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Running Title: New Host Records for the Fish Leech *Cystobranchus klemmi*

The Piscicolid fish leech *Cystobranchus klemmi* was originally described by Williams and Bureson (2005) as *Gonimosobdella klemmi* from the stoneroller, *Campostoma anomalum pullum*, and largescale stoneroller, *Campostoma oligolepis*, from the Little Red River in Searcy County, Arkansas. Williams and Bureson (2005) also reported *C. klemmi* from stonerollers from Bollinger, Cape Girardeau, Perry, Wayne and Washington counties in Missouri, and the redbfin shiner, *Lythrurus umbratilis*, and red shiner, *Cyprinella lutrensis*, from Union County, Illinois. Williams and Bureson (2006) synonymized the genus *Gonimosobdella* with *Cystobranchus*.

Examination of fish in the collection of Henderson State University, Arkadelphia, Arkansas revealed the presence of *C. klemmi* from central stonerollers, *C. anomalum*, from Franklin and Madison counties in Arkansas, and Cherokee County, Oklahoma, highland stonerollers, *Campostoma spadiceum*, from Garland, Hot Spring, Howard, Montgomery, Pike, and Sevier counties in Arkansas, a southern redbelly dace, *Chrosomus erythrogaster*, from Carroll County, Arkansas, and creek chubs, *Semotilus atromaculatus*, from Madison, Montgomery, and Independence counties in Arkansas (Figs. 1-2). Host vouchers are deposited in the vertebrate collection of the Biology Department at Henderson State University, Arkadelphia, Arkansas. All leeches were deposited in the Peabody Museum of Natural History, Yale University, in New Haven, Connecticut. Collection details along with accession numbers are given in Table 1.

This constitutes the first report of *C. klemmi* since its original description by Williams and Bureson

(2005) and the first report of this species from Oklahoma. Williams and Bureson (2005) described *C. klemmi*, in part, based on specimens collected from *C. a. pullum* from the Little Red River in Searcy County, Arkansas and from Apple Creek, Perry County, and Juden Creek and the St. Francis River in



Figure 1. *Cystobranchus klemmi* on a highland stoneroller, *Campostoma spadiceum*, from the Saline River in Howard County, Arkansas. Scale bar = 1cm.



Figure 2. *Cystobranchus klemmi* taken from a creek chub, *Semotilus atromaculatus* from a spring flowing out of Big Spring Mill in Independence County, Arkansas. Scale bar = 1mm.

Table 1. Summary of *Cystobranchus klemmi* collected in this study.

Host	Geographic Location	Number of Fish infested/ Number of fish in sample	Number of Leeches from each host	Collection Date	Host Accession #	Parasite Accession #
<i>Campostoma anomalum</i> (Central stoneroller)	Franklin Co. AR, Mulberry River	2/2	(5,1)	1 February 2003	HSU2855	YPM58384
	Madison Co. AR, White River	1/1	(8,3*)	24 March 1999	HSU2620	YPM58385
	Cherokee CO. OK, Rocky Ford State Park	1/11	(1,3*)	27 April 1991	HSU75	YPM58386
<i>Campostoma spadiceum</i> (Highland stoneroller)	Pike Co. AR, Caddo River	1/3	(1)	2 April 1994	HSU333	YPM58374
	Montgomery Co. AR, Lick Creek	1/6	(1)	2 April 1994	HSU376	YPM58375
	Pike Co. AR, Caddo River	1/3	(1)	20 February 1999	HSU2273	YPM58376
	Hot Spring Co. AR, DeRoche Creek	1/15	(1,2*)	14 January 1999	HSU2517	YPM58377
	Garland Co. AR	1/1	(4,1*)	9 March 1997	HSU1532	YPM58436
	Montgomery Co. AR, Long Creek	1/1	(1)	25 March 1997	HSU2080	YPM58437
	Hot Spring Co. AR, Blakely Creek	1/2	(2,1*)	9 March 1997	HSU1454	YPM58435
	Howard Co. AR, Saline river	1/2	(12)	21 February 1999	HSU2587	YPM58378
	Hot Spring Co. AR, Big Hill Creek	1/1	(1)	28 January 1999	HSU2442	YPM58379
	Sevier Co. AR, Woolly Creek	1/2	(3)	16 February 1997	HSU1957	YPM58380
	Hot Spring Co. AR, Sanders Creek	1/3	(1,1*)	2 February 1999	HSU2556	YPM58381
	Hot Spring Co. AR, Bayou Dee	1/3	(1)	16 February 1997	HSU1468	YPM58382
	Hot Spring Co. AR, Marcus Creek	2/4	(2,4)	5 February 1994	HSU994	YPM58383
	<i>Chrosomus erythrogastar</i> (Southern redbelly dace)	Carroll Co. AR, Dry Creek	1/1	(1)	22 March 1999	HSU2609
<i>Semotilus atromaculatus</i> (Creek chub) - For HSU370: also see <i>Campostoma spadiceum</i> HSU376 from the same date and location	Madison Co. AR, War Eagle Creek	1/1	(2)	23 March 1999	HSU2614	YPM58387
	Montgomery Co. AR, Lick creek	3/5	(2,1,1,2*)	2 April 1994	HSU370	YPM58434
	Independence Co. AR, Big Spring Mill	1/1	(1)	23 February 2013	HSU3489	YPM58393

(All Leeches found on one specimen unless noted as (fish1, fish2); (*) indicates loose specimens found in jar unattached to fish. For more specific information regarding geographic collection localities and site of attachment on host refer to museum catalog numbers.)

Wayne County, Missouri. *Campostoma spadiceum* was resurrected and redescribed by Cashner et al. (2010) who indicated that in many instances specimens previously reported as *C. a. pullum* were actually *C. spadiceum*. Host vouchers were not mentioned by Williams and Burreson (2005) so it is not clear whether some of the host specimens that they examined were *C.*

a. pullum or *C. spadiceum*. In either case, this study definitively documents both *C. anomalum* and *C. spadiceum* as hosts for *C. klemmi*.

Cystobranchus klemmi was always attached to host fins. Chi square analysis revealed a significant preference in caudal attachment over pectoral ($\chi^2=10.00$; 1df) or pelvic ($\chi^2=8.80$; 1df). Pelvic or

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pectoral attachment sites were significantly preferred over dorsal or anal attachment sites ($\chi^2=9.84$, 1df). Attachment sites of 56 individuals are summarized in Fig. 3. The findings of *C. klemmi* on *C. erythrogaster* and *S. atromaculatus* represent new host records.

All occurrences of *C. klemmi* documented in this study were from cyprinid fishes occurring in streams and other lotic environments. Examination of a substantial number of fishes from lakes and reservoirs failed to reveal the presence of *C. klemmi*. Thus, *C. klemmi* may be characterized as a leech of cyprinid fishes of small streams and other lotic habitats. The known distribution of *C. klemmi* is given in Table 1 and Fig. 4.

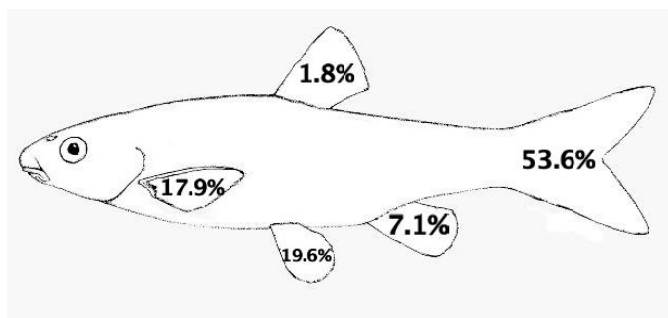


Figure 3. Attachment sites of 56 specimens *Cystobranchus klemmi* on cyprinid fishes. Drawing after McAllister (1990).

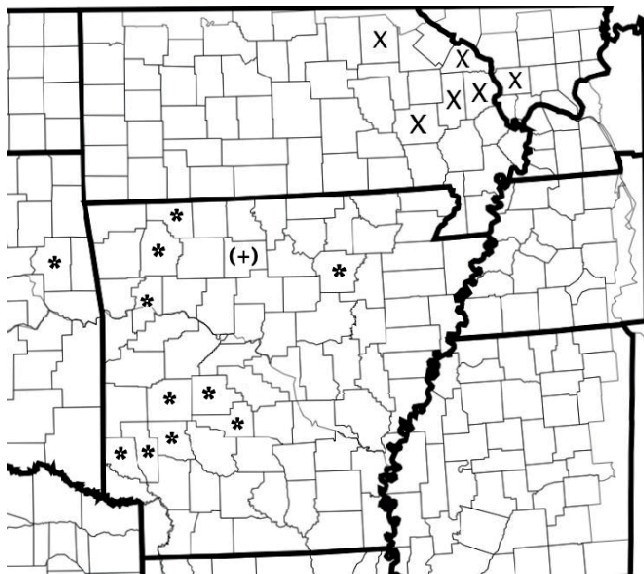


Figure 4. Known distribution of *Cystobranchus klemmi* (+) indicated the type locality given by Williams and Bureson (2005). X indicates other localities reported by Williams and Bureson (2005). * indicates localities reported herein.

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