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THE DISTRIBUTION OF *CORYDALUS CORNUTUS* (LINNAEUS)
AND *NIGRONIA SERRICORNIS* (SAY) (MEGALOPTERA:
CORYDALIDAE) IN MICHIGAN

Allen W. Knight and Clifford A. Siegfried¹

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 *Simulium*, 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 1½ 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.*

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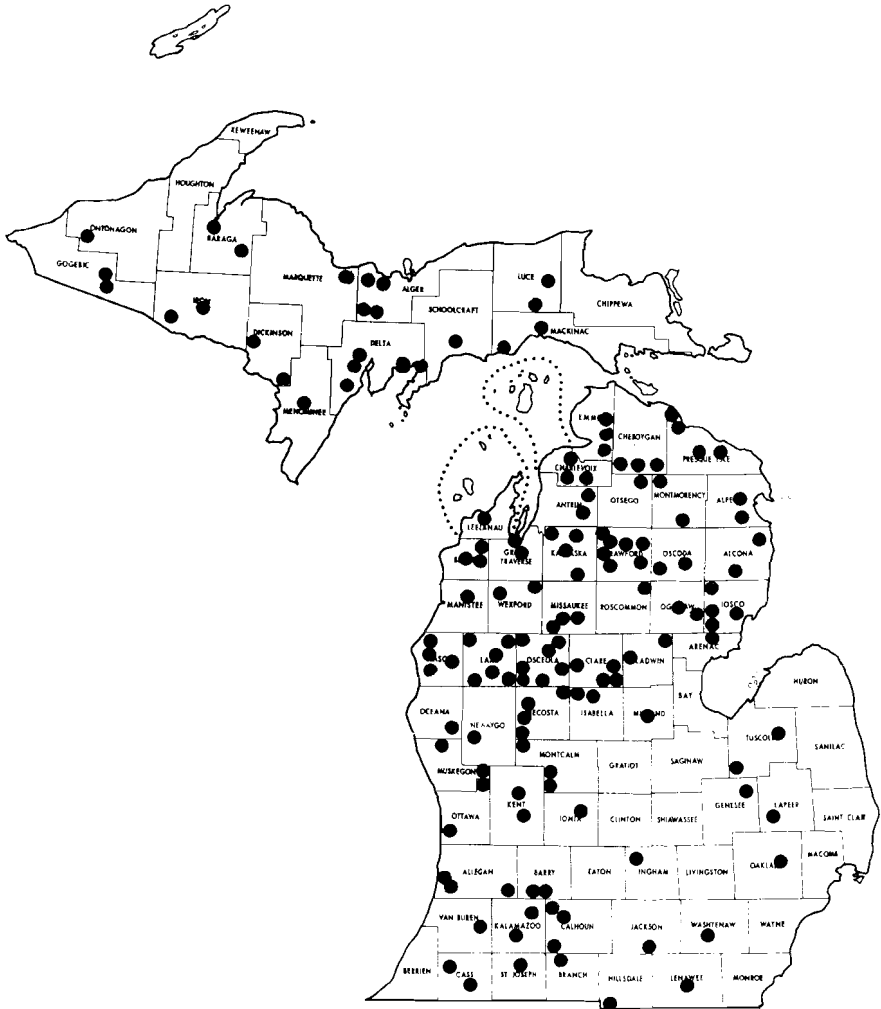


Fig. 1. The distribution of *Nigronia serricornis* (Say) in Michigan, June, 1966, to July, 1969.

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*.

Corydalis 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.



Fig. 2. The distribution of *Corydalus cornutus* (L.) in Michigan, June, 1966, to July, 1969.

C. cornutus larvae were generally collected from cobble-boulder substrata. They were especially abundant below dams, preying on abundant simuliid 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; McGillis Cr. (T25N:R7E:S1), June 5 '68.
- Alger Co.: Laughing Whitefish R., July 21 '64, R. B. Wilson; Dems Cr. (T45N:R22W:S30), May 24 '68; Rock R. (T46N:R21W:S15), May 24 '68; Scotte R. (T44N:R21W:S19), May 25 '68; Dexter Cr. (T45N:R21W:S31), May 24 '68; Trout L., June 29 '49, E. B. Hayden (female).
- 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).
- Antrim Co.: Jordan R. (T31N:R5W:S20), June 4 '68; Jordan R. (T31N:R6W:S32), April 18 '64, April 18 '65, Sept. 1 '66, Aug. 26 '66, E. D. Evans (female); Jordan R. and Kicker Cr. (T31N:R5W:S29), Sept. 1 '66, E. D. Evans; Jordan R., Chestonia (T31N:R5W:S29), Dec. 31 '65, E. D. Evans.
- Arenac Co.: Cedar Cr. (T20N:R5E:S12), May 6 '68.
- Baraga Co.: Chinks 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.
- Benzie Co.: Platte R., June 12 '47, J. W. Leonard; Platte R. (T26N:R14W:S8), May 14 '68; Cr. N. of Lake Ann, Dec. 24 '65, E. D. Evans; Honor/Platte R., July 3 '65, E. D. Evans; Platte R. (T26N:R14W:S15), Sept. 5 '66, E. D. Evans.
- Branch Co.: Burnett Cr. (T5S:R7W:S4), Oct. 25 '67.
- Calhoun Co.: Nottawassee R. (T4S: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.
- Cass Co.: Christiann Cr. (T7S:R14W:S9), Oct. 19 '67; Dowagiac R. (T6S:R16W:S30); Dowagiac R. (T5S:R15W:S36), Oct. 19 '67.
- Charlevoix Co.: Ellsworth Mason Cr., Aug. 31 '66, E. D. Evans; Deer Cr. (T32N:R6W:S32), Aug. 28 '66, E. D. Evans; Boyne R. (T32N:R5W:S5), Sept. 1 '66, E. D. Evans; Advance Cr. (T33N:R6W:S32), Sept. 1 '66, E. D. Evans; Horton Cr. (T33N:R6W:S6), June 4 '68.

- Cheboygan Co.: Sturgeon R. (T33N:R3W: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).
- Clare Co.: Midl. Br. Tobacco R. (T18N:R3W:S32), April 16 '68; Sanford Cr. (T17N:R4W:S14), April 16 '68; Midl. Br. Cedar R. (T19N:R3W:S11), April 16 '68; W. Br. Cedar R., May 2 '64, T. Roelofs; Green Cr. (T19N:R6W:S3), April 16 '68.
- Crawford Co.: Au Sable R. (T28N:R4W:S35), date unknown, R. W. Hodges; E. Br. Big Cr. (T27N:R1W:S22), June 6 '68; E. Br. Au Sable (T28N:R2W:S30), June 6 '68; S. Br. Au Sable (T26N:R1W:S29), June 6 '68; Manistee R. (T27N:R4W:S6), June 6 '68; Au Sable R. (T26N:R4W:S12), June 6 '68; Au Sable R., Oct. 1 '50, June 27 '48 (male), J. W. Leonard; Bradford Cr., July 10 '35, J. W. Leonard.
- Delta Co.: Escanaba R., April 18 '49, S. Lievense; Escanaba R., Cornell, June 23 '56, H. D. Niemczyk, (male), Escanaba R., Cornell, June 27 '58, R. A. Scheibner (female), Sturgeon R. (T41N:R19W:S17), May 22 '68; Inman Cr. (T41N:R21W:S17), May 22 '68; Tacoosh R. (T41N:R21W:S8), May 22 '68; Mink Cr. (T42N:R19W:S27), May 22 '68; Days R. (T40N:R22W:S3), May 22 '68; Fishdam R. (T42N:R18W:S17), May 22 '68; Portage Cr. (T39N:R23W:S27), May 22 '68.
- 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; Minnehaha Cr. (T34N:R4W:S16), Sept. 1 '66, E. D. Evans; Van Cr. (T37N:R4W:S15), June 5 '68.
- Genessee Co.: Butternut Cr. (T8N:R7E:S1), April 3 '68.
- Gladwin Co.: Cedar R., July 8 '35, J. W. Leonard; Tittabawassee R. (T20N:R2E:S7), April 19 '68.
- Gogebic Co.: Slate R. (T46N:R42W:S21), May 23 '68; Ontonagon R. (T45N:R41W:S15), May 23 '68.
- Grand Traverse Co.: Boardman R. (T26N:R11W:S3), July 22 '66, E. D. Evans and T. Schuh; Boardman R. (T26N:R10W:S17), Sept. 5 '66, E. D. Evans; Boardman R. (T26N:R10W:S15), Sept. 5 '66, E. D. Evans; Boardman R. (T27N:R11W:S27), May 14 '68; Boardman R. (T26N:R11W:S3), May 14 '68; Boardman R. (T26N:R10W:S15), May 15 '68.
- Hillsdale Co.: St. Joseph R. (T9S:R3W:S8), July 12 '68.
- Ingham Co.: Red Cedar R. at Okemos (T4N:R1W:S21), Aug. 26 '64, R. B. Wilson.
- Ionia Co.: Prairie Cr. (T7N:R6W:S9), May 23 '67.
- Iosco Co.: S. Br. Au Sable R. (T24N:R5E:S2), May 7 '68; Silver Cr. (T23N:R8E:S30), May 7 '68; Porterfield Cr. (T21N:R5E:S3), May 7 '68; Au Gres R. (T22N:R5E:S27), May 7 '68.
- Iron Co.: Tamarack R., July 9 '48, L. R. Anderson; June 1 '55, K. L. Hays (male); Hemlock R. (T44N:R33W:S17), May 23 '68; Iron R. (T43N:R35W:S17), May 23 '68.
- Isabella Co.: Delaney Cr. (T16N:R6W:S27), Dec. 20 '67; N. Br. Chippewa R. (T16N:R5W:S24), Dec. 20 '67.
- Jackson Co.: N. Br. Kalamazoo R. (T4S:R2W:S4), Oct. 28 '67.
- Kalamazoo Co.: Gull Cr. (T2S:R9W:S6), June 19 '67; Portage Cr. (T2S:R11W:S33), April 9 '66; Augusta Cr. (T1S:R9W:S22), July 15 '57, June 20 '66, June 27 '66.
- Kalkaska Co.: Rapid R. (T25N:R6W:S7), May 1 '64, J. P. Donahue; Rapid R. (T28N:R8W:S9), Dec. 30 '65, E. D. Evans, May 15 '68; Little Silver Cr. (T25N:R6W:S20), July 5 '67; Cannon Cr. (T25N:R6W:S16), July 5 '67; Boardman R. (T27N:R7E:S11), May 14 '68; N. Br. Manistee R. (T27N:R6W:S24), May 15 '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. Baily (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.
- Lapeer Co.: S. Br. Flint R. (T7N:R10E:S26), April 24 '68.
- Leelanau Co.: Crystal R. (T29N:R14W:S23), Sept. 6 '66, E. D. Evans.
- Lenawee Co.: S. Br. River Raisin (T7S:R3E:S3), Nov. 10 '67.
- Luce Co.: Teaspoon Cr. (T47N:R10W:S3), May 24 '68; Murphy Cr. (T47N:R9W:S16), May 24 '68; July 7 '49, J. W. Leonard (female).
- Mackinac Co.: Horseshoe Bay, July 19 '20, S. Moore (female); Milakokia R., Aug. 4 '29, coll. unknown; Millecoguins Cr. (T43N:R10W:S14), May 22 '68.
- Manistee Co.: Cedar Cr. (T23N:R14W:S33), June 4 '68.
- Marquette Co.: N. Br. Escanaba R., June 18 '40, I. J. Cantrall (male, female) Chocoday Cr. (T46N:R23W:S1), May 24 '68; Nelson Cr. (T46N:R23W:S19), May 24 '68.
- Mason Co.: Pere Marquette R., June 17 '47, J. W. Leonard (male); Big Sable R., July 3 '47, J. W. Leonard (female); N. Br. Lincoln R. (T19N:R17W:S20), April 11 '68; Weldon Cr. (T18N:R15W:S8), April 11 '68; Big Sable R. (T20N:R17W:S27), April 11 '68.
- Mecosta Co.: Rattail Cr. (T16N:R7W:S15), Dec. 20 '67; Un-named Creek (T14N:R10W:S16), Dec. 20 '67; Quigley Cr. (T13N:R9W:S22), Dec. 20 '67; Ryan Cr. (T15N:R9W:S5), Dec. 20 '67; N. Br. Chippewa R. (T16N:R7W:S15), Dec. 20 '67; Lincoln Cr. (T14N:R10W:S15), April 16 '68.
- Menominee Co.: Willon Cr. (T38N:R25W:S8), May 22 '68; Willon Cr. (T38N:R24W:S7), May 22 '68.
- Midland Co.: S. Br. Carroll Cr. (T14N:R1W:S3), May 7 '68.
- Missaukee Co.: July 4 '52, R. Dreisbach (male); Butterfield Cr. (T22N:R6W:S32-33), July 5 '67; Mosquito Cr. (T22N:R7W:S18), Nov. 18 '68; Clam R. (T21N:R7W:S6); T21N:R6E:S20), May 15 '68.
- Montcalm Co.: Flat R. (T9N:R8W:S22; T10N:R8W:S18), Dec. 20 '67; Tamarack Cr. (T12N:R10W:S26), Dec. 20 '67; Wabasis Cr. (T9N:R8W:S33), Dec. 20 '67.
- Montmorency Co.: Black R., July 2 '35, J. W. Leonard (female); Hunt Cr., June 6 '41, J. W. Leonard (male); Bush Lake (T32N:R3E:S30), June 22 '67; E. Br. Black R. (T32N:R1E:S22), June 6 '68; Hunt Cr. (T29N:R3E:S17), June 6 '68; Gilchrist Cr. (T29N:R3E:S15), June 6 '68.
- Muskegon Co.: White R. (T12N:R16W:S6), Dec. 14 '67; Crockery Cr. (T10N:R13W:S30), Dec. 14 '67.
- Newaygo Co.: White R. (T14N:R13W:S30), Dec. 14 '67.
- Oakland Co.: Sash-abow Cr. (T4N:R9E:S26), March 21 '68.
- Oceania Co.: Carlton Cr. (T13N:R17W:S21), Dec. 14 '67; N. Br. White R. (T13N:R16W:S3), Dec. 14 '67.
- Ogemaw Co.: Ousselman Cr., July 9 '35, J. W. Leonard (male); Au Gres R. (T22N:R4E:S11), May 7 '68; Klacking Cr. (T22N:R2E:S1), May 7 '68.
- Ontonagon Co.: Merriweather Cr. (T48N:R43W:S11), May 23 '68.
- Osceola Co.: Hoffmyer Cr. (T18N:R8W:S19), June 18 '67; Middle Br. R. (T20N:R8W:S34), April 16 '68; E. Br. Hersey R. (T18N:R10W:S10), April 16 '68; E. Br. Pine R. (T20N:R10W:S21), April 16 '68; Big Stone Cr. (T17N:R8W:S29), April 16 '68; Beebe Cr. (T20N:R8W:S27), April 16 '68; Johnson Cr. (T17N:R10W:S7), April 16 '68.
- Oscoda Co.: Big Cr., June 23 '33, L. K. Gloyd (male); Au Sable R. (T26N:R3E:S10), June 6 '68; Perry Cr. (T26N:R3E:S9), June 6 '68.
- Otsego Co.: Pigeon R. (T32N:R1W:S20), June 6 '68; Black R. (T32N:R1W:S34), June 6 '68.
- Ottawa Co.: N. Br. Crockery Cr. (T9N:R13W:S14), Dec. 14 '67; Tenhaden Cr. (T6N:R16W:S27), Dec. 23 '67.
- Presque Isle Co.: Mulligan Cr. (T37N:R2E:S14), June 5 '68; Black Mallard R.

- (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.
 St. Joseph Co.: Leland Cr. (T6S:R11W:S11), Oct. 25 '67.
 Tuscola Co.: Perry Cr. (T11N:R7E:S33), April 24 '68; Sucker Cr. (T12N:R10E:S7), April 24 '68.
 Van Buren Co.: Paw Paw R. (T2S:R13W:S16), Oct. 19 '67.
 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.
 Branch Co.: Burnett Cr. (T5S:R7W:S4), Oct. 25 '67.
 Calhoun Co.: Kalamazoo R. (T2S: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:S27), 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.
 Kalamazoo Co.: Gull Cr. (T2S:R9W:S6), June 19 '67 (2 males, female), Aug. 24 '66; Gull Cr. (T2S:R9W:S6), Aug. 12 '66, E. D. Evans; Eagle Cr. (T1S:R9W:S35), Aug. 19 '66.
 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.
 Muskegan Co.: Norris Cr. (T9N:R15W:S21), Nov. 24 '68.
 Newaygo Co.: White R. (T14N:R13W:S30), Dec. 14 '67.
 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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