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New Host Records for the Fish Leech *Cystobranchus klemmi* (Hirudinida: Piscicolidae) on Cyprinid Fishes from Arkansas and Oklahoma

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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 Burreson (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 Burreson (2005) also reported *C. klemmi* from stonerollers from Bollinger, Cape Girardeau, Perry, Wayne and Washington counties in Missouri, and the redfin shiner, *Lythrurus umbratilis*, and red shiner, *Cyprinella lutrensis*, from Union County, Illinois. Williams and Burreson (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 redbellied 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 Burreson (2005) and the first report of this species from Oklahoma. Williams and Burreson (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.

<table>
<thead>
<tr>
<th>Host</th>
<th>Geographic Location</th>
<th>Number of Fish infested/Number of fish in sample</th>
<th>Number of Leeches from each host</th>
<th>Collection Date</th>
<th>Host Accession #</th>
<th>Parasite Accession #</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Campostoma anomalum</em> (Central stoneroller)</td>
<td>Franklin Co. AR, Mulberry River</td>
<td>2/2 (5,1)</td>
<td>1 February 2003</td>
<td>HSU2855</td>
<td>YPM58384</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Madison Co. AR, White River</td>
<td>1/1 (8,3*)</td>
<td>24 March 1999</td>
<td>HSU2620</td>
<td>YPM58385</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cherokee CO. OK, Rocky Ford State Park</td>
<td>1/11 (1,3*)</td>
<td>27 April 1991</td>
<td>HSU75</td>
<td>YPM58386</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pike Co. AR, Caddo River</td>
<td>1/3 (1)</td>
<td>2 April 1994</td>
<td>HSU333</td>
<td>YPM58374</td>
<td></td>
</tr>
<tr>
<td><em>Campostoma spadiceum</em> (Highland stoneroller)</td>
<td>Montgomery Co. AR, Lick Creek</td>
<td>1/6 (1)</td>
<td>20 February 1999</td>
<td>HSU2273</td>
<td>YPM58376</td>
<td></td>
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<tr>
<td></td>
<td>Hot Spring Co. AR, DeRoche Creek</td>
<td>1/3 (1,2*)</td>
<td>14 January 1999</td>
<td>HSU2517</td>
<td>YPM58377</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Garland Co. AR</td>
<td>1/1 (4,1*)</td>
<td>9 March 1997</td>
<td>HSU1532</td>
<td>YPM58436</td>
<td></td>
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<td></td>
<td>Montgomery Co. AR, Long Creek</td>
<td>1/1 (1)</td>
<td>25 March 1997</td>
<td>HSU2080</td>
<td>YPM58437</td>
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<td></td>
<td>Hot Spring Co. AR, Blakely Creek</td>
<td>1/2 (2,1*)</td>
<td>9 March 1997</td>
<td>HSU1454</td>
<td>YPM58435</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Howard Co. AR, Saline river</td>
<td>1/2 (12)</td>
<td>21 February 1999</td>
<td>HSU2587</td>
<td>YPM58378</td>
<td></td>
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<td></td>
<td>Hot Spring Co. AR, Big Hill Creek</td>
<td>1/1 (1)</td>
<td>28 January 1999</td>
<td>HSU2442</td>
<td>YPM58379</td>
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<td></td>
<td>Sevier Co. AR, Woolsy Creek</td>
<td>1/2 (3)</td>
<td>16 February 1997</td>
<td>HSU1957</td>
<td>YPM58380</td>
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<td></td>
<td>Hot Spring Co. AR, Sanders Creek</td>
<td>1/3 (1,1*)</td>
<td>2 February 1999</td>
<td>HSU2556</td>
<td>YPM58381</td>
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<tr>
<td></td>
<td>Hot Spring Co. AR, Bayou Dee</td>
<td>1/3 (1)</td>
<td>16 February 1997</td>
<td>HSU1468</td>
<td>YPM58382</td>
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<td></td>
<td>Hot Spring Co. AR, Marcus Creek</td>
<td>2/4 (2,4)</td>
<td>5 February 1994</td>
<td>HSU994</td>
<td>YPM58383</td>
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<tr>
<td><em>Chrosomus erythrogaster</em> (Southern redbelly dace)</td>
<td>Carroll Co. AR, Dry Creek</td>
<td>1/1 (1)</td>
<td>22 March 1999</td>
<td>HSU2609</td>
<td>YPM58394</td>
<td></td>
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<tr>
<td><em>Semotilus atromaculatus</em> (Creek chub)</td>
<td>Madison Co. AR, War Eagle Creek</td>
<td>1/1 (2)</td>
<td>23 March 1999</td>
<td>HSU2614</td>
<td>YPM58387</td>
<td></td>
</tr>
<tr>
<td>- For HSU370: also see <em>Campostoma spadiceum</em></td>
<td>Montgomery Co. AR, Lick creek</td>
<td>3/5 (2,1,1,2*)</td>
<td>2 April 1994</td>
<td>HSU370</td>
<td>YPM58434</td>
<td></td>
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<tr>
<td>HSU376 from the same date and location</td>
<td>Independence Co. AR, Big Spring Mill</td>
<td>1/1 (1)</td>
<td>23 February 2013</td>
<td>HSU3489</td>
<td>YPM58393</td>
<td></td>
</tr>
</tbody>
</table>

(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 ($\chi^2=10.00; 1$ df) or pelvic ($\chi^2=8.80; 1$ df). Pelvic or
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 Burreson (2005). X indicates other localities reported by Williams and Burreson (2005). * indicates localities reported herein.

**New Host Records for the Fish Leech *Cystobranchus klemmi***

### Literature Cited


