Journal of the Arkansas Academy of Science

Volume 47 Article 11

1993

Larval Chironomids of the St. Francis Sunken Lands in Northeast Arkansas

Betty G. Cochran
U.S.D.A. Forest Service

Edmond J. Bacon Jr.
University of Arkansas at Monticello

George L. Harp
Arkansas State University

Larval Chironomids of the St. Francis Sunken Lands in Northeast Arkansas

Betty G. Cochran
U.S.D.A. Forest Service
P.O. Box 369
Glenwood, AR 71943

Edmond J. Bacon
Department of Math and Sciences
University of Arkansas at Monticello
Monticello, AR 71656

George L. Harp
Department of Biological Sciences
Arkansas State University
State University, AR 72467

Abstract

Sixty semi-annual collections (August 1987-July 1988) were made from 30 stations by sampling each station twice for 1.5 man-hours with an aquatic dipnet. Larval chironomids were mounted on slides and identified at 400-1000 magnifications using a Leitz Dialux 20 EB microscope. A survey of the aquatic macroinvertebrates of the St. Francis Sunken Lands in northeast Arkansas revealed 36 taxa of Order Diptera, Family Chironomidae. The taxa were used to evaluate the general health of the aquatic environment. Stations that were located within the least disturbed areas, which were old river channels and oxbows, contained the highest number of organisms and greatest diversity of taxa per station. Stations that were located either in channelized ditches with intense agricultural activities in the watershed or in the St. Francis Lake area, where the homogeneous substate restricted habitat diversity, contained fewer numbers of organisms and taxa per station.

Introduction

The physiographically unique Sunken Lands lie along the eastern edge of Crowley's Ridge in northeast Arkansas within the St. Francis River flood plain. The Sunken Lands range from 1.0-7.5 km wide and extend approximately 50.0 km from the Arkansas-Missouri state line in eastern Greene County through Craighead into Poinsett County. The St. Francis River meanders through the Sunken Lands in a braided series of oxbows, sloughs, natural channels and channelized ditches. The Sunken Lands are characterized by seasonally flooded bottomland hardwood and agriculturally inhospitable terrain, a natural refugium for flora and fauna which were more broadly distributed in the Mississippi Alluvial Plain before man's alteration of habitat became so severe. This unique ecosystem also provides a source of filtration and renewal to the ground water reserve (Cochran and Harp, 1990).

Methods and Materials

Chironomids of this study were collected from August, 1987, through July, 1988, during a survey of the aquatic macroinvertebrates of the St. Francis Sunken Lands. Sixty semi-annual collections were taken from 30 stations by sampling each station twice for 1.5 man-hours with an aquatic dipnet. Organisms were stored in 70 percent ethanol (Cochran and Harp, 1990).

Slides of larval chironomids were prepared for identification according to methodology described by Beckett and Lewis (1982), using CMCP-9 low viscosity colorless mountant manufactured by Polysciences. Identifications were made at 400-1000 magnifications using a Leitz Dialux 20 EB microscope. Some chironomid larvae were identified to species groups because of the lack of larval associations with adults and the complexity of many species groups. Larval chironomids were identified to the lowest possible taxonomic level using primarily the keys provided by Oliver et al. (1978), Simpson and Bode (1979), Bode (1983), Simpson et al. (1983), Wiederholm (1983), and Coffman and Ferrington (1984).

Morisita's idex of community similarity was calculated using the ECOLOGICAL ANALYSIS VOL. 3-PC program of Oakleaf Systems, Decorah, IA.

Results and Discussion

Seven hundred forty-eight specimens were identified representing 37 taxa at the ranks of genus, species and species group. Subfamilies Tanypodinae and Orthocladiinae were represented by eight taxa each and Chironominae by 21, disposed in two tribes, with 15 in Chironomini and six in Tanytarsini (Table 1).

Each of the 30 stations was assigned to one of four associations, distinguished by distinct physical factors, within the river channels and the immediate watershed. The Old River Channel-Oxbow Association (OROA) contained ten stations at the upper region of the study area where the watershed typically consisted of climax vegetation of cypress, oaks and willows, with the natural river channels largely intact (Cochran and Harp, 1990). The mean number of taxa/station at the OROA was 33% greater than that for the entire study area and the mean

Table 1. Chironomidae expressed as number collected/association (OROA, old river channel-oxbow; CDPA, channelized ditches-point source pollution; SFLA, St. Francis Lake-open water; CDAA, channelized ditchs-intense agriculture) and study area total (SAT).

	OROA	CDPA	SFLA	CDAA	SAT
Ablabesmyia mallochi (Walley)	11	0	0	3	14
Ablabesmyia parajanta Roback	3	0	1	1	5
Clinotanypus sp.	18	0	8	2	28
Coelotanypus sp.	7	0	0	0	7
Larsia sp.	5	1	1	2	9
Procladius sublettei Roback	6	0	4	0	10
Tanypus neopunctipennis Sublette	0	0	1	2	3
Thienemannimyia sp.	1	0	0	0	1
Cricotopus bicinctus (Meigen)	7	1	0	3	11
Eukiefferiella potthasti group	8	1	0	1	10
Hydrobaenue sp.	14	0	0	11	25
Nanocladius rectinervis (Kieffer)	1	0	0	0	1
Orthocladius sp.	198	1	4	95	298
Rheocricotopus robacki (Beck and Beck)	0	0	0	1	1
Thienemanniella xena Roback	1	0	0	0	1
Tvetenia bavarica group	51	0	0	0	51
Chironomus decorus group	38	0	5	13	56
Chironomus riparius group	0	0	0	3	3
Cladotanytarsus sp.	0	0	0	1	1
Cryptochironomus fulvus group	3	1	1	7	12
Dicrotendipes neomodestus (Malloch)	15	0	1	16	32
Endochironomus nigricans (Johannsen)	4	0	0	12	16
Endochironomus subtendens (Townes)	0	0	1	0	1
Glyptotendipes lobiferus (Say)	4	0	0	9	13
Parachironomus abortivus (Malloch)	0	0	0	4	4
Paratanytarsus sp.	0	0	1	2	3
Phaenopsectra dyari (Townes)	9	1	5	4	19
Polypedilum convictum (Walker)	1	0	0	0	1
Polypedilum illinoense (Malloch)	31	5	1	21	58
Polypedilum scalaenum (Schrank)	1	0	3	3	7
Pseudochironomus sp.	0	0	7	0	7
Rheotanytarsus sp.	1	0	0	0	1
Rheotanytarsus exiguus group	3	0	4	2	9
Stictochironomus sp.	1	0	0	2	3
Tanytarsus glabrescens group	5	0	0	1	6
Tanytarsus querlus group	12	0	2	6	20
Tribelos jucundum (Walker)	1	0	0	0	1
Total Individuals	460	11	50	227	748
Total Taxa	29	7	17	26	37

Table 2. Mean number of taxa and individuals per station for each association and study area (SA).

	OROA	CDPA	SFLA	CDAA	SA
Taxa	8.3	3.5	5.2	5.3	5.6
Individuals	46.0	5.5	10.0	17.5	19.8

number of individuals/station was 57% greater (Table 2). This association exhibited the greatest diversity of chironomid taxa and the greatest number of individuals within the study area (Table 1). Organisms found to occur exclusively or predominantly in the OROA and occupy a wide range of habitats were: *A. mallochi, A. parajanta, Larsia* sp., *T. glabrescens, T. querlus* and *T. jucundum*. Other taxa exclusive to or predominating in the OROA but preferring slow moving waters with soft sediments and/or sandy-muddy substrate were: *Clinotanypus* sp., *Coelotanypus* sp., *Thienemannimyia* sp., *T. bavarica* and *T. xena*, which is considered to be sensitive to organic pollution (Simpson and Bode, 1979; Wiederholm, 1983; Hudson et al., 1990).

The Channelized Ditches-Point Source Pollution Association (CDPA) contained only two stations, at one of which no chironomids were collected. Due to the small sample size this association was not evaluated further.

The five stations in the St. Francis Lake-Open Water Association (SFLA) occurred in relatively undisturbed areas (Cochran and Harp, 1990). In contrast to the river channels and channelized ditches, the SFLA represented an almost lentic habitat with a homogeneous substrate. Allochthonous organic material typically formed a mat-like substrate of decomposing leaf matter of up to 0.5 m deep, which would be an effective deterrent to many organisms.

The mean number of taxa per station here was 8% less than that for the entire study area and 37% less than that for the OROA. The mean number of organisms per station was only 50% of that for the entire study area and 78% less than that for the OROA (Table 2). Two taxa that occurred exclusively in the SFLA were *E. subtendens* and *Pseudochironomus* sp. (Table 1).

The Channelized Ditches-Intense Agriculture Association (CDAA) was represented by 13 stations typically located in the lower region of the study area (Cochran and Harp, 1990). The stations of this assocation were the most altered by man's intervention, having been subjected to channelization of the river, removal of riparian trees and shrubs, and drainage from agricultural activities. Although not definable as pollution, such habitat alterations may be just as detrimental and/or limiting to the biota.

The mean number of taxa per station at the CDAA was

comparable to that of the SFLA (2%>) and the study area (6%<), but was 33% less than for the OROA. The mean number of organisms per CDAA station was 43% greater than for the SFLA, 12% less than for the study area, and 62% less than for the OROA (Table 2).

Taxa exclusive to or most abundant in the CDAA were: *Paratanytarsus* sp., *E. nigricans*, *G. lobiferus* and *P. abortivus*. The first may be a pest in water, while the last three listed exhibit a tolerance of most toxic and organic wastes and are found to occur in habitats with high nutrient and organic waste levels in channelized sections of slow-moving rivers (Simpson and Bode, 1979; Wiederholm, 1983; and Hudson et al., 1990).

Morisita's index of community similarity, also known as Morisita's index of overlap (Horn, 1966), is based on Simpson's index of dominance and has the desirable characteristic of being little affected by sizes and diversities of samples. It ranges from 0 (no similarity) to 1.0 (identical) and compares the probability that individuals randomly drawn from each of the two communities will be the same species to the probability of randomly selecting a pair of specimens of the same species from one of the communities. Community similarity is not considered significant unless the Morisita's index is 0.7 or above (William J. Matthews, per. comm.).

Morisita's index of community similarity for the OROA, CDPA, SFLA, and CDAA was 0.384 or less for any of the two associations, indicating little similarity. The community dissimilarities are largely explained by the differences in habitat types (natural river channels, lentic/lake and channelized ditches). Only five taxa (14%) were collected within all the associations.

Acknowledgement

This project was sponsored in part by the Arkansas Game and Fish Commission (AFGC) through a research grant intiated under the Dingell-Johnson Sport Fish Restoration Act (Dingell-Johnson Project F-42).

Special thanks are extended to AGFC Law Enforcement Officer Elvis Poe, Jr. and to M. Doug Fletcher for their invaluable collecting assistance.

The authors also express appreciation to J. Alan Clingenpeel for his assistance with the statistical calculations and slide preparations.

Literature Cited

Beckett, D.M. and **P.A. Lewis.** 1982. An efficient procedure for slide mounting of larval chironomids. Trans. Amer. Micros. Soc. 101:96-99.

Bode, R.W. 1983. Larvae of North American *Eukiefferiella* and *Tvetenia* (DIPTERA: CHIRONOMIDAE). Bull. N.Y. St. Mus. No. 452:1-40.

Cochran, B.G. and **G.L. Harp.** 1990. The aquatic macroinvertebrates of the St. Francis Sunken Lands in northeast Arkansas. Proc. Ark. Acad. Sci. 44:23-27.

Coffman, W.P. and **L.C. Ferrington, Jr.** 1984. Chironomidae. Pp. 551-652, *In* An introduction to the aquatic insects of North America. 2nd ed. (R. W. Merritt and K.W. Cummins, eds). Kendall/Hunt Publishing Co., Dubuque, IA.

Horn, H.S. 1966. Measurement of "overlap" in comparative ecological studies. Amer. Natur. 100: 419-424.

Hudson, P.L., D.R. Lenat, B.A. Caldwell and **D. Smith.** 1990. Chironomidae of the Southeastern United States: A checklist of species and notes on biology, distribution, and habitat. US Fish. Wildl. Ser., Fish. Wildl. Res. 7. 46 pp.

Oliver, D.R., D. McClymont and **M.E. Roussel.** 1978. A key to some larvae of Chironomidae (Diptera) from the Mackenzie and Porcupine River watersheds. Fish and Marine Serv. Tech, Report No. 791:1-73.

Simpson, K.W. and **R.W. Bode.** 1979. Common larvae of Chironomidae (Diptera) from New York State streams and rivers with particular reference to the fauna of artificial substrates. Bull. N.Y. St. Mus. No. 439:1-105.

Simpson, K.W., R.W. Bode and **P. Albu.** 1983. Keys for the genus *Cricotopus* adapted from "Revism der Gattung *Cricotopus* van der Wulp and ihrer Verwandten (Diptera, Chironomidae)" by M. Hirvenoja. Bull. N.Y. St. Mus. No. 450:1-133.

Wiederholm, T. (ed.) 1983. Chironomidae of the Holoarctic region. Keys and diagnoses. Part 1. Larvae. Ent. Scand. Suppl. 19:1-457.