU) provided expert curatorial assistance. We also thank Dr. D. J. Richardson (Quinnipiac University, CT) for loaning the electroshocker.

Literature Cited

- American Fisheries Society (AFS).** 2004. Guidelines for the use of fishes in research [web application]. J. G. Nickum (Chair). American Fisheries Society, Bethesda, Maryland. http://fisheries.org/docs/policy_useoffishes.pdf. Accessed 2015 January 15.
- Barger MA and J Janovy Jr.** 1994. Host specificity of *Rhabdochona canadensis* (Nematoda: Rhabdochonidae) in Nebraska. *Journal of Parasitology* 80:1032-1035.
- Bush AO, KD Lafferty, JM Lotz and AW Shostak.** 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *Journal of Parasitology* 83:575-583.
- Cashner RC, JS Rogers and JM Grady.** 1992. Phylogenetic studies of the genus *Fundulus*. Pages 421-437 in RL Mayden (ed.). Systematics, historical ecology, and North American freshwater fishes. Stanford University Press, Stanford, California. 969 pp.
- Cloutman DG.** 1976. Parasitism in relation to taxonomy of the sympatric sibling species of Stonerollers, *Campostoma anomalum pullum* (Agassiz) and *C. oligolepis* Hubbs and Greene, in the White River, Arkansas. *Southwestern Naturalist* 21:67-70.
- Curran SS, EE Pulis, DO Hugg, JP Brown, LC Manuel and RM Overstreet.** 2012. Phylogenetic position of *Creptotrema funduli* in the Allocreadiidae based on partial 28S rDNA sequences. *Journal of Parasitology* 98:873-875.
- Duobinis-Gray LF and KC Corkum.** 1985. Monogenea (Platyhelminthes) of various freshwater fishes of Louisiana. *Proceedings of the Helminthological Society of Washington* 52:133-135.
- Etnier DE and WC Starnes.** 1993. The fishes of Tennessee. Knoxville (TN): University of Tennessee Press. 681 p.
- Gustafson PV.** 1939. Life cycle studies on *Spinitectis gracilis* and *Rhabdochona* sp. (Nematoda: Thelaziidae). *Journal of Parasitology* 25:(supplement):12-13.
- Hoffman GL.** 1999. Parasites of North American freshwater fishes. Second Ed. Ithaca (NY): Comstock Publishing Associates. 539 p.
- Kozel TR and FH Whittaker.** 1985. Ectoparasites of the Blackstripe Topminnow, *Fundulus notatus*, from Harrods Creek, Oldham County, Kentucky. *Proceedings of the Helminthological Society of Washington* 52:314-315.
- McAllister CT, CR Bursey, WF Font, HW Robison, SE Trauth, DG Cloutman and TJ Fayton.** 2016. Helminth parasites of the Northern Studfish, *Fundulus catenatus* (Cypriniformes: Fundulidae) from the Ouachitas and Ozarks of Arkansas, U.S.A. *Comparative Parasitology* 83:(in press).
- Mizelle JD.** 1938. New species of monogenetic flukes from Illinois fishes. *American Midland Naturalist* 19:465-470.
- Moravec F.** 1995. Trichopteran larvae (Insecta) as intermediate hosts of *Rhabdochona hellichi* (Nematoda: Rhabdochonidae), a parasite of *Barbus barbus* (Pisces). *Parasitology Research* 18:268-270.
- Moravec F.** 2007. Some aspects of the taxonomy and biology of adult spirurine nematodes parasitic in fishes: A review. *Folia Parasitologica* 54:239-257.
- Moravec F.** 2010. Some aspects of the taxonomy, biology, possible evolution and biogeography of nematodes of the spirurine genus *Rhabdochona* Railliet, 1916 (Rhabdochonidae, Thelazioidea). *Acta Parasitologica* 55:144-160.
- Mueller JF.** 1934. Two new trematodes from Oneida Lake fishes. *Transactions of the American Microscopical Society* 53:231-236.
- Murith D and M Beverley-Burton.** 1985. *Salsuginus* Beverley-Burton, 1984 (Monogenea: Atheriniformes) in North America with descriptions of *Salsuginus angularis* (Mueller, 1934) Beverley-Burton, 1984 from *Fundulus diaphanus* and *Salsuginus heteroclitus* n. sp. from *F. heteroclitus*. *Canadian Journal of Zoology* 63:703-714.
- Page LM and BM Burr.** 2011. Peterson field guide to freshwater fishes of North America north of Mexico. Second Ed. Boston (MA): Houghton Mifflin Harcourt. 663 p.
- Pflieger WL.** 1997. The fishes of Missouri. Revised Ed. Jefferson City (MO): Missouri Department of Conservation. 372 p.
- Rice LA.** 1942. The food of seventeen Reelfoot Lake fishes in 1941. *Journal of the Tennessee Academy of Science* 17:4-13.
- Robison HW and TM Buchanan.** 1988. Fishes of Arkansas. Fayetteville (AR): University of Arkansas Press. 536 p.
- Wellborn TL Jr and WA Rogers.** 1967. Five new species of *Gyrodactylus* (Trematoda: Monogenea) from the southeastern U.S. *Journal of Parasitology* 53:10-14.