A List of Records of Freshwater Aspidogastrids (Trematoda) and Their Hosts in North America

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ABSTRACT: Published records for the six species of North American freshwater aspidogastrid trematodes from molluscs and vertebrates have been compiled, listing both hosts and localities for state or province. Seventeen new unionid mussel hosts (Bivalvia) are reported for Aspidogaster conchicola along with new state records for Arkansas, Connecticut, Delaware, Maryland, Mississippi, North Carolina, New York, Virginia, and San Luis Potosi (Mexico); 12 new unionid host species for Cotylaspis insignis, with new state records for Arkansas, Delaware, Massachusetts, Mississippi, New Jersey, Rhode Island, and Wisconsin; five new unionid hosts for Cotylaster occidentalis, with new state records for Connecticut, Delaware, Florida, and Texas; and a new unionid host record for Lophotaspis interiora. No new records are given for Cotylaspis cokeri nor for C. stunkardi from turtles.

In North America, aspidogastrid trematodes are common parasites of freshwater unionid mussels (Bivalvia). They occur less often in gastropods, fishes, and turtles (Dollfus, 1958; Rohde, 1972). Aspidogaster conchicola von Baer, 1826, Cotylaspis insignis Leidy, 1857 (=Platyspis anodontae Osborn, 1898 and C. reelfootensis Najarian, 1961), and Cotylaster occidentalis Nickerson, 1902 (=C. barowi Huehner and Etges, 1972) are widely distributed, but distributional limits have not been established, particularly at the northern and western boundaries of their ranges. Information on Cotylaspis cokeri Barker and Parsons, 1914, C. stunkardi Rumbold, 1928, and Lophotaspis interiora Ward and Hopkins, 1931 are based on one to five reports each, and the distributions are poorly known.

Distribution and host records are scattered in the literature; the nomenclature of unionid mussels has been unstable and changing; and recent surveys have almost consistently recorded declines in mussel species, diversity, and ranges as habitats are modified by human activities (Suloway, 1981; Havlik, 1983). To create a checklist of locality records for North American aspidogastrids, we reviewed and numbered 74 publications (Appendix 1) (note that the numbers are also cited in the checklist).

The checklist (Appendix 2) includes previously unpublished host and locality data from the authors’ collections of A. conchicola, C. insignis, C. occidentalis, and L. interiora. To conserve space in the checklist, we are listing the stations as given in Appendix B of Vidrine (1980), in parentheses. Photocopies of this Appendix have been deposited at the U.S. National Parasite Collection, USDA, ARS, BARC-East No. 1180, Beltsville, Maryland 20705; the Harold W. Manter Laboratory, University of Nebraska State Museum, Lincoln, Nebraska 68588-0514; and the Biology Department of Gettysburg College.

Localities for our new state records are listed in Table 1. Two additional localities from Pennsylvania (§7 and §8, are included in this table but are not new state records. Mussel names are based on the works of many authors, especially Burch (1975), but the higher taxa are based on Davis and Fuller (1981); gastropod names are based on Burch and Tottenham (1980) and Burch (1982); turtle names are based on Ernst and Ernst (1977). Junior synonyms of host names are included when those names have been used by authors reporting aspidogastrids.

Mussels were collected by hand, with a modified quahog clamping rake, by snorkeling, or with a crowfoot apparatus. The soft parts were dissected in a manner similar to that of Hendrix and Short (1965, 1972), but the visceral mass was also cut open to locate any C. occidentalis that might be in the intestine. The worms were collected, fixed, and identified using standard parasitological techniques. Voucher specimens have been deposited in the USNM Helminthological Collection, USDA, Beltsville, Maryland 20705, Nos. 78804-78810.
Table 1. Localities of new state records for aspidogastrids.

<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>279</td>
<td>A.c./C.i.</td>
<td>Lake Chicot, junct. of US 82 and US 65, ca. 5 mi east of Lake Village, Chicot Co., AR</td>
</tr>
<tr>
<td>391</td>
<td>C.i.</td>
<td>Saline River at AR 160, east of Johnsville, Ashley and Bradley cos., AR</td>
</tr>
<tr>
<td>396</td>
<td>A.c./C.i.</td>
<td>North Cadron Cr., US 65, north of Greenbriar, Faulkner Co., AR</td>
</tr>
<tr>
<td>398</td>
<td>C.i.</td>
<td>Saline River at US 167, Grant and Dallas cos., AR</td>
</tr>
<tr>
<td>400</td>
<td>C.i.</td>
<td>Ouachita River at AR 270, Rocky Shoals Park, Montgomery Co., AR</td>
</tr>
<tr>
<td>404</td>
<td>A.c./C.i.</td>
<td>Ouachita River, 6 mi southeast of Ink, Polk Co., AR</td>
</tr>
<tr>
<td>406</td>
<td>C.i.</td>
<td>Strawberry River at US 167, 2 mi north of Evening Shade, Sharp Co., AR</td>
</tr>
</tbody>
</table>

§1 A.c. | Carlson’s Pond, junct. of CT 207 and Pond Rd., North Franklin, New London Co., CT |

§2 A.c./C.o. | Williams Pond, off CT 207, Amston, New London Co., CT |

3 A.c./C.i./C.o. | Deep Cr. at Nanticoke Acres, DE 20, Seaford, Sussex Co., DE |

§3 A.c./C.i. | Maspheo Pond, Masphee Twp., Barnstable Co., MA |

§4 A.c./C.i. | Sargo Lake, Town landing, Dennis, Barnstable Co., MA |

§5 A.c./C.i. | Upper Mill Pond, Brewster, Barnstable Co., MA |

74 C.o. | Little Withlacoochee River, at US 301, south of Bushnell, Sumter and Hernando cos., FL |

9 A.c. | Chester River, east of junct. of MD 297 and MD 313, Millington, Kent Co., MD |

110 A.c./C.i. | Tombigbee River at US 82, Columbus, Lowndes Co., MS |

111 A.c. | Tombigbee River at MS 50, ca. 6 mi northwest of Columbus, Lowndes and Clay cos., MS |

133 C.i. | Tickfaw River at MS 584, east of Gilsburg, Amite Co., MS |

134 C.i. | East Fork of Amite River, ca. 4 mi north of LA state line, Amite Co., MS |

135 C.i. | East Fork of Amite River at MS 584, Amite Co., MS |

138 C.i. | Leaf River at US 98, Greene Co., MS |

139 C.i. | Yokonookany River at MS 429, Leake Co., MS |

140 C.i. | Bogue Chitto River at US 84, Bogue Chitto, Lincoln Co., MS |

142 A.c. | Pearl River at US 98, Marion Co., MS |

Table 1. Continued.

<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>143</td>
<td>A.c./C.i.</td>
<td>Hobolochito Cr. at MS 11, Pearl River Co., MS</td>
</tr>
<tr>
<td>144</td>
<td>C.i.</td>
<td>Wolf River at MS 26, Pearl River Co., MS</td>
</tr>
<tr>
<td>145</td>
<td>C.i.</td>
<td>Bogue Chitto River at US 98, Pike Co., MS</td>
</tr>
<tr>
<td>146</td>
<td>C.i.</td>
<td>Tangipahoa River at US 51, Pike Co., MS</td>
</tr>
<tr>
<td>386</td>
<td>A.c.</td>
<td>Big Black River at MS 12, Holmes and Atalaya cos., MS</td>
</tr>
<tr>
<td>388</td>
<td>C.i.</td>
<td>Sunflower River at MS 14, ca. 3 mi east of Anguilla, Sharkey Co., MS</td>
</tr>
</tbody>
</table>

45 A.c. | Chowan River at Raye’s Beach Fishing Club, Gates Co., NC |

14 A.c./C.i. | Delaware River at Kinkora Island, Roebling, Burlington Co., NJ |

§6 A.c. | Susquehanna River at Recreation Park, off NY 7, Conklin, NY |

§7 C.i. | Schuykill River at Hawes Ave. Park, Norristown, Montgomery Co., PA |

§8 A.c./C.i. | Susquehanna River at Selinsgrove, Snyder Co., PA |

§9 C.i. | 30 Acre Pond, off RI 138 and RI 110, Univ. of Rhode Island, Kingston, Washington Co., RI |

174 C.o. | Village Cr. at US 96, south of Silsbee, Hardin Co., TX |

446 A.c. | Possum Cr., near Gate City, Scott Co., VA |

231 C.i. | Mississippi River at DeSoto, above Indian Camp Light, Vernon Co., WI |

462 A.c. | Valles River below RR station in Micos, San Luis Potosi, MEX |


Discussion

Although the checklist includes numerous unionid mussel and other hosts, there are large gaps in the known host range and geographic distribution of these freshwater aspidogastrids. Burch (1975) lists 227 species of unionacean mussels north of Mexico, only a fraction of which are reported to have aspidogastrids. For example, there may be no North American records of aspidogastrids from the more primitive subfamily Margaritiferinae because few specimens and localities have been examined. Aspidogastrids are presently reported from only 30 states, one Canadian province, and one Mexican state. A. conchicola is the only aspidogastrid reported from
the western third of the continent (Pauley and Becker, 1968); the remaining records come from the midwestern, southern, and eastern regions of North America, primarily the United States. The northern boundary of the aspidogastrid range is uncertain because, although unionid mussels have migrated into previously glaciated areas of North America, it appears that the aspidogastrids have not necessarily accompanied them. Several mussel collections in Washington County, Maine yielded no aspidogastrids, yet we report them in Connecticut, Rhode Island, and Massachusetts. Further, Dr. M. D. B. Burt (pers. comm.) has examined numerous unionids in New Brunswick, Canada without finding these helminths. No aspidogastrids were found upon examination of numerous mussels in the Canadian National Museum collection by M.F.V. (C. occidentalis was not sought). Gaps in known host and geographic distribution probably reflect more the interests of workers in various laboratories and the availability of host material than true gaps. In drainages where these helminths have been reported, usually not all of the potential host species from those drainages have been examined.

Both A. conchicola and C. insignis have rather low unionid host specificity and a large distributional range which suggests an ancient coevolutionary relationship between mussels and these two aspidogastrids. This specificity may however, be limited primarily by habitat preferences of the hosts rather than physiological preferences of the parasites. As yet, too little is known about the ecology, life histories and host–parasite relationships of these species in mussels to make generalizations.

The host and geographic ranges of C. occidentalis and L. interiora also are known incompletely, perhaps because they utilize vertebrate hosts as well as molluscs. Lophotaspis interiora appears to have a two-host life cycle; adults are known only from a single turtle originally from Arkansas (Ward and Hopkins, 1931), whereas juveniles are known only from Florida mussels (Hendrix and Short, 1972). The availability of a fish host, A. grunniens Raf., may partially explain the fairly wide geographic range of C. occidentalis. The fact that the mussel visceral mass must be dissected in order to locate these worms in the intestine may contribute to the relatively few reports of this species.

We report in the checklist an additional 17 new mussel hosts for A. conchicola, 12 for C. insignis, 5 for C. occidentalis, and 1 for L. interiora. New state records (Table 1) are given for all of these except L. interiora which has yet to be reported from mussels outside of Florida. The range of A. conchicola is extended to Arkansas, Connecticut, Delaware, Maryland, Mississippi, New York, North Carolina, Virginia, and San Luis Potosi (Mexico); that of C. insignis to Arkansas, Delaware, Massachusetts, Mississippi, New Jersey, Rhode Island, and Wisconsin; that of C. occidentalis to Connecticut, Delaware, Florida, and Texas.

Both A. conchicola and C. insignis are found in Mexico. A. conchicola is found in a number of the Atlantic drainages in the northern portion of the country whereas C. insignis occurs in the more southern ones (Vidrine et al., 1983). The taxonomy of Mexican mussels is being revised, and the best available names are in the checklist.

Acknowledgments

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The Ohio State Museum of Natural History, Columbus; the Delaware Museum of Natural History; the Canadian National Collection, Ottawa; the U.S. National Museum; and the University of Michigan Museum of Zoology made their collections of Unionacea available to M.F.V.
Appendix I

Publications Containing Locality Information on North American Aspidogastrids


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Appendix 2

Checklist of State and Province Records of Known Molluscan and Vertebrate Hosts of Freshwater Aspidogastrids in North America

CLASS GASTROPODA, Subclass Prosobranchia, Family Pleuroceridae: Elimia livescens (Menke) as Goniostrongylus livescens, A. conchicola †OH 28, 31; Elimia virginica (Say) as Goniostrongylus virginicus, A. conchicola NJ 33; Elimia sp. as Goniostrongylus sp., C. occidentals KY 69, OH 12; Pleurocera acuta Rafinesque, C. occidentals IN 8, C. cokeri IN 8, Family Viviparidae: Campeoloma decisum (Say) as Paludina decisa, A. conchicola PA 43; Cipangopaludina japonica (Martens) as Viviparous japonicus, A. conchicola MA 47; Cipangopaludina chinesis malleata (Reeve) as Viviparous malleatus, A. conchicola MA 47, OH 28, 29, 31.

CLASS BIVALVIA, Superfamily Unionaceae, Family Unionidae: Actioninae carinata (Barnes) as A. ligamentina carinata, A. l. ligamentina, Lampsilis ligamentinus, and Unio ligamentinus, A. conchicola MO 27, OH 32, C. insignis IA 37, IL 37, 39, MO 27, C. occidentals MO 27; Actioninae ellipsiformis (Conrad) as Venustaconchia ellipsiformis ellipsiformis and V. e. planata, A. conchicola MO 27, C. insignis AR(406), MO 27; Alasmidonta marginata (Say) as A. conchicola OH 60, PA 37; Amblema dombyeana (Val.) as Plectomerus dombyeana, A. conchicola LA(289, 294, 302, 305, 320, 335, 341, 346, 347, 363, 369) 66, 67, C. insignis LA(304), †MS(138); Amblema giganta (Barnes) as Megalanias giganta, Magnanias nervosa, and Quadrula undulata, A. conchicola IN 61.

* = New host record.
‡( ) = New state and locality record (see Table 1).
($) = Locality listed in Table 1, not in Vidrine (1980).
gumia subrostrata, A. conchicola
Ligumia nasuta (Say) as Lamphislis tenuissimus, C. insignis IL 37; Ligumia nasuta (Say) as Lamphislis nasuta and Unio nasutus, A. conchicola

Ligumia recta (Lam.) as Lamphislis rectus and Unio rectus, A. conchicola IA 37, IL 37, OH 60, C. insignis IL 37, 39, IN 72, 73, LA(349), MO 27, OH 72, C. occidentalis MI 45; Ligumia subrostrata (Say) as Lamphislis subrostratus, A. conchicola LA(314), MO 27, C. insignis LA(113, 297, 338) 67, MO 27, TN 48, 49; Medionidus conradicus (Lea), *A. conchicola *LA(446); Obovaria reflexa Raf., A. conchicola MO 27, *A. conchicola *LA(110), OH 60, OK 50, TN 24; Obovaria castanea (Lea), *A. conchicola *LA(157, 168); Obovaria olivaria (Raf.) as Obovaria olivaria and Lamphislis elliptis, A. conchicola IA 37, IL 37, 65, TN 24, C. insignis IL 37, IL 27; Obovaria retusa (Lam.) as Obovaria retusa, A. conchicola TN 24; Obovaria subrotunda (Raf.), A. conchicola OH 6; Orthonymus cylindrica (Say) as Quadrula cylindrica, *A. conchicola *TN(437); Orthonymus metanevra (Raf.) as Quadrula metanevra, A. conchicola MO 27, TN 24, C. insignis IL 37; Plagiola triqueta (Raf.) as Dysonemia triqueta, A. conchicola OH 60; Pleothobasis cyphus (Raf.), C. insignis TN 30; Pleurobema cordatum (Conrad) as P. coccineum, A. conchicola IL 65, OH 6, 60, TN 24, WV 11; Pleurobema sintonia (Raf.), A. conchicola MO 27; Pleurobema strobacum (B. H. Wright), A. conchicola FL 25, L. interiora FL 26; Popenaeas sp., *A. conchicola *SLP(462); Proptera alata (Say) as Lamphislis alatus and Potamalus alatus, A. conchicola IA 37, IL 37, MO 27, OH 6, 60, OK 50, TN 24, WI 71, WIV 11, C. insignis IL 37, IL 37, 39, MO 27, OK 50; Proptera amphichaena (Frieson), *A. conchicola *TX(176), C. insignis TX(176); Proptera laevissima (Lea) as Leptodea laevissima and Potamalus ohiosiensis, A. conchicola *AR(279), MO 27, WI 71, C. insignis *AR(279); Proptera purpurata (Lam.) as Potamalus purpuratus, A. conchicola LA(154, 168, 287, 304, 305, 311, 312, 320, 322, 334, 337, 345, 347, 349, 363, 369, 370, 377) 66, 67; *MS(110), OK(389) 2, 50, TX(175, 181) 1, *C. insignis *SLP(398), 404, LA(154, 168, 305, 311, 334, 341, 345, 347, 349, 363, 368, 369, 377) 67, *MS(139), OK(389) 50, TX(175, 176) 1, 13; Ptychobranchus fasciolar (Raf.), A. conchicola OH 6, 60, C. insignis MO 27, OH (207); Ptychobranchus subutentum (Say), *A. conchicola *TN(437); Quadrula apiculata (Say), A. conchicola LA(287, 293, 294, 322, 324, 375, 377) 66, C. insignis LA(375) 67; Quadrula nodulata (Say) as Q. puntulata, A. conchicola LA(312, 326) 67, C. insignis, IL 37, LA(326, 368); Quadrula pustulosa (Lea) as Q. houstonensis and Unio pustulosus, A. conchicola IA 37, IL 37, 65, LA(151, 168, 171, 294, 312, 324, 326, 349, 378) 67, MO 27, *MS(386), OH 6, 60, OK 50, TN 24, TX 19, WI 71, WIV 11, C. insignis IL 37, 61, LA(363, 368) 67, MO 27, *MS(110, 139), TX 19, WIV 11, C. occidentalis MO 27; Quadrula quadrula (Raf.) as Q. forseyi, A. conchicola LA(171), MO 27, OH(206, 208) 6, 32, 60, OK 2, 50, TN 24, TX 19, C. insignis LA(303, 345, 347, 368), TX 19, WIV 11; Quincuncia burkii (Walker), *A. conchicola *FL(100); Quincuncia infucata (Conrad), A. conchicola FL 25, C. insignis FL(97) 25, L. interiora FL(97); Strophitus subvexus (Conrad), *A. conchicola *LA(157), *C. insignis *MS(143), *Strophitus undulatus (Say) as S. edentulus, S. rugosus and Unio edentulus, A. conchicola IA 37, IL 37, LA(337) 3, MO 27, OH 50, C. insignis IL 37, IL 37, 39, LA(337), OH 60, WIV 11; Tritogonia verrucosa (Raf.) as Quadrula tuberculata and Unio tuberculata, A. conchicola *AR(396), IL 37, LA(162, 168, 171, 303, 323, 347, 369, 370) 66, 67, MO 27, *MS(111), OH 6, 60, OK 2, 50, TN 24, WI 71, WIV 11, C. insignis *AR(396), IL 37, 39, LA(154, 171, 305, 341, 349, 370) 66, 67, MO 27, *MS(139, 140, 146) 60 OK 50; Truncilla donaciformis (Lea) as Plagiola donaciformis, A. conchicola IA 37, IL 37, OH 60, C. insignis LA(363); Truncilla truncata Raf. as Plagiola elegans and Unio elegans, A. conchicola IL 37, OK 50, WI 71, C. insignis IL 39, 50; Unio merus tetractus (Say) as U. obesus, A. conchicola LA(324) 67, MO 27, C. insignis FL 25, GA 25, LA(310, 324, 338, 364) 67, MO 27, TN 48, 49, TX(390); Villoasa delumbis (Conrad), *C. insignis NC(40); Villoasa iris (Lea), *A. conchicola *AR(404), *C. insignis *AR(404), OH 207; Villoasa lienas (Conrad), *A. conchicola FL(100) 25, LA(168, 377), *MS(143), C. insignis FL(97) 25, GA 25, LA(123, 124, 168, 322, 338, 377), *MS(133, 134, 140, 143, 144, 145), OK(414); Villoasa vixen (Conrad), A. conchicola LA 67, *MS(143, 145), *C. insignis FL 25, LA(123), *MS(143, 146); Villoasa villosa (B. H. Wright) as Carunculina villosa, C. insignis FL(95) 25; Unionidae or Mussels, A. conchicola IL 70, PA 20, 21.


CLASE REPTILIA, Order Testudines, Family Chelydridae: Chelydra serpentina (L.), C. stunkardi NC 57; Macroclemys temminckii (Troost), L. interiora AR 68. Family Enydiidae: Chrysemys scripta (Schoepff), Cotylaspis sp. LA 7; Graptemys geographica (LeSueur) as Malacoclemmys leseueri, C. cokeri IN 8, OH 56, TX 61; Graptemys pseudeoaothographica (Gray) as Malacoclemmys leseueri and Lesseuer’s terrapin, C. cokeri IA 5. Family Trionychidae: Trionyx ferox (Schneider), C. insignis OK 17 (incidental host).