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Cytogenetic characteristics of species of the *Chironomus* genus (Diptera, Chironomidae) from Lake Łuknajno Biosphere Reserve (northwest Poland)

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Key words: *Chironomus*, polytene chromosomes, Lake Łuknajno

Abstract

The cytotaxonomic characteristics of two species of the *Chironomus* genus from Lake Łuknajno (northwest Poland) were determined: *Chironomus nuditarsis* Strenzke, 1959 with the chromosome arm combinations of AB, CD, EF, and G (the "thummi" cytocomplex), and *Camptochironomus tentans* (Fabricius, 1805) with the chromosome arm combinations of AB, CF, DE, and G. A heterozygous inversion in arm F of the *Chironomus nuditarsis* chromosomes was detected. The polymorphism of *Camptochironomus tentans* as a homozygous inversion in arms A and E and a heterozygous inversion in arm F were revealed.

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INTRODUCTION

Many species of the Chironomidae family in the larval stage are used in limnological and ecological studies. Usually, species identification is studied only based on the external morphology of the specimen (Kownacki 1999). Because the majority of the species do not differ in their external morphology at the larval stage, species identification within this family is based mainly on the karyotype characteristics of the salivary gland chromosomes (Keyl 1962, Wülker and Butler 1983, Michailova 1989, Kiknadze et al. 1991, Kiknadze et al. 1998). Therefore, it is only possible that similar species can be identified using species-specific cytogenetic markers.

The purpose of this study was to apply the cytogenetic approach using markers of the salivary gland chromosomes to identify larvae from the *Chironomus* genus that are similar in external morphology.

MATERIALS AND METHODS

The material analyzed in the study was collected from Lake Łuknajno situated in the Great Mazurian Lakes Region (53°49'N, 21°38'E) in northeastern Poland. Due to its natural values, particularly its diversified and abundant avian fauna, the lake has been protected as a nature reserve since 1937 and a biosphere reserve since 1977.

It is a small (623 ha), shallow (mean depth – 0.6 m; maximum – 3.0 m), eutrophic lake. The submerged macrophytes cover about 50% of the lake bottom.

Chironomid larvae in the IVth instar stage were collected as material for cytogenetic analyses. They were fixed in ethanol (96%) and glacial acetic acid (3:1). Isolated salivary glands were used for further elaboration and chromosome preparations. It was done by the routine aceto-orcein method (Michailova 1989). Permanent slides were prepared according to Michailova (2004). The bodies of larva and the head capsules were mounted on slides for morphological analysis.

The standardization of the banding pattern was carried out according to Keyl (1962) and Michailova (1989).

RESULTS AND DISCUSSION

In Lake Łuknajno, the larvae of the *Chironomus* genus occur at a mean density of 133 individuals per square meter. Individuals of two species from the Chironomus genus were identified with the cytotaxonomical method:

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Chironomus nuditarsis Strenzke, 1959 and *Camptochironomus tentans* (Fabricius 1805). Both species have chromosome set 2n=8.

Chironomus nuditarsis Strenzke, 1959 (n=10) had polytene chromosomes with the chromosome arm combinations: the Ist (AB), the IInd (CD), the IIIrd (EF), and the IVth (G) (Fig. 1). The species belongs to the *thummi* cytocomplex. Its chromosomes AB, CD are metacentric, EF – submetacentric, and G - telocentric. Arms A (A22), B (B11), C (11), D (D11), and E (E11) have standard sequences. The homologues of arm G are unpaired with one Balbiani ring (BR) and one nucleolar organizer (NOR). Arm F has standard sequences and a heterozygous inversion.

The karyology of the Polish population of this species was studied by Michailova et al. (2002). The individuals of *Chironomus nuditarsis* were found in an artificial lake near Tarnobrzeg. The population inhabiting the Tarnobrzeg Reservoir is more polymorphic in comparison to the population representing Lake Łuknajno. Specimens collected in the artificial lake have homozygous inversions in arms A and B and a heterozygous inversion in arms C and G. Until now, the inversion in arm F was not recorded in the Polish populations. *C. nuditarsis* from Lake Łuknajno is less polymorphic than those in Bulgaria and Belgium (Kiknadze et al. 2006).

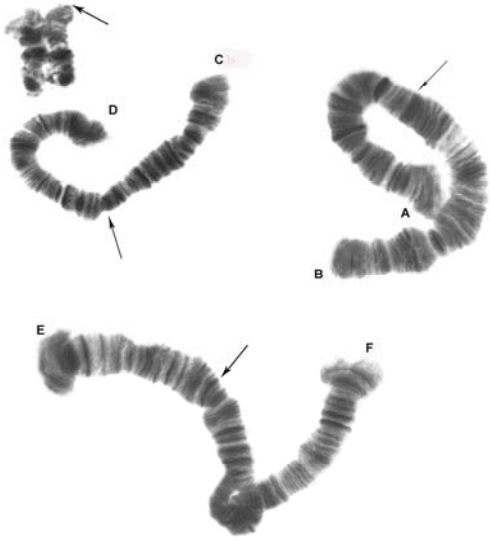


Fig. 1. Polytene chromosomes of *Chironomus nuditarsis* Strenzke, 1959. Chromosome arms are identified by A-G and centromeric bands by arrows; BR - Balbiani ring, NOR - nucleolar organizer, Inv. - region of inversion.

Camptochironomus tentans (Fabricius, 1805) (n=7) had polytene chromosomes with the chromosome arm combinations: the Ist (AB), the IInd (CF), the IIIrd (DE), and the IVth (G) (Fig. 2). Chromosomes AB, CF, and DE are metacentric, while G is acrocentric. Chromosome arms C (22), D (D11), and G (G11) have a standard sequence. Arms A (A11) and E (E11) have standard sequences, but also an inverted homozygous inversion. In arm B (B22), heterozygous inversion occurs. The species has two nucleolar organizers (NOR), located in arms D and G, respectively, and three Balbiani rings (BR) in chromosome G. The analysis of chromosome polymorphism of this species from this locality has been done by Michailova and Jabłońska-Barna (2008).

The observed chromosome polymorphism can be considered to be an effect of environmental influences since the high level of chromosome polymorphism in populations of *C. anthracinus* inhabiting shallow waters where environmental conditions were subject to strong variations, was reported previously (Kiknadze et al. 2005).

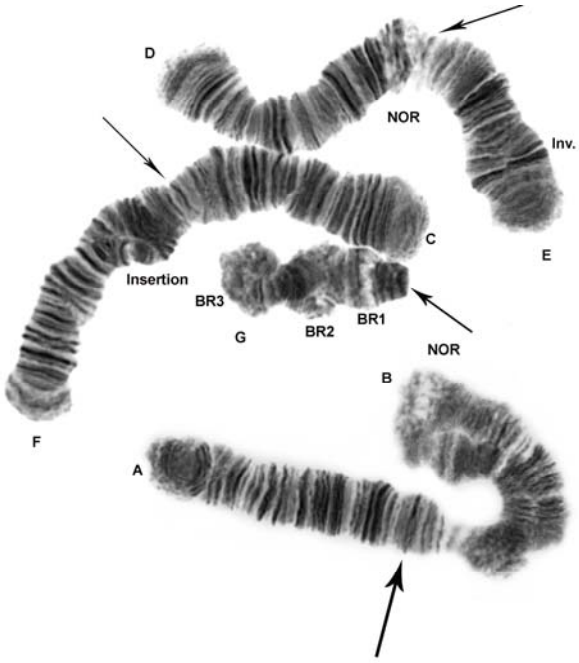


Fig. 2. Polytene chromosomes of *Camptochironomus tentans* (Fabricius, 1805). Chromosome arms are identifited by A-G and centromeric bands by arrows; BR - Balbiani ring, NOR - nucleolar organizer, Inv. - region of inversion.

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