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The Distribution of *Corydalus Cornutus* (Linnaeus) and *Nigronia Serricornis* (Say) (Megaloptera: Corydalidae) in Michigan

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INTRODUCTION

The distribution of the hellgrammite [Corydalus cornutus (Linnaeus)] and the sawcombed fishfly [Nigronia serricornis (Say)] in Michigan was determined as part of an investigation of the biology of these large Megalopterans (Knight and Simmons, 1975a, 1975b). Megalopteran larvae are some of the largest aquatic insects, with a maximum length of approximately 84 mm. They are robust larvae with paired lateral abdominal appendages on segments 1-8 and a pair of anal prolegs bearing two strong hooks. They are fiercely predaceous and generally insectivorous, feeding chiefly on larvae of Simuliium, Cheumatopsyche, Hydropsyche and Chironomidae, but eating almost anything they can subdue, including their own kind (Chandler, 1956; Stewart et al., 1973).

The Corydalidae genera of Michigan are easily separated as larvae and adults. The adult of Corydalus is easily recognized by large mandibles protruding beyond the labrum, especially prominent in males. The larvae of Corydalus are separated from those of other corydalids by the large tufts of filamentous gills at the base of each lateral process. The adults of Nigronia and Chauliodes (Chauliodes was not included in the present study) can be separated by coloration (Nigronia being black and Chauliodes gray and mottled) as well as wing venation and the shape of the ocellus (Chandler, 1956). Chauliodes larvae are distinguished by long respiratory tubes extending from the eighth abdominal segment well past the end of the terminal claws. Nigronia has much shorter respiratory tubes, generally only about 1 1/2 times as long as wide.

To date, information on the distribution or biology of Corydalidae in Michigan is only fragmentary (Hazard, 1969; Petersen, 1974). Distribution data for aquatic insects such as the Corydalidae can be important historically since they provide an indication of the water quality at the time of the survey. Changes in distribution patterns are often associated with changes in water quality. Conversely, distribution data can provide information on the habitat requirements of aquatic insects.

The distributions reported below are based on an extensive survey of accessible streams of Michigan, carried out from June, 1966, to July, 1969, and an examination of collections at the University of Michigan and at Michigan State University.

RESULTS

Nigronia serricornis (Say)

N. serricornis is generally distributed throughout Michigan (Fig. 1) except in the heavily industrialized counties of central and southeast Michigan, and Berrien County in the southwest. N. serricornis was also not collected in three counties of the Upper Peninsula. These include Keweenaw and Houghton Counties, the streams of which often contain copper from copper mining, and Chippewa County, which has little running water so few sites were sampled in the present survey.

Although Chandler (1956) states that Nigronia is found in quiet or stagnant water, our results demonstrate its widespread occurrence in the lotic waters of Michigan. N.
Fig. 1. The distribution of *Nigronia serricornis* (Say) in Michigan, June, 1966, to July, 1969.

*serricornis* larvae appeared flexible in habitat requirements, being found on substrates ranging from sand and mud to boulders with frequent branches and logs which are apparently a preferred habitat for *Nigronia*.

*Corydalus cornutus* (Linnaeus)

*C. cornutus* is restricted to the south half of the Lower Peninsula (Fig. 2). It is generally distributed in the south, although absent from the heavily industrialized counties of central and southeast Michigan.
C. cornutus larvae were generally collected from cobble-boulder substrata. They were especially abundant below dams, preying on abundant simulid larvae and other filter feeding organisms.

The absence of Nigronia and Corydalus larvae from the streams of central and southeast Michigan may reflect their sensitivity to urbanization. Corydalus may be slightly more tolerant of the effects of urbanization than is Nigronia.

Nigronia and Corydalus were found to be sympatric in only nine of a possible 185 instances in which they were found. C. cornutus appears to be excluded from the...
northern portion of the Lower Peninsula and from the entire Upper Peninsula. Interspecific competition with *N. serricornis* may be responsible for the restriction of *C. cornutus* to southern Michigan. In southern Michigan the streams are generally summer-warm, often exceeding 30°C. Knight and Simmons (1975a) have demonstrated that larvae of *C. cornutus* have a respiratory adaptation to increasing temperature that is lacking in *N. serricornis* (Knight and Simmons, 1975b). This may allow *C. cornutus* to compete with *N. serricornis* in the southern summer-warm streams but offers no advantage in the summer-cool streams of northern Michigan with maximum temperature generally less than 28°C. It is also possible that the differences in distribution reflect basic differences in environmental preference or tolerance. The streams of southern Michigan are generally broader and have lower gradients than those of northern Michigan. Concentrations of dissolved solids, hardness, chloride and sulfate increase from north to south in Michigan streams (Wood, 1970) and may influence the distribution of *Corydalus* and *Nigronia*. More detailed studies are necessary to determine the mechanisms operating to determine the distribution of these two corydalids.

Collection records (All collections without collector's name are from the present survey; sex indications following collectors' names are for adult specimens only):

*Nigronia serricornis*

Alcona Co.: Black R. (T28N:R9E:S34), June 5 '68; McQuillan Cr. (T25N:R7E:S1), June 5 '68.


Allegan Co.: Silver Cr., M-89 (T1N:R11W:S26); Dumont Cr.-County Pk. (T3N:R13W:S33); Dumont Cr.—Dumont Rd. (T2N:R13W:S6); Dumont Cr., 121st. (T2N:R13W:S7); Saugatuck 3 mi. N., May 21 '66, L. C. Barton.

Alpena Co.: Wolf Cr. (T30N:R7E:S32), June 5 '68; Alpena St. Forest, June 17 '32, N. A. Wood (male).


 Arenac Co.: Cedar Cr. (T20N:R5E:S12), May 6 '68.

Baraga Co.: Chineks Cr., July 27 '67; (T49N:R32W:S4), May 24 '68; Sturgeon R. Trib. (T49N:R33W:S31), May 24 '68; Canal Town Cr. (T48N:R31W:S5), May 24 '68.

Barry Co.: Glass Cr. (T3N:R9W:S32), May '66; Podunk Cr. (T3N:R9W:S32), June '66; Augusta Cr., Oct. 13 '65, E. D. Evans.


Calhoun Co.: Notawasappee R. (T45S:R7W:S17), Oct. 25 '67; Seven Mile Cr. (T1S:R8W:S5); Wabasacon Cr. (T1S:R8W:S22); Kalamazoo R. (T2S:R8W:S15); Seven Mile Cr.—Hwy 96 (T1S:R8W:S19), June 6 '66, Aug. 20 '66, E. D. Evans.


Cheboygan Co.: Sturgeon R. (T33N:R2W:S14), June 21 '67; Sturgeon R., Wolverine (T33N:R2W:S7), July 24 '65, E. D. Evans; Pigeon R. (T34N:R2W:S2), June 5 '68; Black R. (T35N:R1E:S34), June 5 '68; Milligan Cr. (T34N:R1E:S6), June 5 '68; June 26 '39, F. Hubbs (female).
Dickinson Co.: June 28 '49 (male, female), J. W. Leonard; Sturgeon R., Loretto, June 18 '64, R. B. Wilson; Mitchell Cr. Sagola, Sept. 8 '67; Sturgeon R. (T40N:R28W:S23), May 22 '68.
Emmet Co.: Maple R., June 7 '42 (female), P. H. Barrett; Mud Cr. (T34N:R4W:S3), Sept. 1 '66, E. D. Evans; Van Cr. (T37N:R15W:S15), June 5 '68.
Genessee Co.: Butternut Cr. (T8N:R7E:S1), April 3 '68.
Gogebic Co.: Slate R. (T46N:R42W:S21), May 23 '68; Ontonagon R. (T45N:R41W:S15), May 23 '68.
Hillsdale Co.: St. Joseph R. (T9S:R3W:S8), July 12 '68.
Ionia Co.: Prairie Cr. (T7N:R6W:S9), May 23 '67.
Iron Co.: Tamarack R., July 9 '48, L. R. Anderson; June 1 '55, K. L. Hays (male); Hemlock R. (T44N:R35W:S17), May 23 '68; Iron R. (T43N:R35W:S17), May 23 '68.
Kent Co.: Do Not Pass Cr., Nov. 14 '64, J. Trasky; Honey Cr. (T7N:R10W:S23), May 12 '67.
Lake Co.: N. Walhalla, June 25 '37, J. R. Bally (female); Pine R., June 22 '38, coll. unknown (male); June 15 '47, J. W. Leonard (female); Marquette R., May 27 '47,
coll. unknown; July 7 '49, J. W. Leonard (male); Danaher Cr. (T17N:R13W:S20), April 11 '68; Cool Cr. (T20N:R14W:S8), April 11 '68; Marquette R. (T17N:R11W:S15), April 11 '68; Baldwin Cr. (T18N:R13W:S25), April 11 '68; L. Manistee R. (T19N:R12W:S15), April 11 '68.


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(T37N:R2E:S36), June 5 '68; Swan R. (T34N:R6E:S17), June 5 '68; Ocqueoc R. (T34N:R3E:S9), June 5 '68.
Roscommon Co.: East Cr. (T24N:R1W:S10), May 7 '68.
Schoolcraft Co.: July 4 '47, R. R. Dreisbach (male), Stutts Cr. (T45N:R17W:S18), May 24 '68.
Tuscola Co.: Perry Cr. (T11N:R7E:S33), April 24 '68; Sucker Cr. (T12N:R10F:S7), April 24 '68.
Washtenaw Co.: June 5 '18, Coll. unknown (male).
Wexford Co.: Wheeler Cr. (T24N:R11W:S31), Sept. 5 '66, E. D. Evans; Burkett Cr. (T23N:R12W:S1), May 15 '68.

Corydalus cornutus

Allegan Co.: Swan Cr. (T2N:R14W:S17), June '66.
Calhoun Co.: Kalamazoo R. (T25S:R7W:S26), June 22 '67, K. Krum (male); Wabasacon Cr. (T1S:R8W:S22), March 3 '67; Kalamazoo R. (T4S:R4W:S8), Jan. 3 '68.
Hillsdale Co.: Sand Cr. (T5S:R4W:S34), Jan. 3 '68.
Ingham Co.: Red Cedar R. (T4N:R1W:S21), May 18 '64, E. D. Evans; Red Cedar R. (T4N:R1W:S21), July 2 '63, R. B. Willson; Red Cedar R. (T4N:R1W:S21), June 2 '63, R. B. Willson; Red Cedar R., 7 mi. E. of Lansing, May 7 '64, R. W. Matthews; Red Cedar R. at Vanatta Rd., April 24 '65, E. D. Evans; Red Cedar R., April 4 '66, E. G. Igbokwe.
Kent Co.: Thornapple R. (T5N:R10W:S10), May 12 '67.
Lapeer Co.: S. Br. Flint R. (T7N:R10E:S23), April 24 '68.
Montcalm Co.: Wabasis Cr. (T9N:R8W:S33), Dec. 20 '67.
Muskigan Co.: Norris Cr. (T9N:R15W:S21), Nov. 24 '68.
St. Clair Co.: Mill Cr. (T7N:R16E:S17), April 23 '68.
Shiawassee Co.: Shiawassee R. (T8N:R2E:S13), April 3 '68.
Tuscola Co.: Perry Cr. (T11N:R7E:S33), April 24 '68.
Washtenaw Co.: Huron R. (T2S:R5E:S5), Nov. 10 '67.

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LITERATURE CITED


