© Comparative Cytogenetics, 2008 . Vol. 2, No. 2, P. 127-130. ISSN 1993-0771 (Print), ISSN 1993-078X (Online)

Polytene chromosomes of salivary glands of chironomids (Diptera: Chironomidae) from the Wrangel Island (Russia)

N.A. Petrova, S.V. Zhirov

Zoological Institute, Russian Academy of Sciences, Universitetskaya nab. 1, St. Petersburg 199034, Russia.
E-mail: chironom@zin.ru

Abstract. Polytene chromosomes of chironomid larvae (Diptera: Chironomidae), collected on the Wrangel Island are described. Larvae have 2n=8: AB, CD, EF, G (*Ch. thummi* Keyl, 1962 complex). By karyotype larvae are identical to *Chironomus* sp. Le1, described from the Sagystyr Island of the Ust-Lena Reserve (Yakutia) (Kiknadze et al., 1996). The insignificant differences include the number of nucleoli and puffs, which is regarded as a result of habitation of populations under different ecological conditions.

Key words: polytene chromosomes, larvae, *Chironomus* sp. Le1, Wrangel Island.

Introduction

In the cryolitozone of Yakutia in small polygonal lakes (the Lena River delta) 14 larvae were found that were named *Chironomus* sp. Le1 having 2n=8: AB, CD, EF, G (*Ch. thummi* Keyl, 1962 cytocomplex) (Kiknadze et al., 1996). In the present work 5 larvae collected in a brook on the Wrangel Island were examined. By the pattern of bands of polytene chromosomes of salivary glands these larvae are identical to species *Chironomus* sp. Le1.

Material and methods

Larvae of 4th instar were collected on the Wrangel Island in July 1994 in a brook falling into the Mamontova River by Yu.V. Mamkaev (Zoological Institute of the Russian Academy of Sciences, St. Petersburg). The larvae inhabited on the bottom on a thick moss pad. Material was fixed in the mixture of 96% ethanol and glacial acetic acid (3:1). The preparations were made using the aceto-orsein technique (Chubareva, Petrova, 1982).

A total of 5 specimens were studied. For two of them microphotographs of polytene chromosomes were prepared.

Results

2n=8. Combination of chromosome arms: AB, CD, EF, G ("thummi" cytocomplex) (Figs 1, 2). Chromosome I (AB) and II (CD) – metacentric; chromosome III (EF) – submetacentric; chromosome IV (G) – acrocentric. All chromosomes have large blocks of pericentromeric heterochromatin that are not joined into chromocentre. Three nucleoli (N) are situated in arms IIC (site 11d-13), IID (site 9-10) and IVG, in one larva a heterozygous nucleolus was discovered in IIC (site 6b) (Fig. 1). In IVG two Balbiani rings are localized (BR); in IIIF and IB there are one and two puffs respectively (Figs 1, 2). For a few exceptions conjugation of homologues was absent in each pair of chromosomes.

Chromosome I (AB)

Bands pattern is species-specific. Conjugation of homologues is confined to centromeric and pericentromeric (on the side of arm B) regions.

Arm A is monomorphic:

Le1A11 1-2c 10-11 9 2d-3 12 8-4 13-19

Arm B is monomorphic (not mapped). In the middle of the arm there are two puffs (Figs 1, 2).

Chromosome II (CD)

Bands pattern is species-specific. The chromosome is functionally active, bands are not distinct. Homologues conjugate only in the region of centromere and site 17-22 (Figs 1, 2).

Arm C is monomorphic:

Le1C11 1-6b 11c-8 15-11d 6gh 17a 16h-a 7 6f-c 17-22

There are a homozygous (site 11d-13) and a heterozygous (site 6b) nucleoli.

Arm D is monomorphic:

Le1D11 1-3 11-17 8-4 10-9 18-24

There is one large homozygous nucleolus (site 10-9) (Fig. 1).

Chromosome III (EF)

As a rule homologues do not conjugate. Arm E is monomorphic:

Le1E11 1-3e 5-10b 4-3f 10c-13

Pattern of bands coincides completely with that of *Ch. plumosus* (Kiknadze et al., 1996) (Figs 1, 2).

Arm F is monomorphic:

Le1F11 1-10 17-11 18-13

There is a puff on the end near the telomere (Figs 1, 2).

Arm IV (G) monomorphic.

Bands pattern defies detailed mapping because of high physiological activity of homologues. Arms G do not conjugate, in one larva ectopic connection between heterochromatin of two homologues was discovered.

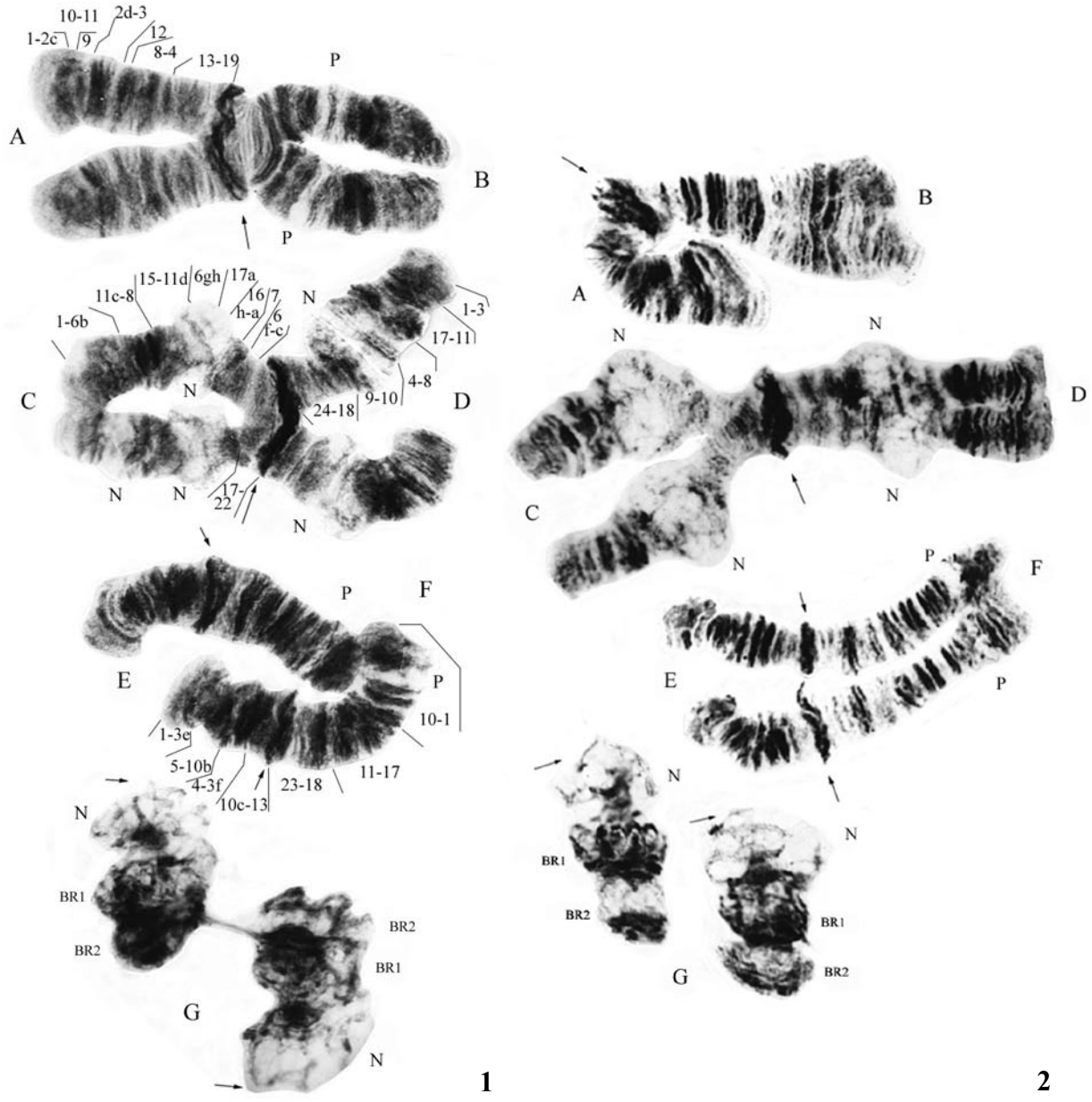
On one end near centromere a nucleolus is situated. There are two clearly visible Balbiani rings (Figs 1, 2).

Discussion

The studied larvae are identical in band patterns of polytene chromosomes to species *Chironomus* sp. Le1, described from numerous small lakes in Ust-Lena Reserve (Yakutia) and karyologically close to *Ch. riihimakiensis* Wülker, 1980 (Kiknadze et al., 1996). The differences between two populations of *Chironomus* sp. Le1 are limited to the degree of conjugation of homologues, number of puffs and nucleoli. In specimens of the Yakutian population in arm B there is BR and a large puff, whereas in specimens of population from the Wrangel Island this arm has two puffs. In arm C of this population there is a heterozygous nucleolus, which is absent in specimens of the Yakutian population.

Populations differ also by chromosome IIIE, in which according to the data of Kiknadze et al. (1996), there is a large puff, whereas in our material this puff is absent. Arm IVG, as in the majority of northern species is a morphologically peculiar structure (Kiknadze et al., 1996), formed by three active sites – N and two BR. These sites are separated by small groups of dark bands, which give the impression of constrictions. Heterochromatine regions conjugate ecotopically, which is not characteristic of the Yakutian population.

It is known that interpopulation differences in conjugation of homologues, number nucleoli and puffs frequently occur in chironomids and are related to different ecological conditions of populations. The studied populations of *Chironomus* sp. Le1 inhabit north of the Arctic circle. It can be assumed that this species is widely spread on the Arctic coast. Natural conditions on the Wrangel Island differ greatly from those on the continent, which



Figs 1, 2. Karyotype of *Chironomus* sp. Le1. AB - chromosome I, CD - chromosome II, EF - chromosome III, G - chromosome IV. Designated by Arabic numerals and Latin characters are sections of chromosomes, N – nucleolus, BR – Balbiani ring, P – puff, designated by arrows, are centromeric regions.

may be responsible for the differences in functional activity of polytene chromosomes discovered between the studied populations of *Chironomus* sp. Le1.

Acknowledgements

Authors are greatly appreciated to professor Yu.V. Mamkaev for collecting material. The study was financially supported by

the Program of the Presidium of the Russian Academy of Sciences "Biodiversity and Dynamics of Gene Pools" and the Program "Origin and Evolution of Boisphere".

References

Chubareva L.A., Petrova N.A. 1982. The cytogenetical method of chironomid chromosome analysis (pp. 64-73) // Akhrorov F. (Ed.). *The methodical manual on studying of chironomids*. Dushanbe. 84 p. (In Russian).

Kiknadze I.I., Istomina A.G., Gunderina L.I., Salova T.A., Ajmanova K.G., Savvinov D.D. 1996. Karyofunds of chironomids of cryolitozone of Yakutia: tribe Chironomini. Novosibirsk. 166 p. (In Russian).

Received December, 1, 2007.
Accepted by V.G. Kuznetsova and N.V. Golub, June, 9, 2008.
Published December 30, 2008.