

HOST AND LOCALITY RECORDS OF THE FISH ECTOPARASITE, *ARGULUS* (BRANCHIURA), FROM OHIO (U.S.A.)

BY

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ABSTRACT

Argulus flavescens and *A. appendiculosus* were collected from five fish species in two major Ohio river basins during August-October, 1994. The golden redbhorse, *Moxostoma erythrurum*, is a new host record for *Argulus*. The 1994 records as well as past host and distribution records of *Argulus* in Ohio and Lake Erie (U.S. and Canadian waters) have been compiled. Six species, *A. flavescens*, *A. appendiculosus*, *A. lepidostei*, *A. stizostethii*, *A. americanus*, and *A. catostomi* have been recorded from 15 Ohio fish species.

ZUSAMMENFASSUNG

Zwischen August und Oktober 1994 wurden in zwei großen Flußsystemen in Ohio *Argulus flavescens* und *A. appendiculosus* gefunden. Eine der fünf Fischarten, an denen die Ektoparasiten gefunden wurden, *Moxostoma erythrurum*, wird hier erstmals als Wirt von *Argulus* beschrieben. Die Daten von 1994 wurden mit älteren Beschreibungen der Wirte und Verbreitungsgebiete von *Argulus* in Ohio und im Erie-See (U.S.A. und Kanada) verglichen. Sechs verschiedene *Argulus*-Arten wurden gefunden: *A. flavescens*, *A. appendiculosus*, *A. lepidostei*, *A. stizostethii*, *A. americanus* und *A. catostomi*. In Ohio sind insgesamt 15 verschiedene Fischarten als Wirte von *Argulus* bekannt.

INTRODUCTION

The genus *Argulus* (Branchiura) is widespread and known from Africa, Europe, Asia, and North, Central, and South America (Ringuelet, 1943; Fryer, 1968; Yamaguti, 1963). Twenty-three species of these parasitic crustaceans are currently recognized in marine and fresh waters of the United States by Cressey (1972), but their taxonomy has not been studied sufficiently. Recently, investigators have worked on a few species in the United States (Sutherland & Wittrock, 1986; Overstreet, Dyková & Hawkins, 1992; Benz, Otting & Case, 1995), but taxonomic problems persist. Little is known of the argulid fauna of Ohio. In 1994, *Argulus* spp. were captured in the Muskingum and Great Miami River

drainages, both direct tributaries to the Ohio River, and a search was made for published or unpublished records of *Argulus* spp. in Ohio. The known distribution and hosts of the argulids of Ohio and Lake Erie are presented.

MATERIALS AND METHODS

During routine biological monitoring of Ohio surface waters by Ohio Environmental Protection Agency personnel in 1994, the author collected *Argulus* while processing fishes. Specimens were kept alive in the field and preserved later in 70% ethyl alcohol; most were immersed in hot water to flare appendages before preservation. The parasites were collected from fishes that had been held in a livewell with many other species for periods between \approx 45 min and 1.5 h; so it is possible that some of them could have moved from the original host onto another species in the livewell. Three *A. flavescens* Wilson, 1916 taken from one *Ictalurus punctatus* (Rafinesque, 1818) in Wills Creek were definitely parasitizing this fish, and lesions were present at the attachment site. Also, most of the host species in this study are known hosts of *Argulus* spp., except *Moxostoma erythrurum* (Rafinesque, 1818). Keys, original descriptions, and revisionary studies (Cressey, 1972, 1978; Mueller, 1936; Meehan, 1940; Wilson, 1902, 1907, 1916) were used to identify the argulids found. I follow Wilson (1902) and Yeatman (1965) in recognizing both *A. americanus* Wilson, 1902 and *A. maculosus* Wilson, 1902. All specimens were deposited in the United States National Museum (USNM). Ciliated protozoans from one *A. appendiculosus* Wilson, 1907 (USNM 274261) were stained in carmine and mounted on slides for identification.

RESULTS AND DISCUSSION

Eleven *Argulus* were found on five fish species at eight sites. *Argulus flavescens* and *A. appendiculosus* were collected from the Ohio River drainage basin (table I). Literature reports and personal communications added further records for the State. Fig. 1 depicts the known distribution of *Argulus* spp. in Ohio waters.

Argulus appendiculosus was recorded from *Ictalurus punctatus* from Lake Erie (Dechtiar & Nepszy, 1988), Sunfish Creek, and Great Miami River (this study), and *Micropterus dolomieu* Lacépède, 1802 was found with *A. appendiculosus* for the first time. Deutsch (1977) reported unidentified *Argulus* sp. from *M. dolomieu* in Pennsylvania. Bangham & Hunter (1939) examined 2156 fishes (76 species) from Lake Erie and found only one *Argulus catostomi* Dana & Herrick, 1837 on *Ameiurus melas* (Rafinesque, 1820) from the West end. Bowen (unpubl. M.Sc.

TABLE I

Localities and hosts of *Argulus* spp. in Ohio and Lake Erie (United States and Canadian waters). Data from this study unless otherwise indicated. The number of host fishes parasitized is given in parentheses

Locality	Host fish	Number of <i>Argulus</i> collected	Species
Ohio River Drainage			
Licking River	<i>Moxostoma erythrurum</i> [†] (1)	1	<i>A. sp.</i> [†])
	<i>Pylodictis olivaris</i> (Rafinesque, 1818) (1)	1	<i>A. sp.</i> [†])
Wills Creek	<i>Ictalurus punctatus</i> (1)	3♀	<i>A. flavescens</i> (USNM 274259)
Muskingum River	<i>Pylodictis olivaris</i> (1)	1♀	<i>A. appendiculosus</i> (USNM 274260)
Great Miami River	<i>Micropterus dolomieu</i> [†] (1)	1♀	<i>A. appendiculosus</i> (USNM 274261)
	<i>Ictalurus punctatus</i> (1)	1♀	<i>A. appendiculosus</i> (USNM 274262)
	<i>Cyprinus carpio</i> Linnaeus, 1758 (1)	1♀	<i>A. appendiculosus</i> (USNM 274263)
	<i>C. carpio</i> (1)	1♀	<i>A. appendiculosus</i> (USNM 274265)
Buck Creek	<i>C. carpio</i> (1)	1♀	<i>A. appendiculosus</i> (USNM 274264)
Little Muskingum River	<i>Pylodictis olivaris</i> (1)	?	<i>A. sp.</i> ¹)
Middle Fork Little Beaver Creek	<i>Catostomus commersoni</i> (Lacépède, 1803) (?)	abundant	<i>A. sp.</i> ¹)
Salt Creek	<i>Noturus miurus</i> (8)	5♂, 4♀	<i>A. appendiculosus</i> ²)
Buckeye Lake	<i>Morone chrysops</i> (3)	?	<i>A. stizostethii</i> ³)
	<i>M. chrysops</i> *) (1)	4	<i>A. stizostethii</i> ⁴)
	<i>M. chrysops</i> *) (2)	?	<i>A. sp.</i> ⁴)
	<i>Lepomis macrochirus</i> (1)	1	<i>A. sp.</i> ⁵)
Big Darby Creek	<i>Cyprinus carpio</i> (1)	1	<i>A. sp.</i> ⁶)
Ohio River	<i>Hypentelium nigricans</i> (?)	?	<i>A. flavescens</i> ⁷)
Sunfish Creek	<i>Ictalurus punctatus</i> (1)	2♀	<i>A. appendiculosus</i> ⁸)
Lake Erie Drainage			
Lake Erie	<i>Ameiurus nebulosus</i> (Lesueur, 1819) (?)	?	<i>A. appendiculosus</i> ⁷)
	<i>A. melas</i> (?)	?	<i>A. catostomi</i> ⁹)
	<i>A. sp.</i> (1)	1	<i>A. appendiculosus</i> ¹⁰)
	free-swimming	6	<i>A. stizostethii</i> ¹⁰)
	<i>Cyprinus carpio</i> (3)	?	<i>A. appendiculosus</i> ¹¹)
	host not listed	?	<i>A. americanus</i> ¹¹)
	<i>Aplodinotus grunniens</i> Rafinesque, 1819 (1)	1	<i>A. sp.</i> ¹²)
	<i>Carpionodes cyprinus</i> (Lesueur, 1817) (?)	?	<i>A. catostomi</i> ¹³)
	<i>Catostomus commersoni</i> (?)	?	<i>A. catostomi</i> ¹³)

TABLE I
 (Continued)

Locality	Host fish	Number of <i>Argulus</i> collected	Species
	<i>Ictalurus punctatus</i> (?)	?	<i>A. appendiculosus</i> ¹³⁾ (as <i>A. biramosus</i> Bere, 1931)
	<i>Morone chrysops</i> *) (2)	2	<i>A. stizostethii</i> ¹⁴⁾
Put-in-Bay	?	?	<i>A. lepidostei</i> ⁷⁾
Terwilliger's Pond	?	?	<i>A. sp.</i> ¹⁵⁾
Kelleys Island	?	?	<i>A. sp.</i> ¹⁵⁾
Maumee River	<i>Lepisosteus osseus</i> (Linnaeus, 1758) (?)	1♂, 1♀	<i>A. lepidostei</i> (USNM 43522) ¹⁶⁾
Sandusky River	free-swimming	1	<i>A. stizostethii</i> ¹⁷⁾

†) New host record; ‡) Specimens are missing and will be reported later if found; *) In stomach; 1) Roger Thoma (pers. comm.; white suckers were reported to have been heavily infested, but no specimens were retained); 2) Bowen (unpubl.); 3) Bangham (1941b); 4) Ewers & Boesel (1935); 5) Morgan (1951); 6) Charles E. Boucher & Anthony Minamyer (pers. comm.; specimen not saved); 7) Meehan (1940); 8) A. Minamyer (pers. comm.; specimens sent to author); 9) Bangham & Hunter (1939); 10) Tidd (1931); 11) Dechtiar (1972; Canadian waters); 12) Bangham (1972); 13) Dechtiar & Nepszy (1988); 14) Ewers (1933); 15) John L. Crites (pers. comm.); 16) USNM record courtesy of Raymond B. Manning (pers. comm.) and also in Wilson (1916); 17) David C. Cray (pers. comm.; specimen examined by author).

Thesis, The Ohio State University, Columbus) examined 334 *Noturus miurus* Jordan, 1877 for parasites and found eight individuals with *A. appendiculosus*. This was a new host record for *A. appendiculosus*, and according to Bowen (unpubl.), the deaths of two *N. miurus* in captivity were due to parasitism from a single female *A. appendiculosus*. Morgan (1951) recorded one *Argulus* sp. from *Lepomis macrochirus* Rafinesque, 1819 at Buckeye Lake, Ohio. *Argulus flavescens* has been reported only on a *Hypentelium nigricans* (Lesueur, 1817) from the Ohio River previously, but has been recorded from a variety of fishes in the U.S.A. including *Ictalurus punctatus* (Bangham, 1941a; Meehan, 1940).

There seems to be a recurring association between *A. stizostethii* Kellicott, 1880 and *Morone chrysops* (Rafinesque, 1820) (table I). At Buckeye Lake, three *M. chrysops* bore *A. stizostethii* (Bangham, 1941b), and one contained four *A. stizostethii* in its stomach (Ewers & Boesel, 1935) that presumably had been eaten. Two *M. chrysops* from the western end of Lake Erie also contained *A. stizostethii* in their stomachs (Ewers, 1933). If the parasite is living in the buccal cavity or on the gills of *M. chrysops*, ingestion may be incidental (fish sizes were not reported); however, several centrarchids are known to feed actively on *Argulus* (Spall, 1970). The only other species reported on *M. chrysops* is *A. appendiculosus* (cf. Wilson, 1916; Amin, 1981), and unidentified *Argulus* were noted on

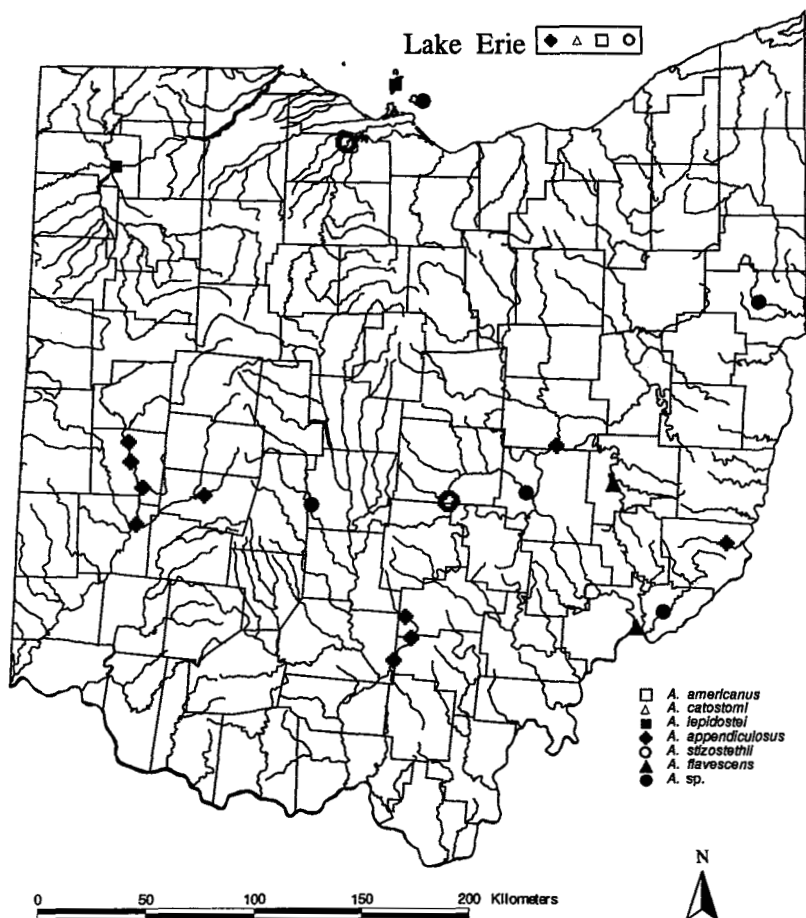


Fig. 1. Distribution of *Argulus* spp. in Ohio and Lake Erie (United States and Canadian waters). Inland Ohio and Lake Erie island localities are plotted; Lake Erie records are in the box at top of figure.

M. chrysops in Oklahoma (Spall, 1970). Three male *A. stizostethii* have been collected recently in plankton tows from unspecified Ohio reservoirs (most likely from the Ohio River basin, D. Cray & S. Strong-Betz, pers. comm.; these were examined by the author, but are not listed in table I or fig. 1).

Two *A. appendiculosus* (USNM 274263 and 274261) from the Great Miami River had ciliated protozoans, either *Epistylis* or *Opercularia* (Kudo, 1966; Penak, 1989), with a heavy infestation occurring anteroventrally on one individual (USNM 274261). *Epistylis* (?) has been observed on this species previously (Sutherland & Wittrock, 1986). One *A. flavescens* from Wills Creek had what appeared to be crustacean shell disease lesions located ventrally on its right, third leg and second maxilla and ventrally on the left, lateral edge of the carapace,

and one *A. appendiculosus* from Sunfish Creek had a lesion on the left, third leg. Rushton-Mellor & Whitfield (1993) reported this disease from *A. foliaceus* Linnaeus, 1758 for the first time and examined the nature of the infected lesions characteristic of the disease.

Six *Argulus* species have been recorded in inland Ohio and Lake Erie. Most are known from only a few scattered localities, but are probably more widespread. Examination of more *Lepisosteus* spp. will doubtless result in additional records of *A. lepidostei* Kellicott, 1877 and perhaps the first record of *A. mississippiensis* Wilson, 1916, both of which are found most often on gars. *Argulus mississippiensis* has been collected in the neighboring state of Indiana (Benda, 1975).

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