

CHIRONOMID ASSAMBLAGES OF MEZO/EUTROPHIC,
MACROPHYTE DOMINATED LAKE SKOMIELNO
(WESTERN POLESIE REGION, EASTERN POLAND)
– PALAEO LIMNOLOGICAL APPROACH

Anna Kaczorowska, Magdalena Suchora

Department of Hydrobiology, University of Life Sciences in Lublin
B. Dobrzańskiego str. 37, 20–262 Lublin
anna.k.kaczorowska@gmail.com, magda.suchora@up.lublin.pl



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Summary. The study of subfossil Chironomidae was conducted in 2014, in Lake Skomielno, a shallow, meso/ eutrophic, macrophyte-dominated lake. We analyzed the surface three-centimeter layer of sediments, with a total volume of 20 cm³. Only the remains of sizes over 100 μm were analyzed. In total, the presence of 16 taxa were encountered, among which the highest share were: *Glyptotendipes*, *Dicrotendipes* and *Polypedilum* sp. The epiphytic chironomids dominated. The concentration of remains in 1 cm³ of sediment was 3.7 head capsules, which is a comparable value to other macrophyte-dominated lakes found in the Western Polesie Region. The obtained results on composition of sedimentary chironomid thanatocenosis of Lake Skomielno are consistent with the results of previous neolimnological studies.

Key words: subfossil Chironomidae, macrophyte-dominated lake, Skomielno, palaeolimnology

INTRODUCTION

Chironomids (Insecta: Diptera) are cosmopolitan insects consisting of about 400 genera. These are frequently the most abundant insect in freshwater ecosystems [Cranston 1995], where they are the dominate element of zoobenthos and epiphytic fauna [Armitage *et al.* 1995, Kornijów 1996, 2003]. Individual

taxa have specific ecological requirements, and therefore are commonly used as indicators in the inference of ecological conditions of freshwaters.

Due to their good preservation in sediments and easy identification of chitinous head capsules, Chironomidae are regarded as one of the best proxies in palaeolimnological studies [Walker 1993, 1995]. Their defined ecological demands make this group very useful for evaluation not only the present, but also past environmental conditions of water bodies [Devai and Moldovan 1983, Brodersen and Lindegaard 1997]. In freshwater ecosystems the qualitative and quantitative structure of Chironomidae is shaped mainly by such environmental factors as: food availability, oxygen conditions in water column and sediments, the trophy of waters [Douglas and Lake 1994], the extent of vegetation and macrophyte species composition [Zimmer *et al.* 2000, Taniguchi *et al.* 2003, Tessier *et al.* 2004, Rennie and Jackson 2005], as well as plant morphology [Cyr and Downing 1988, Kornijów and Kairesalo 1994, Cheruvilil *et al.* 2002].

Macrophyte-dominated Lake Skomielno was recently an object of extensive, multidisciplinary neo-limnological studies [Kornijów and Buczyński 2012], but the paleolimnological reflection of contemporary lake condition has never been analyzed. The aim of the study was to investigate the sedimentary record of the Chironomidae community with reference to existing literature data concerning the contemporary shape of the ecosystem.

STUDY AREA, MATERIAL AND METHODS

The studied lake is located in Polesie Lubelskie Region (Eastern Poland). It is small (area 75 ha), shallow (depth max 5.5 m, mean 1.6 m; Suchora 2012), mezo/eutrophic [Kornijów 2012] lake, retaining a good ecological status [Pęczuła 2012]. According to the alternative stable states theory [Scheffer *et al.* 1993], it is a macrophyte-dominated lake [Kornijów 2012], with an extensive vegetation covering the majority of the lake bottom. Since 1969 the lake has been supplied by a tributary, introducing allochthonous, fertile waters from Wieprz-Krzna channel inlet [Suchora 2012].

Sediments for analysis of subfossil Chironomidae remains were sampled in summer 2014. Four 3-cm thick slices of surface sediments were collected from the deepest part of the lake by the use of Uwitec gravity corer, equipped with a 120 cm-length, plexiglas tube, of 6 cm inner diameter. As the top-most sediments are characterized by a high water content, to obtain sufficient number of head capsules, all four sub-samples were joined, mixed and analyzed together as one sample of 20 cm³ volume. The laboratory preparation followed the procedure introduced by Hofmann [1986]. The subfossil material was sieved through a 100- μ m mesh. The count exceeded the guideline of 50 head capsules which has been conventionally accepted as representative for making reliable paleo-

inferences [Heiri and Lotter 2001, Walker 2001]. The head capsules were identified according to Wiederholm [1983] and Brooks *et. al.* [2007]. The majority of identifications were done to the genus level.

RESULTS AND DISCUSSION

The number of encountered Chironomidae head capsules (hc) in 20 cm³ of fresh sediments was 73, which is an equivalent to the concentration of 3.7 hc in 1 cm³. Walker [1987] reports, that the concentration of remains may range from 0, up to even 8000 hc·cm⁻³, however, he includes also older, highly impacted sediments. According to Warwick [1980], the high changeability of concentration may result from several factors, including compression of deeper sediments, the difference in sedimentation rate or various head capsule production. The abundance of Chironomidae is known to be related to water trophy [Walker 1995]. The concentration of sedimentary head capsules in Lake Skomielno is closest to that identified from another macrophyte-dominated lake in Łęczna-Włodawa Lakeland – Lake Kleszczów, where the concentration was 4.95 hc·cm⁻³ [Halkiewicz 2009]. A similar concentration (4.6 hc·cm⁻³) was found also in Lake Ontario [Warwick 1980]. In other studied Łęczna-Włodawa lakes, the concentration was lower and ranged from 0.5 up to 1.54 hc·cm⁻³, however, all of them represented more elevated trophy, than in the case of Lake Skomielno [Halkiewicz 2009].

The thanatocenosis of Chironomidae in Lake Skomielno was represented by 16 taxa (Tab. 2). The phytophilous taxa dominated, both, in terms of the relative abundance, as well as in the number of taxa (Tab. 1). A similar taxonomic composition of the subfossil Chironomidae fauna appeared in two other macrophyte-dominated lakes of Polesie (Tab. 2), however, in these lakes, the eurytopic Chironomidae were the most abundant [Halkiewicz 2009]. In Lake Skomielno, the higher share of epiphytic taxa may result from a greater coverage of macrophytes (62% of water surface), higher variety of habitats due to the high diversity and mosaic pattern of vegetation (in total, 55 species of macrophytes; Sender 2012). In addition, a wide (up to 60 m) and of high diversity belt of emergent macrophytes [Sender 2012], may be a favorable habitat for epiphytic fauna. Submerged stems of helophytes are an excellent substrate for the development of periphyton, which, in turn, is a good food source for invertebrate scrapers, including epiphytic Chironomidae [Pinder 1992, Grzybkowska *et al.* 2003]. The *Chara* beds in Lake Skomielno, when compared to lakes Rotcze [Sugier and Lorens 2002] and Kleszczów [Sugier Lorens, unpublished materials], is less extent [Sender 2012]. This group of plants is known to be poorly colonized by epiphytic fauna [Pawlik-Skowrońska and Toporowska 2012, Tarkowska-Kukuryk 2012]. The vast area of submerged macrophyte communities of Lake Skomielno is occupied by *Stratiotes aloides*, which is an important component of macrophyte cover also in terms of biomass. This

Table 1. Ecological assemblages and relative abundance of subfossil chironomids in Lake Skomielno

Taxa	%
Benthic	
<i>Chironomus plumosus</i>	7
<i>Cladopelma</i>	4
<i>Corynocera ambigua</i>	5
<i>Microtendipes</i>	3
<i>Procladius</i>	8
Benthic together	27
Epiphytic	
<i>Cricotopus</i>	5
<i>Endochironomus</i>	1
<i>Glyptotendipes</i>	18
<i>Labrundinia</i>	3
<i>Parachironomus</i>	1
<i>Polypedilum (Pentapedilum) sordens</i>	3
<i>Psectrocladius</i>	3
Epiphytic together	34
Eurytopic	
<i>Dicrotendipes</i>	12
<i>Polypedilum sp.</i>	11
<i>Ablabesmyia</i>	4
Eurytopic together	27
Ecologically unidentifid	
Tanytarsini	8
Chironomidae n.det	3
Ecologically un. together	11

species is frequently colonized by chironomids [Tarkowska-Kukuryk 2012, 2006] and periphyton [Toporowska *et al.* 2008]. Pawlik-Skowrońska and Toporowska [2012] demonstrated that the *Stratiotes aloides* creates better conditions for the development of phytoperiphyton (a food source for epiphytic fauna) than the *Chara*, which may be the result of not only the different structures of plants, but also of different allelopathic properties of macrophytes.

The taxonomic composition of subfossil Chironomidae in Lake Skomielno point to the slightly elevated trophy of its waters, in comparison to the lakes Kleszczów and Rotcze. This is evident from the predominance of epiphytic taxa, the lower taxonomic richness of Chironomidae (Halkiewicz 2005), as well as the dominance of *Glyptotendipes*, *Dicrotendipes* and *Polypedilum* (Tab. 1), which are typical for eutrophic, macrophyte-dominated waters [Brodersen *et al.* 2001]. The important factor responsible for the elevated trophy of the lake water is the inlet of nutrient-rich waters from the Wieprz-Krzna Channel [Stępień 2012].

Table 2. The qualitative composition of subfossil chironomid assemblages in three lakes of the Łęczna-Włodawa Group

Taxa	Skomielno	Kleszczów	Rotcze
Benthic			
<i>Chironomus plumosus</i>	+	+	+
<i>Cladopelma</i>	+	+	
<i>Corynocera ambigua</i>	+		+
<i>Cryptochironomus</i>		+	+
<i>Einfeldia</i>		+	+
<i>Microtendipes</i>	+	+	
<i>Procladius</i>	+	+	+
<i>Pseudochironomus</i>		+	
Epiphytic			
<i>Anatopynia</i>		+	
<i>Corynoneura</i>		+	+
<i>Cricotopus</i>	+	+	+
<i>Endochironomus</i>	+	+	+
<i>Glyptotendipes</i>	+	+	+
<i>Labrundinia</i>	+	+	
<i>Parachironomus</i>	+		+
<i>Parakiefferella</i>			+
<i>Polypedilum (Pentapedilum) sordens</i>	+	+	+
<i>Psectrocladius</i>	+	+	+
<i>Phaenopsectra</i>		+	+
Eurytopic			
<i>Dicrotendipes</i>	+	+	+
<i>Polypedilum sp.</i>	+	+	+
<i>Ablabesmyia</i>	+	+	+
<i>Stempellina</i>			+
<i>Tanytarsini</i>	+	+	+
Total number of taxa	16	20	19

CONCLUSION

The composition of subfossil assemblages of Chironomidae obtained by the paleolimnological method is consistent with the previous studies of living Chironomidae larvae in this lake. In comparison with other macrophyte-dominated lakes within the Łęczna-Włodawa Lake District studied by way of the paleolimnological method, the composition of subfossil chironomid fauna of Lake Skomielno was characterized by: the comparable concentration of remains, a higher proportion of epiphytic taxa, and the dominance of taxa typical for elevated trophic and macrophyte-rich habitats – *Glyptotendipes*, *Dicrotendipes* and *Polypedilum sp.*

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ZGRUPOWANIA CHIRONOMIDAE MEZO/EUTROFICZNEGO, MAKROFITOWEGO
JEZIORA SKOMIELNO (REGION POLESIE ZACHODNIE, POLSKA WSCHODNIA)
– PODEJŚCIE PALEOLIMNOLOGICZNE

Streszczenie. Badania subfosalnych ochotek prowadzono w roku 2014 w płytkim, mezo/eutroficznym, makrofitowym jeziorze Skomielno. Analizie poddano powierzchniową, trzycentymetrową warstwę osadów o łącznej objętości 20 cm³. Analizowano szczątki o rozmiarach przekraczających 100 μm. W uzyskanym materiale stwierdzono obecność 16 taksonów, wśród których największy udział miały: *Glyptotendipes*, *Dicrotendipes* i *Polypedilum* sp. Dominowały ochotki naroślinne. Koncentracja szczątków w 1 cm³ osadu wynosiła 3,7 kapsuły główowej, co jest wartością porównywalną z innymi makrofitowymi jeziorami poleskimi. Wyniki badań tanatocenozy ochotkowatych jeziora Skomielno są spójne z wynikami współczesnych badań limnologicznych tego jeziora.

Słowa kluczowe: subfosalne Chironomidae, jezioro makrofitowe, Skomielno, paleolimnologia