 0030-0950/85/0004-0190 $2.00/0

ECOLOGY AND DISTRIBUTION OF CHIRONOMID LARVAE FROM CARROLL COUNTY, OHIO (DIPTERA: CHIRONOMIDAE)[1]

DAVE McSHAFFREY[2] and JOHN H. OLIVE, Department of Biology, The University of Akron, Akron, OH 44325

ABSTRACT. Chironomid larvae were collected from lotic and lentic sites in Carroll Co., Ohio, from October 1981 to October 1982. Over 700 larvae were mounted on glass slides for identification. A total of 80 species was found. The species collected are listed with site and date of collection. The number of species is comparable to that reported in other studies. Gut contents are listed for 49 species, most of which are detritivores. Some species probably change feeding habits depending on their age and stream flow. Approximate emergence periods are given for 10 species.

OHIO J. SCI. 85 (4): 190-198, 1985

INTRODUCTION

The larvae of the family Chironomidae are important as water quality indicators because of their abundance, widespread distribution, and ecological diversity. This study investigated the larval chironomid fauna of several different types of water bodies in Carroll Co., Ohio, including streams, farm ponds, reservoirs, and swamps. In general, the Ohio chironomid fauna is not well known. Most of the reports of the fauna are found in the ecological literature, and as a rule most ecologists have not dealt with the family below the generic level. Little natural history work has been done in Carroll Co.; Buchanan (1980) is a noteworthy exception.

Carroll Co. is part of the unglaciated Allegheny Plateau in east central Ohio (fig. 1). Most of the county is in forest or farmland, with dairy farms being the predominant farm type (Gerber and Buzard 1981). The Flushing Escarpment runs north-south across the county; to the west of the escarpment the streams are predominantly low-gradient and lie in beds of glacial outwash; to the east the streams are high-gradient and cut through bedrock. The streams to the west flow into Sandy and Connotton Creeks of the Tuscarawas River drainage; to the east they flow into Yellow Creek of the Ohio River drainage.

METHODS AND MATERIALS

Larval chironomids were collected by sieving substrate through a No. 30 U.S. soil sieve. To supplement the larval material for taxonomic and life history analyses, adults were collected at the various sites by sweeping the vegetation along the banks, or

[1]Manuscript received 15 May 1985 and in revised form 27 June 1985 (#85-18).

[2]Present Address: Department of Entomology, Entomology Hall, Purdue University, West Lafayette, IN 47907 (Author to whom correspondence should be addressed.)

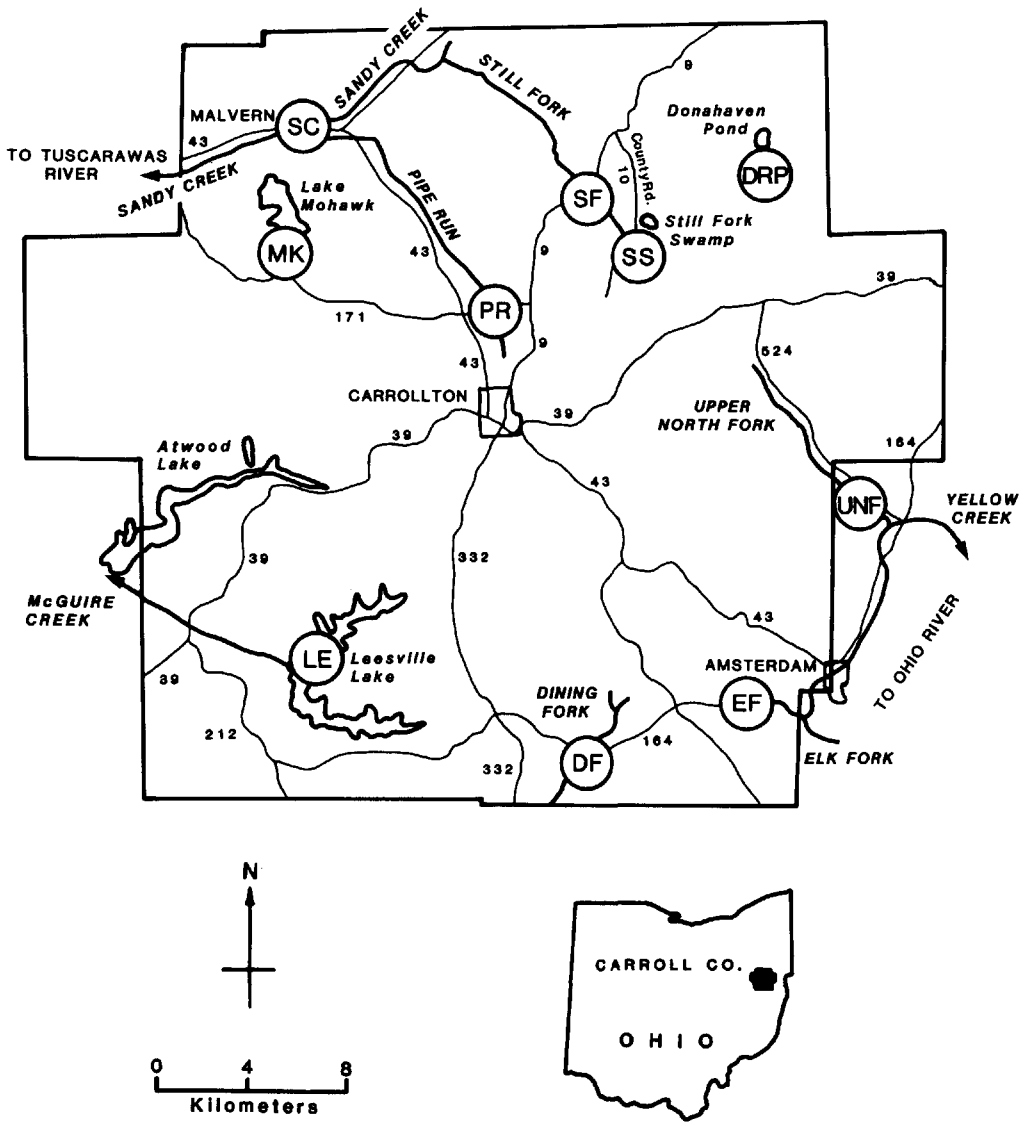

FIGURE 1. Map of Carroll Co. showing location of the 10 sampling sites. The sites are denoted as follows: DF — Dining Fork, DRP — Donahaven Rainbow Pond, EF — Elk Fork, LE — Leesville Lake, MK — Lake Mohawk, PR — Pipe Run, SC — Sandy Creek, SF — Still Fork, SS — Still Fork Swamp, UNF — Upper North Fork.

collecting the adults directly from the vegetation with an aspirator. A black light was used to attract adults at Sandy Creek and Upper North Fork. Black-lighting was conducted at dusk or dawn. Larvae were mounted on glass slides in CMCP9/9AF mounting medium, as suggested by Beckett and Lewis (1982). Identifications were based on a variety of keys including Simpson and Bode (1980), Mason (1973), Beck (1976), Boesel (1974), Maschwitz (1976), Oliver (1981), Roback (1957, 1962, 1976, 1978, 1980, 1981), Saether (1975, 1976, 1977), and Soponis (1977). Collections were made from October 1981, to October 1982, at 10 sites judged to be representative of the major types of water bodies present in the county. Dates of the collections are included in table 1.

The following lotic sites were sampled: Sandy Creek (SC) at the State Route (SR) 43 bridge (bridge

TABLE 1

Chironomidae collected from Carroll Co., Ohio, USA from October 1981 to October 1982.

Taxa	Station* UNF A	B	C	D	E	F	G	H	I	J	K	SC L	M	N	O	P	Q	R	S	T	U	EF	DF	SF	PR	LE	MK	DRP	SS
TANYPODINAE																													
TANYPODINI																													
Tanypus sp.		B																								LE			
MACROPELOPIINI																													
Djalmabatista pulcher (Johannsen)																												DRP	
Procladius (Procladius) sp.																										LE	MK	DRP	
Procladius (Psilotanypus) bellus (Loew)																										LE		DRP	
COELOTANYPODINI																													
Clinotanypus pinguis (Lowe)																												DRP	
Coelotanypus concinnus (Coquillett)																										LE			
Coelotanypus scapularis (Loew)																										LE			
PENTANEURINI																													
Ablabesmyia mallochi (Walley)																								SF					
Ablabesmyia parajanta (Roback)																											MK		SS
Conchapelopia (Conchapelopia) sp.						F	G		I	J											U				PR				
Conchapelopia (Helopelopia) cornuticaudata (Walley)												L																	
Conchapelopia (Meropelopia) americana Fittkau												L													PR				
Conchapelopia (Meropelopia) flavifrons (Johannsen)												L													PR				
Thienemannimyia sp.													M														MK		
DIAMESINAE																													
DIAMESINI																													
Diamesa sp.			C																										
Sympotthastia sp.		B			E		G	H	I	J																			
ORTHOCLADIINAE																													
CORYNONEURINI																													
Corynoneura celeripes (Winnertz)																						EF							
Corynoneura taris Roback		B																											
Thienemanniella probably *xena* Roback											K																		

(Continued)

ORTHOCLADIINI																											
Brillia par (Coquillet)																							DF					
Cricotopus sp. A			C																								
Cricotopus sp. B					E		G	H																			
Cricotopus bicintus (Meigen)					E													R	S	T	U		DF		PR			
Cricotopus intersectus group					E		G	H	I																			
Cricotopus sylvestris group													M															
Cricotopus tremulus group	A	B	C	D	E			H	I	J			M		O				S			EF		SF				
Cricotopus trifascia group								H																				
Eukiefferiella discoloripes group						F	G																					
Eukiefferiella potthasti group						F																	DF					
Eukiefferiella pseudomontana group																							DF					
Heterotrissocladius sp. A													M															
Heterotrissocladius sp. B																											MK	
Hydrobaenus pilipes (Malloch)													M															
Orthocladius (Orthocladius) *carlatus* (Roback)		B								J																		
Orthocladius (Orthocladius) *dentifer* Brundin		B																										
Orthocladius (Orthocladius) *obumbratus* Johannsen		B									K																	
Parakiefferiella sp.																						EF		SF				
Parametriocnemus lundbecki (Johannsen)																							DF					
Paraphaenocladius sp.																											MK	
Rheocricotopus prob. *robacki* (Beck and Beck)										J									S				DF					
CHIRONOMINAE																												
CHIRONOMINI																												
Chironomus sp.														N	O					T				SF		LE	MK	DRP
Chironomus sp. A																											MK	
Chironomus sp. B																											MK	
Cryptochironomus digitatus (Malloch)												L															MK	DRP
Cryptochironomus fulvus (Johannsen)																											MK	
Dicrotendipes neomodestus (Malloch)									I								Q	R									MK	
Dicrotendipes nervosus (Staeger)-Type II												L																
Einfeldia insolita (Kieffer)																												DRP
Microtendipes caelum Townes	A	B			E	F		H	I		K							R				EF	DF	SF	PR			
Parachironomus monochromus (Van der Wulp)															O													
Paralauterborniella nigrohalteralis Malloch																												DRP
Phaenopsectra sp.															O													
Polypedilum species A																												DRP
Polypedilum species B																											MK	
Polypedilum species C																			S		U							

(Continued)

TABLE 1 (Continued)

Taxa	Station* UNF A	B	C	D	E	F	G	H	I	J	K	SC L	M	N	O	P	Q	R	S	T	U	EF	DF	SF	PR	LE	MK	DRP	SS
Polypedilum (Pentapedilum) sp.														N															
Polypedilum (Polypedilum) aviceps Townes						F	G	H	I	J																			
Polypedilum (Polypedilum) convictum (Walker)		B			E	F		H	I							P	Q	R	S	T	U	EF		SF					
Polypedilum (Polypedilum) fallax Johannsen												L																	
Polypedilum (Polypedilum) illinoense (Malloch)																								SF					
Polypedilum (Polypedilum) nymphaeorum Maschwitz																								SF					
Polypedilum (Polypedilum) trigonum Townes																													SS
Polypedilum (Tripodura) scalaenum (Schrank)												L	M		O	P	Q	R	S										
Pseudochironomus sp.																				T									
Pseudochironomus richardsoni (Malloch)		B																											
Stenochironomus sp.		B										L														LE			
Stictochironomus devinctus (Say)																						EF							
Tribelos jucundus (Walker)																										LE			
Xenochironomus (Xenochironomus) xenolabis (Kieffer)																	Q	R	S	T	U								
TANYTARSINI																													
Cladotanytarsus nr. *conversus* (Johannsen)					E																	EF					MK		
Cladotanytarsus viridiventris Malloch																											MK		
Rheotanytarsus distinctissimus group		B									K											EF	DF						
Rheotanytarsus exiguus group		B			E				I												U		DF	SF					
Tanytarsus sp.																											MK		
Tanytarsus species A											K																		
Tanytarsus species B																												DRP	
Tanytarsus coffmani Roback					E	F	G			J	K																		
Tanytarsus glabrescens group											K																		
Tanytarsus guerlus group																						EF		SF		LE	MK		
Zavrelia sp.						F																							

*Stations are abbreviated as follows: UNF = Upper North Fork—A = X/3/81, B = X/10/81, C = IV/10/82, D = VI/14/82, E = VI/28/82, F = VII/10/82, G = VII/25/82, H = VIII/18/82, I = IX/4/82, J = IX/20/82, K = X/9/82. SC = Sandy Creek—L = X/11/81, M = III/13/82, N = VI/15/82, O = VI/29/82, P = VII/13/82, Q = VII/25/82, R = VIII/18/82, S = IX/4/82, T = IX/20/82, U = X/9/82. EF = Elk Fork, IX/20/82. DF = Dining Fork, IX/20/82. SF = Still Fork, IX/4/82. PR = Pipe Run, X/9/82. LE = Leesville Lake, X/17/81. MK = Lake Mohawk; X/31/81, III/6/82, VII/23/82, with adults collected at various times. DRP = Donahaven Rainbow Pond; XI/14/81, IV/10/82. SS = Still Fork Swamp Nature Preserve; VII/3/82, IX/4/82. Underscoring indicates collection of adult specimens.

CAR 43/2347) in Malvern, Ohio; Upper North Fork of Yellow Creek (UNF) in Jefferson Co. 2.1 km south of the Carroll Co. line along SR 524; Pipe Run (PR) at SR 171 (bridge CAR 171/0953); Dining Fork of Connotton Creek (DF) at SR 164 (bridge CAR 164/1047); Elk Fork of Yellow Creek (EF) at SR 164 (bridge CAR 164/1556); Still Fork of Sandy Creek (SF) at SR 9 (bridge CAR 9/2165).

Four lentic sites were also examined: Still Fork Swamp Nature Preserve (SS), owned by The Nature Conservancy, is located on County Road 10; and Donahaven Rainbow Pond (DRP), an aerated trout pond that is now part of a Boy Scout camp near Kensington, Ohio. Leesville Lake (LE) was sampled at the middle of its north fork in six meters of water. This site probably is anoxic in the late summer (Tobin and Youger 1979). Lake Mohawk (MK) was sampled at two sites: at the shoreline of a swamp at the south end of the lake, and in open water near the west end of the dam at the north end of the lake in five meters of water.

Upper North Fork and Sandy Creek are desirable candidates for future biological monitoring projects. Therefore they were sampled 11 and 10 times, respectively. The remaining sites were examined only once or twice each in order to more thoroughly evaluate the chironomid fauna of the county.

Gut content analyses were made of all the larval specimens mounted. No attempt was made during collection to prevent regurgitation of food in the gut, and many specimens had empty guts. Guts were left in the bodies and examined microscopically through the cuticle. Contents were identified as being detritus, diatoms, plant material, or animal material. Detritus was classified as fine material which could not be assigned to any of the other groups. Specimens containing detritus often had considerable non-organic material such as fine sand in the gut. An attempt was also made to identify the diatoms or at least distinguish between benthic or planktonic forms. Identification of the plant or animal material was determined whenever possible. All specimens are retained in the Purdue University Entomological Research Collection.

RESULTS AND DISCUSSION

Over 700 larval chironomids were mounted on slides, examined, and identified. Eighty species were collected, including representatives of 39 genera. Ten of the species are represented by adults collected in the field or reared from larvae. A complete list of species is given in table 1, along with date and place of collection.

Of the 80 species collected, 43 are recognized species. The remaining specimens were identified to the lowest taxonomic grouping practical with the keys used. Where two or more morphologically distinct specimens key to the same taxonomic grouping they are indicated by a letter (i.e. *Chironomus* sp. A). These lettered species do not necessarily correspond to any described species. For a further interpretation of the taxonomy and ecology of the taxa listed, see McShaffrey (1983).

Carroll Co. has a chironomid fauna comparable to other regions. Ferrington (1981) listed 34 species from Kansas, although 54 genera have been reported there. Roback (1953) lists 69 species from the Savannah River, and Curry (1954) found 39 taxa in Hunt Creek, MI. Dendy and Sublette (1959) listed 50 species in Alabama, and Boerger (1981) found 112 species in a river in Alberta. Hyland (1982) collected 32 genera which could have been divided into about 60 species from the Tuscarawas River, Ohio.

This study was designed to survey the chironomid fauna that would most likely be encountered in a benthic macroinvertebrate water quality survey. Therefore, many microhabitats were not sampled, including submerged wood, aquatic vascular plants, and terrestrial microhabitats such as rotting wood or water-filled stump holes. No attempt was made to comprehensively sample the adult fauna, or to identify the majority of the adult chironomids that were collected. Consequently, the number of species found probably represents a significant underestimate of the number of chironomid species in Carroll Co.

Based on the collection of adults and larvae of known developmental stage, the emergence phenology of several taxa can be estimated. The following taxa were collected as adults: *Ablabesmyia parajanta* (Roback) V-1-82; *Heterotrissocladius* sp. A III-13-82; *Heterotrissocladius* sp. B V-1-82; *Paraphaenocladius* sp. V-1-82; *Parachironomus monochromus* (Van der Wulp) VI-29-82; *Polypedilum (Pentapedilum)* sp. VI-29-82; *Cladotanytarsus viridiventris* Malloch VII-2-82. *Hydrobaenus pilipes* (Malloch) prepupae were collected on III-

TABLE 2

Gut contents of chironomid larvae collected from Carroll Co., Ohio, from October 1981 to October 1982.

Taxa	Gut Contents
Tanypus sp.	filamentous algae
Clinotanypus pinguis	*Chironomus* sp.
Conchapelopia (Conchapelopia)	*Polypedilum* sp., *Tanytarsus* sp.
Conchapelopia (Helopelopia) cornuticaudata	diatoms, detritus
Sympotthastia sp.	detritus (high flow), benthic diatoms (low flow)
Thienemanniella prob. *xena*	detritus
Cricotopus sp. A.	benthic diatoms
Cricotopus sp. B.	benthic diatoms, detritus
Cricotopus bicinctus	*Gomphonema, Melosira, Cymbella*
Cricotopus intersectus group	detritus (high flow), benthic diatoms (low flow)
Cricotopus tremulus group	*Gomphonema, Melosira, Meridion, Cymbella,* plant debris, detritus (high flow), benthic diatoms (low flow)
Cricotopus trifascia group	detritus
Eukiefferiella discoloripes group	detritus, diatoms
Eukiefferiella potthasti group	detritus, planktonic diatoms
Eukiefferiella pseudomontana group	planktonic diatoms
Orthocladius (Orthocladius) carlatus	detritus, benthic diatoms
Orthocladius (Orthocladius) obumbratus	detritus, benthic diatoms, filamentous blue-green algae
Parametriocnemus lundbecki	*Melosira,* other diatoms
Rheocricotopus prob. *robacki*	*Melosira,* detritus
Chironomus sp. A	detritus
Cryptochironomus digitatus	diatoms, chironomid larvae
Dicrotendipes neomodestus	detritus
Dicrotendipes nervosus Type II	detritus
Einfeldia insolita	diatoms
Microtendipes caelum	
early instar	benthic diatoms
older larvae	detritus, benthic diatoms
Paralauterborniella nigrohalteralis	detritus
Phaenopsectra sp.	detritus, diatoms
Polypedilum sp. A	detritus
Polypedilum sp. B	detritus
Polypedilum sp. C.	detritus
Polypedilum (Polypedilum) aviceps	detritus
Polypedilum (Polypedilum) convictum	detritus, planktonic diatoms
Polypedilum (Polypedilum) illinoense	detritus
Polypedilum (Polypedilum) nymphaeorum	detritus, plant debris
Polypedilum (Polypedilum) trigonum	diatoms
Polypedilum (Tripodura) scalaenum	detritus (high flow), benthic diatoms (low flow)
Pseudochironomus richardsoni	detritus
Stenochironomus sp.	plant debris
Stictochironomus devinctus	detritus
Tribelos jucundus	detritus
Xenochironomus (Xenochironomus) xenolabis	
early instar	planktonic diatoms
later instars	sponge spicules (presumably from feeding on sponge)
Rheotanytarsus distinctissimus group	*Melosira,* detritus, planktonic diatoms
Rheotanytarsus exiguus group	*Melosira,* detritus, planktonic diatoms
Tanytarsus sp. A	detritus
Tanytarsus sp. B	detritus
Tanytarsus coffmani	detritus, benthic diatoms, planktonic diatoms
Tanytarsus glabrescens group	detritus, benthic diatoms, planktonic diatoms
Tanytarsus guerlus group	detritus, planktonic diatoms
Zavrelia sp.	detritus

13-82. Early instar larvae of *Microtendipes caelum* Townes were present on IX-4-82. In the case of *Xenochironomus (Xenochironomus) xenolabis* (Kieffer), emergence apparently occurred between VIII-18-82 and IX-4-82. In addition, some first instar larvae of this species were collected on VII-25-82.

Gut content analyses (table 2), while often based on a very small number of individuals, suggest some interesting phenomena. In several species there was an apparent shift in food source from benthic diatoms to detritus within a cohort. This shift was coincident with summer rains increasing both flow and turbidity. The shift may have been an opportunistic response to increased amounts of food particles carried by the increased flow. Alternately, it could represent an accommodation to the higher flow rate preventing grazing on the preferred food source. In either case it illustrates the flexibility of the organisms to exploit various food sources and the danger in making generalizations about a species' feeding habits and its role in the whole ecosystem. Other species, such as *Xenochironomus (Xenochironomus) xenolabis* (Kieffer), apparently shift their feeding habits with age; this increases the complexity of describing a given species' ecology.

ACKNOWLEDGMENTS. The authors wish to thank the Department of Biology at The University of Akron for support of this project. We would also like to thank Mike Bolton, John Campbell, Jody Dremann, Richard Dremann, Janet Gammell, Susanne Hyland, Mark Sanders and the other personnel at Bio-Grad for field and laboratory support. Drs. John MacDonald and W. P. McCafferty kindly reviewed an early copy of the manuscript.

LITERATURE CITED

Beck, W. M., Jr. 1976 Biology of the larval chironomids. Fla. St. Dept. Envir. Reg. Tech. Ser. 2(1): 1-58.

Beckett, D. C. and P. L. Lewis 1982 An efficient procedure for slide mounting of larval chironomids. Trans. Amer. Micr. Soc. 101: 96-99.

Boerger, H. 1981 Species composition abundance and emergence phenology of midges (Diptera: Chironomidae) in a brown water stream of West Central Alberta, Canada. Hydrobiologica 80: 7-30.

Boesel, M. W. 1974 Observations on the Coelotanypodini of the northeastern states with keys to the known stages (Diptera: Chironomidae: Tanypodinae). J. Kans. Entomol. Soc. 47: 417-432.

Buchanan, F. W. 1980 The breeding birds of Carroll and northern Jefferson Counties, Ohio. Ohio Biol. Sur. Biol. Notes No. 12. 50 p.

Curry, L. L. 1954 Notes on the ecology of the midge fauna (Diptera: Tendipedidae) of Hunt Creek, Montmorency County Michigan. Ecol. 35: 541-550.

Dendy, J. S. and J. E. Sublette 1959 The Chironomidae (=Tendipedidae: Diptera) of Alabama with descriptions of 6 new species. Ann. Entomol. Soc. Amer. 52: 506-519.

Ferrington, L. C. Jr. 1981 Kansas USA Chironomidae 1. Tech. Pub. Sta. Biol. Sur. Kan. 10: 45-51.

Gerber, T. D. and R. W. Buzard 1981 An inventory of Ohio Soils — Carroll County. Ohio Dept. Natur. Res., Div. Lands and Soil. Prog. Rep. No. 62. 49 p.

Hyland, S. M. 1982 Benthic macroinvertebrates as indices of water quality in the upper Tuscarawas River. M.S. Thesis. Univ. Akron, Akron, OH. 76 p.

Maschwitz, D. E. 1976 Revision of the neartic species of the subgenus *Polypedilum* (Chironomidae: Diptera). PhD. Diss. Univ. Minnesota. 325 p.

Mason, W. T., Jr. 1973 An introduction to the identification of chironomid larvae. Anal. Qual. Contr. Lab., U.S. EPA. 90 p.

McShaffrey, D. 1983 The ecology and distribution of the Chironomidae (Diptera) in Carroll County, Ohio, USA. M.S. Thesis. Univ. Akron, Akron, OH. 73 p.

Oliver, D. R. 1981 Family Chironomidae. *In:* J. F. McAlpine et al. (eds.), Manual of Neartic Diptera. Vol. 1. Can. Gov. Publ. Cent., Hull, Quebec. 674 p.

Roback, S. S. 1953 Savannah River tendipedid larvae (Diptera: Tendipedidae (=Chironomidae)). Proc. Acad. Nat. Sci. Phila. 105: 91-132.

——— 1957 The immature tendipedids of the Philadelphia area (Diptera: Tendipedidae). Monogr. Acad. Nat. Sci. Phila. 9: 1-152.

——— 1962 The genus *Xenochironomus* (Diptera: Tendipedidae) Kieffer, taxonomy and immature stages. Trans. Amer. Entomol. Soc. 88: 235-246.

——— 1976 The immature chironomids of the eastern United States. I. Introduction and Tanypodinae-Coelotanypodini. Proc. Nat. Acad. Sci. Phila. 127: 147-201.

——— 1978 The immature chironomids of the eastern United States III. Tanypodinae-Anatopyniini, Macropelopiini and Natarsiini. Proc. Acad. Nat. Sci. Phila. 129: 151-202.

——— 1980 The immature chironomids of the eastern United States IV. Tanypodinae — Procladiini. Proc. Acad. Nat. Sci. Phila. 132: 1-63.

——— 1981 The immature chironomids of the eastern United States V. Pentaneurini —

Thienemannimyia group. Proc. Acad. Nat. Sci. Phil. 133: 73-128.

Saether, O. A. 1975 Nearctic and Palearctic *Heterotrissocladius* (Diptera: Chironomidae). Bull. Fish. Res. Bd. Can. 193: 1-67.

——— 1976 Revision of *Hydrobaenus, Trissocladius, Zalutschia, Paratrissocladius,* and some related genera (Diptera: Chironomidae). Bull. Fish. Res. Bd. Can. 195: 1-283.

——— 1977 Taxonomic studies on Chironomidae: *Nanocladius, Pseudochironomus,* and the *Harnischia* complex. Bull. Fish. Res. Bd. Can. 196: 1-143.

Simpson, K. W. and R. W. Bode 1980 Common larvae of Chironomidae (Diptera) from New York state streams and rivers. New York State Museum Bul. Number 439. 105 p.

Soponis, A. R. 1977 A revision of the nearctic species of *Orthocladius (Orthocladius)* van der Wulp (Diptera: Chironomidae). Mem. Entomol. Soc. Can. 102: 1-188.

Tobin, R. L. and J. D. Youger 1979 Chemical and Biological Quality of Selected Lakes In Ohio — 1976 and 1977. U.S. Geol. Sur. Wat. Res. Invest. p. 78-104.