



**I. Kiknadze, A. Istomina, V. Golygina & L. Gunderina. 2016.**

## **Karyotypes of Palearctic and Holarctic species of the genus *Chironomus***

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In 2016, a very interesting from both theoretical and practical point of view book was published. It is entitled "Karyotypes of Palearctic and Holarctic species of the genus *Chironomus*" and the authors are outstanding Russian geneticists and cytogeneticists – Professor I. I. Kiknadze, Dr A. Istomina, Dr V.

Golygina and DSc L. Gunderina. The book contains the cytogenetic characteristics of 63 species of the genus *Chironomus* Mg. collected from various geographical areas: Western and Eastern Europe, Western and Eastern Siberia and the Russian Far East.

Chironomid larvae, especially those of the genus *Chironomus*, are a widely distributed group of insects in aquatic ecosystems. They are very suitable for understanding and monitoring the impact of contaminants and for the assessment of their importance for freshwater ecosystem. These larvae possess exceptional salivary gland chromosomes, with structural and functional peculiarities making chironomids prospective subjects for genetic, cytogenetic, biochemical and molecular studies. However, to realize the full potential of chironomid larvae requires the precise identification of their larval stage. In many cases, conventional morphological methods do not help to identify the larval stage at the species level as they have no distinct morphological differences. Therefore, the genus *Chironomus* contains numerous sibling species and the detailed cytogenetic analysis of the salivary gland chromosomes (interphase chromosomes) appears to be promising for the taxonomic diagnostics, especially when combined with morphological data of developmental stages. As additional characteristics of the species determination, the authors propose cytogenetic markers of the chironomid salivary gland chromosomes. They presented excellent salivary gland chromosomes of 63 chironomid species. The chromosome pictures of all polytene chromosomes are brilliant and this allows a reliable species identification. Furthermore, these data are an excellent basis for analysing chromosome rearrangements involved in the species divergence, chromosomal polymorphism and phylogeny.

The book consists of two chapters and a reference list of more than 280 bibliographic descriptions. In the beginning, the authors presented the sibling species of the genus *Chironomus*, which are arranged in five groups. In Chapter I, the authors underline that the chironomids can be used as a model group for studying the chromosomal diversity of populations and the species divergence. It is shown that the speciation is accompanied by development of reproductive isolating mechanisms, by which the gene flow is restricted or completely suppressed. The analysis of the speciation is detailed as well as the description of the chromosome rearrangements involved in this process. The authors show very well the consecutive changes in karyotypes of the species, enhancing the adaptive potential of chironomids and resulting into microevolutionary differentiation of populations. Chapter I starts with a detailed description of the karyotype structure of the genus *Chironomus*. It presents not only the names of the chromosome arms but also the patterns of chromosome rearrangements. The reciprocal translocations are demonstrated to play an important role in the

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karyotype evolution in the genus *Chironomus*. Due to different chromosome arm combinations, the species are grouped in several cytocomplexes. In each complex, the species are distinguished by species-specific fixed homozygous inversions. The authors collate the current knowledge from Russian and foreign literature about the role of the chromosome inversions in the phylogeny and their importance for the speciation. In addition, they have taken under consideration the chromosome polymorphism of the studied species as a basis for cytogenetic population divergence. Chromosome polymorphisms are considered as the starting point of speciation. Different inversion sequences in the populations can serve as a sign of cytogenetic divergence.

The book presents in clear manner authors' original ideas for classification of banding inverted sequences according to their frequency, zoogeographic distribution and specificity. On their basis, a reconstruction of their cytogenetic history and origin of species can be proposed. Cytogenetic differentiation is very well demonstrated when Palearctic and Nearctic chironomid populations are compared. Among different groups of sibling species, homologous banding sequences and interesting relation between number of bands homology and genetic distance have been found and clearly demonstrated. The bands homology is decreasing with increasing the genetic distance. Furthermore, many Palearctic and Nearctic species have no unique band sequences only but also identical band sequences, which is a good marker for their common ancestry.

An interesting contribution of the authors is Chapter II, which is dedicated to the cytogenetic description of every species. The authors performed chromosome mapping for five chromosome arms of every species, using polytene chromosomes of *Chironomus piger* Strenzke as a standard. The maps are illustrated by brilliant original microphotographs, which have a great documentary and diagnostic value and are very useful as a basis of genotoxicological studies. For every species, the book presents data about its distribution, synonyms and karyotype characteristics. The latter include chromosome set, chromosome arm combinations, localization of the key structures such as the Nucleolar Organizer (NOR) and Balbiani ring (BR), the sets and frequencies of banding sequences and the level of chromosome polymorphism. Some of presented species are homosequential (banding patterns of polytene chromosomes are identical). However, the authors emphasise their specific characteristics by the localization of the heterochromatin, satellite DNA and transposable elements.

A special attention is paid to the molecular data of some chironomid species. The cytogenetic characteristics of chironomids have a great contribution for taxonomy of the genus *Chironomus*, especially enabling the precise identification of the species. The unique illustrations of the polytene chromosomes can be used as a basis for tracing the microevolutionary differentiation as well as for solving many systematic and evolutionary problems. The book devoted to the karyotypes of Palaearctic and Holarctic species of the genus *Chironomus* is a valuable tool for examination of taxonomy, biodiversity, phylogeny and evolution of a widespread group of insects, family Chironomidae, which is important for hydrobiology, ecology and genetics. This book may serve as a reliable basis for further evolutionary, phylogenetical, genotoxicological and molecular studies of theoretical and practical importance.

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