CHIRONOMUS

Newsletter on Chironomidae Research

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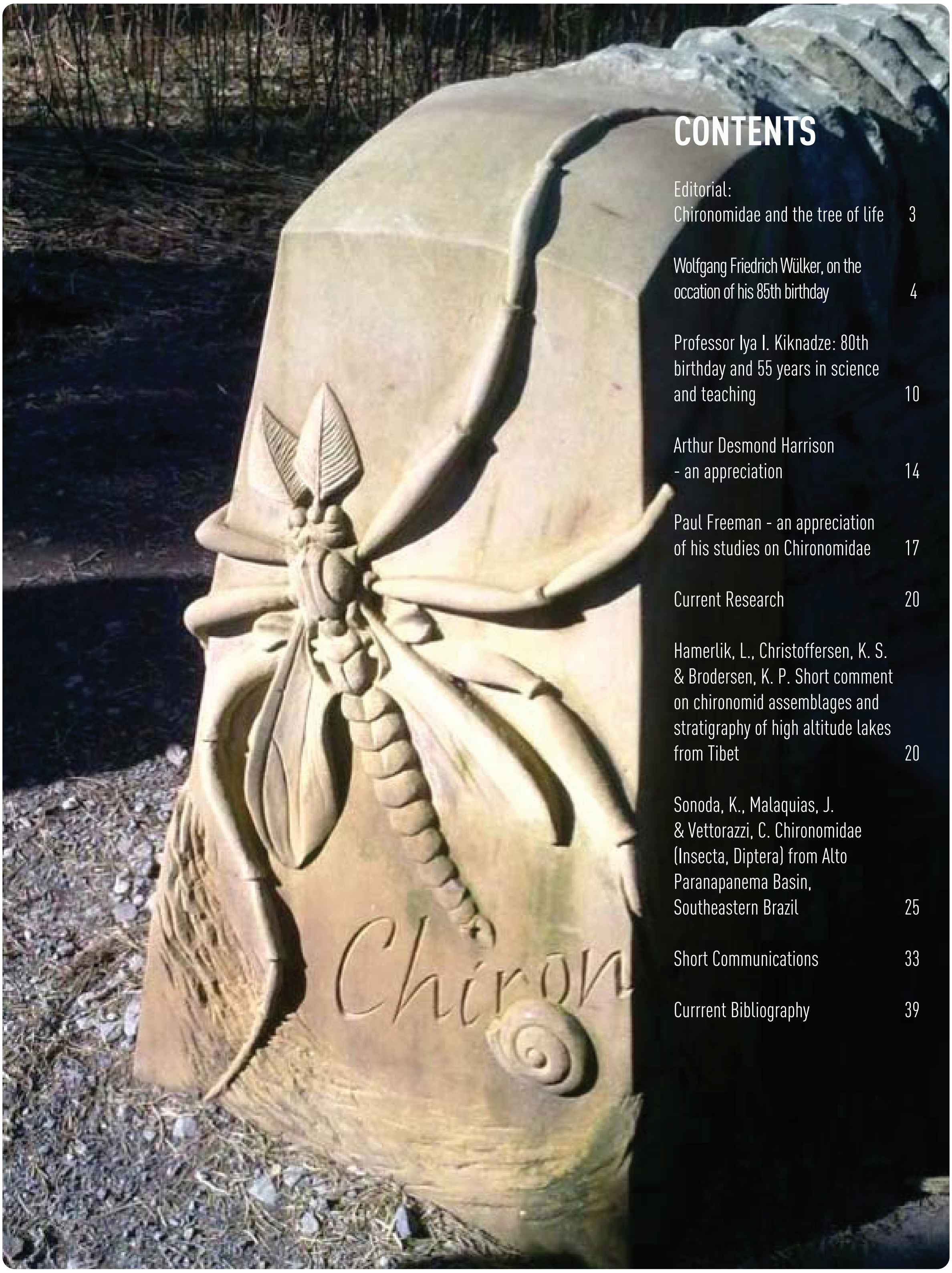

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Sculpture by David Wilson close to the shore of Loch Leven at Kinross. Photo Sarah Stenhouse

CHIRONOMUS Newsletter on Chironomidae Research

The *CHIRONOMUS Newsletter on Chironomidae Research* is devoted to all aspects of chironomid research and aims to be an updated news bulletin for the Chironomidae research community. The newsletter is published yearly in October, is open access, and can be downloaded free from this website: http://www.ntnu.no/ojs/index.php/chironomus.

Research articles for the *CHIRONOMUS Newsletter* are subject to peer-review. The newsletter also contains a current bibliography that is maintained by Odwin Hoffrichter, please send complete references of your new Chironomidae publications directly to him.

Contributions to *CHIRONOMUS Newsletter on Chironomidae Research* should be submitted online through the online journal system: http://www.ntnu.no/ojs/index.php/chironomus following the author guidelines. Submission deadline for contributions to the newsletter is July 1.

Would you like to see your picture on the front page? Please send us your favourite midge photograph or drawing (Torbjorn.Ekrem@vm.ntnu.no).

Front page layout: Chironomid in title from photograph by Steve Marshall, Graphic design by Kolbjørn Skarpnes, NTNU Information Division.

Front page photo: Sculpture by David Wilson, commissioned by Scottish Natural Heritage, at Burleigh Sands, Kinross, close to the shore of Loch Leven. Photograph by Sarah Stenhouse, SEPA Aberdeen (used with permission and adapted from Sue McBean (in Langton & McBean, 2010 Dipterists Digest, in press)).

Editorial

Chironomidae and the tree of life

The importance of understanding the genealogical relationships between populations, species and species groups can hardly be exaggerated. As reconstructions of evolutionary pathways through time, phylogenetic trees provide a framework on which biological hypotheses can be tested; without robust phylogenies we will be unable to fully understand the processes behind speciation and biogeographical distributions. It is therefore perhaps not surprising that research devoted to systematics and phylogenetics on various branches of the tree of life has found increased interest over the last 10-20 years. Easier access to molecular data for use in phylogenetic analyses and the development of new analytical tools has promoted what has become a huge production of statistically testable hypotheses of evolutionary relationships.

Diptera is no exception and it was remarkable to see the number of papers dealing with phylogenetic analyses at the 7th International Congress of Dipterology in Costa Rica in August this year. In addition to being numerous, most of the phylogenetic studies that were presented at this conference used multiple markers, often in combination with morphological characters, to test for congruence and investigate the evolution of morphological and ecological traits. Datasets comprising more than 2000 characters were not uncommon and some even approached 6000! It is obvious in which direction phylogenetic research is going; what was regarded as a thorough study with a couple of genes yesterday will be a small pilot study tomorrow. - So also for the Chironomidae.

But, as for other dipteran taxa, morphological characters in phylogenetics are far from dead. As an example, Art Borkent at the Diptera Congress presented new evidence from pupal morphology that chironomids should be regarded as sister to all the other families in the Culicomorpha. The relationship has been backed by Pete Cranston et al.'s molecular phylogeny using molecular characters from four different genes. The latter study also has revealed Buchonomyiinae as sister to all other Chironomidae subfamilies, a relationship conforming to Murray and Ashe's earlier observation on the general plesiomorphous morphology of adult, pupa and egg of *Buchonomyia thienemanni* (Murray & Ashe 1981; Ashe & Murray 1983). There are many groups with unresolved relationships, however, and there will definitely be many interesting results from phylogenetic studies within our family in the years to come.

I hope that some of these will be presented at the next Chironomidae symposium in Trondheim and that they in concert with research results in taxonomy, ecology, genetics, cytology, palaeolimnology and toxicology will guarantee for a successful meeting. Please read more about the symposium and how to preregister in the *Short Communications* section in this newsletter. We look forward to see you there!

Torbjørn Ekrem, *Museum of Natural History and Archaeology, Norwegian University of Science and Technology, Norway. E-mail: Torbjorn.Ekrem@vm.ntnu.no*

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Wolfgang Friedrich Wülker, on the Occasion of His 85th Birthday

Wolfgang Wülker was born on 25 September 1925 at Frankfurt, Germany.

In 1952 he began working as a scientific assistant at the Hydrobiological Station Falkau

(later the Limnological Institute of the University of Freiburg, Walter Schlienz-Institut). His initial publications were on fish, but papers on chironomids began appearing from 1956. He was at Falkau for about 10 years and added to the collection of the station both specimens from the Black Forest area, and specimens collected on his research trips to Spain (1954), Fennoscandinavia (1956), Sudan (1963), USA and Canada (1964).

He did his Habilitation in Zoology and Limnology on intersexuality in *Chironomus* and the biology of *Sergentia* at the University of Freiburg, in 1960. Then in 1962 he joined the University of Freiburg.

After his official retirement Wolfgang continued to work at the University, later transferring his laboratory to his home.

Wolfgang was involved in collaborations with colleagues in many countries during his long career, some of which lasted for many years and produced many publications. A photograph of Wolfgang with Jim Sublette in Portales, N.M. in 1964 was reproduced on page 6 of volume 21 of this newsletter. His collaboration with Jim Sublette, Jon Martin and later Mac Butler, has produced 16 papers from 1967 to the present; that with the Russian workers, notably Iya Kiknadze and her group, 15 since about 1993; seven with the Swiss group of Adolf Scholl; four with György Dévai and colleagues from Hungary; and numerous others with students or colleagues from Germany. Wolfgang's full bibliography of chironomid publications is attached.

Jon Martin
Melbourne

My wife, Mary, and I first met Wolfgang and his wife, Dorothea, in Vienna at the 1959 SIL meeting. It was a most auspicious meeting for us which laid the groundwork for a collaborative 40+ years research team of Wuelker, Sublette and Sublette, which shortly thereafter was joined by Jon Martin who was then doing a postdoctoral in Ottawa at Canada Agriculture. The Sublettes were able to get grants to visit Wuelker in Freiburg. In their brief stay there Jim and Wolfgang held endless discussions on midge taxonomy and Mary focused on getting a camera lucida drawing of some of the Keyl arms. Wolfgang became more entranced with the possibility of using polytene chromosomes in Chironomid taxonomy and phylogeny and spent some time in other labs in Germany becoming acquainted with methodology and cytotaxonomy in general.

Wolfgang Wülker. Photo NN

In 1965 Wolfgang was still working in the field of mermithid parasitism in Chironomidae and he was funded to come to the U.S. to attempt cross-inoculation of mermithid infective larvae into Nearctic samples. Wolfgang had worked with *Sergentia* and wanted to locate nearctic populations. He knew that John Stahl at the University of Indiana had worked on *Sergentia* in Crooked Lake. The Sublette family and Wuelker family met up in Indiana and spent a week together at Shafer Lake, where Jim's brother had lakeside acreage and a home. The Wuelkers pitched their camping trailer on the lawn and Jim and Wolfgang set out in search of *Sergentia*. We located a Crooked Lake on a topographic map, near Ft. Wayne. However, sampling that lake showed it was a shallow lake with only plumosus type larvae. The Wuelkers were anxious to start a grand tour of the west and bought an old VW microbus in Monon from a dealer recommended by Jim's brother. Seven miles from where the dealership was, the motor fell out of the old VW. Jim's brother did a bit of arm twisting and they replaced the motor gratis. THEN the Wuelkers set of on the grand trip. After touring all of the national parks in the western United States, the Wuelkers ended up in Portales, NM where Jim was teaching. The University provided a guest apartment for the Wuelkers and they stayed there about 4 months. Wolfgang's infective larvae had moulted once as I recall but were still infective. We attempted to infect them into a plumosus type larva and a decorus type larva and a *Glyptotendipes* larva. No *Sergentia* were available. Infections occurred at a low rate but in all cases the mermithid died before moulting again.

Mary acquired the technique of making polytene chromosome squashes and produced several thousand over the next several years. Over the years Wolfgang returned again to Portales to sort through the growing collection of squashes accumulated there. We were most fortunate to make the association and receive the help from Patrick L. Hudson, U.S. Fish and Wildlife Service, who sent innumerable mature, fixed larvae with associated adults and larval/pupal skins. Much of this material was examined by Wolfgang and later by Jon Martin. Jon and Wolfgang were responsible for cytology and Jim and Mary, the larva, pupa and adults. Jim, in ENMU administration, was instrumental in establishing an in-house journal, Studies in Natural Science (Portales) which served as the publication vehicle for several of these joint studies.

Jim Sublette
Tucson

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Professor Iya I. Kiknadze: 80th Birthday and 55 years in science and teaching

Professor Iya Ivanovna Kiknadze is a leading expert in cell biology, cytogenetics, karyosystematics, and comparative and evolutionary genomics of Chironomidae.

On February 9, 2010, this honoured worker of science of the Russian Federation celebrated her 80th anniversary. She is among the oldest researchers at the Institute of Cytology and Genetics (ICG), Novosibirsk, and Professors of the Novosibirsk State University (NSU). In addition, in 2010 it will be 55 years since the beginning of her research work, of them, three years at the Laboratory of Cytology, Zoological Institute, Leningrad, later transformed into the Institute of Cytology. She has been working at ICG, Novosibirsk, for 52 years, since January, 1958. For 32 years, from1962 till 1994, she headed a laboratory at the institute and from 1963 to 1986, at NSU.

Iya Kiknadze is the founder in Russia of the new research field: functional organization of chromosomes and differential gene activity in Diptera. She developed the notion of puffing as the basis for differential gene transcription and described the pattern and dynamics of puffs at major stages of chironomid development. With her supervision, the role of tissue-specific puffs was analyzed and an insight into the genetic control of tissue-specific secretory proteins was obtained. She pioneered in microdissection of the disk containing genes of the tissue-specific Balbiani ring, investigation of the molecular study of these genes, description of transposable elements in Chironomidae, and study of the cytogenetic control of the fine structure of chironomid salivary glands in the course of induced gene repression and expression. This study provided grounds for the original hypothesis of periodic genome reprogramming. Construction of high-resolution cytophotographic maps of chironomid polytene chromosomes allowed these species to be enrolled on the list of models for studies of evolutionary transformations in genomes and genetic impact of industrial factors on organisms. In particular, these results were extensively used in the assessment of radioactive pollution in the integrated projects: *Remote Consequences of the Radioactive Impact of Nuclear Tests at the Semipalatinsk Test Site on the Population of the Altai Territory* and *Study of the Genetic Consequences of Nuclear Tests at the Semipalatinsk Test Site on Plant and Animal Populations*. Iya Kiknadze supervised the development of inversion genomics of chironomids, based on global analysis of the disk (gene) sequence polymorphism on various continents: Eurasia, North and South America, Africa, and Australia. Putative ancestral disk sequences were recognized in each of the chromosome arms of the genome (primitive karyotype). Phylogenetic trees were constructed for the first time for the genus *Chironomus* on the basis of inversion polymorphism in cooperation with researchers of the Institute of Mathematics, Novosibirsk, and the cytogenetic history of the genus was reconstructed.

Iya I. Kiknadze at the Symposium of Cytogenetics of Invertebrates, August 2010. Photo W. Wülker.

Iya Kiknadze was the first to obtain experimental evidence against the involvement of endomitosis in somatic polyploidization. It allowed revision of the endomitosis concept. Functional organization of chromosomes and differential gene activity are also among the subjects of Kiknadze's seminal studies. Her monograph "Functional organization of polytene chromosomes" summarizes studies in this field. Iya Kiknadze applied the polytene chromosome model to the development of the essentials of the functional organization of interphase chromosomes and introduced the notion of chromomeres as functional units of these chromosomes.

When working at ICG, Iya Kiknadze commenced studies of interphase chromosomes, chromomeres, and nucleoli. In collaboration with Dr. E. S. Belyaeva, she proved that the nucleolus was a transcriptionally active region of an interphase chromosome.

One more field of research conducted under Kiknadze's supervision since 1980s is the molecular and cytological organization of specific regions in eukaryotic chromosomes, including the organization of multigenic loci and their transformation in the course of evolution.

Long-term monitoring of chromosome pools of natural chironomid populations is conducted in permafrost regions of Yakutia in cooperation with the Institute of Ecology, Yakutian Academy of Sciences.

Iya Ivanovna Kiknadze was born in the old merchant city of Tyumen on February 9, 1930. Her mother Antonina Reshetnikova and father Ivan Balakin were clerks.

Iya spent all her childhood and school years in Tyumen, never going further than ten miles from it. She entered first School No. 1 and graduated from girl's school No. 25. In wartime, Tyumen gave home not to only evacuated industrial enterprises but also many higher educational institutions from Moscow and other Russian cities. They included the staff of the Moscow Medical Institute. As it later turned out, the embalmed body of Vladimir Lenin was kept there during the Second World War. The cultural standard of the provincial town was notably improved by performances of companies of the Moscow Academic Art Theatre and other theatres. The metropolitan culture influenced the artistic taste of Tyumen inhabitants, in particular, teenagers. In 1947, Iya graduated school with a School Gold Medal and went to the "northern capital" to enter the Leningrad State University.

In 1952, Iya Kiknadze graduated from the Faculty of Biology and Soil Science cum laude and became specialist in a field rare at that time: Darwinist–Geneticist. She started her research activity when learning at the University. From 1952 to 1955, she took a postgraduate course at the Leningrad State University and defended a candidate's dissertation entitled *Dynamics of DNA and RNA in oogenesis and early cleavage in invertebrates*. Then she obtained her first position of Junior Researcher at the Laboratory of Cytology, Zoological Institute (In 1956, the laboratory was transformed into the Institute of Cytology). Her research advisor at the University and Zoological Institute was Ivan I. Sokolov, a prominent cytologist. For years, he remained her tutor and standard of dedication and ethics. In 1957 Iya was advised by A. A. Prokof'eva–Bel'govskaya to move to the just established Akademgorodok in Novosibirsk and obtain a job at ICG. She was promised she would have an apartment and interesting work. Iya was a daughter of Siberia, and she did not resist it. In 1957 Iya Kiknadze, her husband the botanist Georgii Sergeevich Kiknadze, and their small daughter Irene left for Novosibirsk.

At ICG, Iya Kiknadze became Junior Researcher at the Department of Physical, Chemical, and Cytological Basics of Heredity. It was headed by Prof. Ivan Dmitrievich Romanov till 1961. It was a remarkable time with a remarkable scientist. Even now, his portrait is on the wall in Iya Kiknadze's study. During her first decade in Novosibirsk, Kiknadze made friends with older colleagues, Vera V. Khvostova and Raisa P. Martynova, and colleagues of her age, Ninel B. Khristolyubova and Klavdia K. Sidorova.

In 1961–1962, Kiknadze worked as a Senior Researcher. Since October, 1962, she has headed the Laboratory of General Cytology. She defended her doctoral dissertation *Functional Organization of Chromosomes* in 1967, at a session of the Joint Dissertation Council in Biological Sciences, Siberian Branch of the USSR Academy of Sciences. She was awarded Professor's rank at the Chair of Cytology and Genetics on December 10, 1970.

On January 21, 1988, the Department of Cell Biology was founded on the base of the Laboratory of General Cytology. It included the Laboratory of Evolutionary Cytogenetics and several sectors: Genetics of Tissue-Specific Traits, Molecular Neurogenetics, and Genomics.

Since 1994, Prof. Kiknadze has held the position of Chief Researcher at the Laboratory of Evolutionary Biology, ICG.

Professor Iya Kiknadze convened several All-Union and international conferences: the 2nd All-Union Symposium *Chromosome Structure and Function* (Novosibirsk, 1970) and the All-Union Symposium *Chironomidae Evolution, Speciation, and Systematics* (Novosibirsk, 1985). In 1982, the international symposium *Organization and Expression of Tissue-Specific Genes* was held in Akademgorodok in 1982. It marked the beginning of regular workshops on chironomid Balbiani rings. At present, I. Kiknadze is participating in the preparation of the conference *Invertebrate Karyosystematics* (Novosibirsk) as Chairlady of the Organizing Committee.

Professor Iya Kiknadze is the founder of the Novosibirsk school of dipterologists, experts in Chironomidae and Drosophilidae. Twenty-nine candidate's dissertations were defended with her scientific supervision. She generously presents her ideas to her students. She has dozens of followers and disciples who have chosen their own research ways in many countries. Many of Kiknadze's students have raised their own students.

Professor Iya Kiknadze applied much effort to teaching of cytology at the Chair of Cytology and Genetics, Biological Department, Faculty of Sciences, NSU. From the foundation of the Chair of Cytology and Genetics in 1962 to 1986, she performed the offices of Vice-Chairholder. She was the first not only at NSU but in the USSR to develop and deliver the course *Cytology/Cell Biology* after decades of the stranglehold of Michurin's biology. She also held and supervised seminars and laboratory courses on branches of cytology and genetics.

Iya Kiknadze introduced her experience acquired from the Leningrad biological research school to ICG and NSU. She started with the system of biologist tutorship. Major and minor laboratory courses on cytology and genetics and summer practicals in the field were conducted in the image and likeness of corresponding activities at the Chair of Biology of the Leningrad University. This was how the famous Leningrad school of cytology and genetics, created by the famous scientists Yu. A. Filipchenko, M. E. Lobashov, D. N. Nasonov, and M. S. Navashin, sprouted in Siberia.

Since 1965, Iya Kiknadze has been a member of the Joint Academic Board in Biology, Siberian Branch of the USSR Academy of Sciences. She was a permanent member of the Academic Board of ICG since its establishment, a member of the Academic Board of the Faculty of Sciences, NSU, and a member of the Dissertation Council at the Novosibirsk State Medical University. Now Prof. Kiknadze is also a member of the Dissertation Council at the Institute of Systematics and Ecology of Animals.

For 28 years, from 1974 to 2001, Iya Kiknadze was a member of the Editorial Board of the journal *Tsitologiya* (*Cytology*), and for 5 years, from 1984 to 1989, of the Editorial Board of *Ontogenez* (*Development*). Since 2003, she has been a member of the Editorial Board of *Evroaziatskii Entomologicheskii Zhurnal* (*Eurasian Entomological Journal*), and since 2008, of the Editorial Board of *Comparative Cytogenetics*.

The Honoured Worker of Science of the Russian Federation (since 1998), Professor Kiknadze was awarded the Order of the Badge of Honour in 1967 for participation in the development of the Novosibirsk Research Centre and scientific contribution; in 1970, the Medal for Valorous Labour. She has the titles of Honoured Veteran of the Siberian Branch of the USSR Academy of Sciences and Honoured Veteran of Labour. Certificates of Merit: from SB RAS on the occasion of the 275th Anniversary of the Academy of Sciences in 1999, from the Ministry of Education and Science on the occasion of the 50th Anniversary of the Siberian Branch of the RAS in 2007, and from the Novosibirsk Governor V. A. Tolokonsky in 2010.

Iya Kiknadze is an earnest and fruitful worker. It is apparent from her numerous publications in the recent decade and enormous work on reviewing and editing of research papers. Her desk is always covered by fans of photographs of her favourite polytene chromosomes. Their banding patterns serve as barcodes. They allow the features and evolutional history of each species to be understood. With the help of her students, A. G. Istomina, L. I. Gunderina, V. V. Golygina, and A. D. Broshkov, as well as with numerous Russian and foreign colleagues, Iya Kiknadze works in the enormous field of chromosome pools, chromosome polymorphism, and speciation in Holarctic Chironomidae species. These studies contribute to cytogenetics of natural chironomid populations in the context of the role of chromosome rearrangements in population adaptation and chromosome set divergence during speciation. They have revealed profound cytogenetic divergence between Palearctic and Nearctic populations of Holarctic species.

Iya Kiknadze is among authors of over 350 publications, including 10 monographs.

During all scientific activity Prof. I. Kiknadze had fruitful contacts with many specialists from different countries. She took part in many international symposia and other scientific meetings. While studying the structure and function of chironomid polytene chromosomes she had associated with Prof. B. Daneholt, Prof. E.R. Schmidt, Prof. M. Lezzi, Prof. J.E. Edström, Prof. U. Grossbach, Prof. R. Panitz, Prof. S. Case, H. Bäumlein, U. Wobus. Joint work with Prof. W. Wülker, Prof. J. Martin, Prof. M. Butler, Prof. X. Wang, Prof. R. Contreras-Lichtenberg, H. Vallenduuk, H. Moller-Pilot result in the description of new species, their karyotypes and chromosomal polymorphism. Iya Kiknadze collected chironomid larvae with M. Butler in North America. The fruitful interactions with Prof. W. Wülker and Prof. J. Martin resulted in revision and making cytomaps of polytene chromosomes of many *Chironomus* species more precise. In joint work with Prof. W. Wülker, Prof. J. Martin, Prof M. Butler and Dr. L. Gunderina it has been shown that the banding sequence pools of populations of the same species on different continents differed much in the sets and frequencies of gene inversion orders. Banding sequence pools of populations on each continent were found to contain continent-specific banding sequences in addition to sequences occurring on several continents.

We wish Iya Kiknadze many more interesting years full with new ideas and successes.

I.K. Zakharov, A.G. Istomina, W. Wülker

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Arthur Desmond Harrison (24.12.1921 - 30.12.2007) – An appreciation

Arthur D. Harrison, the doyen of African limnology and studies of the Afrotropical Chironomidae, died in Canada over 3 years ago with little or no posthumous scientific recognition. This piece is an attempt to rectify the situation, and to recognise the significance of Arthur as a clear-thinking and often pioneering biogeographer, entomologist, educator and above all as a limnologist in the broadest sense. His life and career spanned Africa and Canada, although his influence remains very much associated with Africa, from Ethiopia to the Cape.

Arthur D. Harrison. Photo Helen James

Arthur was born in the Western Cape of South Africa, at Kalk Bay, on 24th December 1921, and he lived for a period at Fish Hoek (where he returned in retirement – see photograph). He attended school in Rondebosch and then studied at the University of Cape Town where he gained B.Sc and M.Sc. He then obtained teaching qualifications (B.Ed) and took up a teaching appointment before deciding that research was to be his career. He gained a position at CSIR (South Africa's Council for Scientific and Industrial Research) undertaking limnological surveys in rivers and estuaries. This led to the award of a Ph.D. for his pioneering studies of the Great Berg River (of the Western Cape), published in two parts in the Transactions of the Royal Society of South Africa (Harrison 1958; Harrison & Elsworth 1958) and revisited subsequently (e.g. Harrison 1964). These papers ('beacons' in the literature according Allanson 2003) remain well-cited and show Arthur's early recognition of the downstream effects (zonation) in river structure and function from headwaters to estuaries. From the outset Arthur balanced his limnological studies with the applied – one of his earliest papers concerned the effects of acidic mine pollution on the streams of the Transvaal. Throughout his career, by himself or others with his assistance, revealed a range of human impacts on aquatic ecosystems.

Fish Hoek. Photo P. Cranston

After relocations with CSIR (Witwatersrand University, then Pretoria) Arthur took up a Rockefeller-funded position studying *Bilharzia* at the University of Salisbury, in what was then (early-1960s) Rhodesia. Arthur clearly had some time on his hands aside from studying the effects of molluscicides. He observed the recovery of a Rhodesian stream, post-drought, including documenting the chironomids, and finding the adults of the first known podonomine midge from Africa, described as *Afrochlus harrisoni* by Freeman (1964). Following the Unilateral Declaration of Independence (from the UK) in November 1965, Rockefeller funding was withdrawn under sanctions, and Arthur returned to South Africa to become Professor of Zoology at the University of Natal, in Pietermaritzburg.

This was a short-lived appointment as Arthur accepted an invitation to join the faculty of the University of Waterloo in Ontario, Canada, where under Noel Hynes he joined a dynamic group of tropical limnologists. At this time Arthur's deepening personal interest in the chironomids became more evident. Although he had collected the midges throughout his career, including finding in 1954 *Harrisonina petricola* Freeman in an ephemeral stream in Oliphants Valley and recognising it as curious, he passed many of his specimens onto others, first to Marjorie Scott, and then to Paul Freeman at the Natural History Museum, London (BMNH). However his own first publications on the group started to appear in the early 1970s, with his interest in the Tanypodinae evident when he took Sepp Fittkau's (1962) revision of the Tanypodinae and placed the somewhat neglected African species into the modern generic concepts (Harrison 1971). In the course of this study, he described his first midge genus (*Lepidopelopia*) for the 'one that didn't fit' the Fittkau scheme (Harrison 1970). It was at this time that I first met Arthur as he came through London to view the types of the African Tanypodinae held in the BMNH – he asked me to make microscope slide preparations in advance of his visit so that he could see features such as the spurs on the adult legs that characterised Fittkau's new taxa. Arthur was a stickler for correct preparations, and it gave me some pleasure to 'pass the test'. He was very alert to the 'modern' means of doing chironomid taxonomy, and made slides of most of his specimens as he collected them. Further, he reared much and tried to incorporate the immature stages.

For many subsequent years our paths did not cross, as Arthur spent his time either in Waterloo, or seconded to the University of Addis Ababa in Ethiopia. From 1981 to 1989 he was a major contributor to the Canadian International Development Agency (CIDA)-funded Institutional Enhancement project, spending 4 years living there. Another of the Waterloo faculty engaged in this project, Herbert Fernando, recalled 'At the best of times Ethiopia is not an easy country to work in. But these were not good times. We needed permission from the highest government authorities to leave Addis Ababa even for field work.' Despite this situation, experienced Africa-hand Arthur succeeded in doing much publishable research, and he produced a series of papers on the Chironomidae of Ethiopian lakes, extending distributions of known taxa, and describing new species and new life histories. He managed to get himself to the high elevation streams as well as the Rift Valley lakes, and published general invertebrate reviews with Noel Hynes and some particular chironomid papers. Arthur published this work especially in Archiv für Hydrobiology and Spixiana, and always he tried to get his research out to the appropriate audience. When Aquatic Insects started, he was a contributor and supporter from the outset (e.g. Harrison 2000). Further, he seemed never to decline an invitation to summarise his compendious and very broad understanding of the ecology and distribution of African invertebrates (e.g. Harrison 1978, 1995). He wrote fluently and with a highly readable style – and was a frequent correspondent and an early adopter of e-mail.

On his retirement from Waterloo, he lived on Vancouver Island for some years, but he felt the health of his wife, Jessie, might benefit from returning to South Africa where more help was available. Although she died in 1994, Arthur remained in Fish Hoek, making periodic visits to his family in Canada and to Perth, Australia. It was in the Western Cape, post-apartheid, that I resumed 'in person' acquaintance with Arthur as I started to visit the 'rainbow nation' and adjacent countries. Arthur guided me by hand-drawn maps and photographs and detailed verbal instructions to localities including for *Afrochlus* in Zimbabwe (see photograph of Ngoma Kurira) and *Aphrotenia* in the Western Cape. He had immense knowledge (and profound memory) of aquatic locations and their inhabitants throughout southern Africa. In the 1990s and early years of this century, this knowledge continued to be extended as he identified chironomids, seemingly for all aquatic research groups in South Africa. Fortunately he continued to publish from his immense collections and those provided by his collaborators, although his field work was curtailed. When Don Edward (University of Western Australia) and I visited the Cape in 1998, Arthur accompanied us to the upper Eerste River in Jonkershoek. We collaborated subsequently, including over an orthoclad, *Elpiscladius*, a member of the Brillia group for which Arthur had a pharate male (Harrison & Cranston 2007). Little did we know but the then-unknown larva was in the Eerste– mining in immersed wood as its phylogeny predicted (Cranston 2008).

Ngome Kurira. Photo: P. Cranston.

My last meeting with Arthur in person was in Fish Hoek in early 2004 when he announced that he was to return to be nearer to the trusted medical facilities of Vancouver. Arthur continued to write wonderful e-mails, full of biogeographic and taxonomic insights from the vast range of organisms with which he was familiar. If a communication silence went on too long he would write simply to enquire 'where in the world was I?'. The last silence though was on his part: the precursor to his death at the end of 2007, although sadly this news was slow to spread.

Arthur Harrison was an immensely knowledgeable, insightful and very productive scientist to the end. Justifiably, his major works continue to be well cited – he was a limnological pioneer in Africa at the time the field was in its infancy. His breadth of knowledge of invertebrates and their distributions was unrivalled, and his biogeographic insights (e.g. Harrison 1978) have stood the test of time. Further, although he had a tremendous empathy with local peoples, he showed that quality biological research can be produced under most arduous circumstances. We will not see his like again.

I am grateful to Ferdy de Moor for provoking this article – I hope that my heartfelt appreciation is better late than not at all.

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Paul Freeman – an appreciation of his studies on Chironomidae

Paul Freeman, August 1960. Photo G.W. Byers

Dr. Paul Freeman died at the age of 94 at the end of July this year. To many contemporary chironomidologists he will be known principally for his contribution to untangling the taxonomy of the sub-Saharan African Chironomidae. The results were published in 4 parts in the *Bulletin of the British Museum (Natural History)*, Entomology series, between 1955 and 1958 (Freeman 1955, 1956, 1957, 1958), followed by the Chironomidae of New Zealand (Freeman 1959) and of Australia (Freeman, 1961). One third of Freeman's scientific publications (of 86 in total) concerned the Chironomidae: the others ranged across several other families of nematocerous Diptera. After his first publication on chironomid midges (adding two new species to the United Kingdom list in 1948), the remainder concerned non-European species, especially, but not exclusively, from Africa, Australia and New Zealand. Freeman apparently never visited these countries but relied on an extensive network of colleagues who sent him adult midges. Amongst these scientists based in Africa were Arthur Harrison (whose commemoration can be found elsewhere in this issue) and Margaret (K.M.F.) Scott from the University of Cape Town, who are expressly thanked at the outset of the sub-Saharan studies for their big collection of adult midges 'in excellent condition'. From the Sudan, David (D.J.) Lewis is acknowledged for much material including the asthma-inducing Nile midge that Freeman named for its collector (*Cladotanytarsus lewisi* (Freeman, 1950)). From throughout colonial Africa people sent material to London, providing the impetus for a series of short papers on particular National Parks, especially those in central Africa. This material led Freeman to understand the problematic influence of the Abbe J.J. Kieffer – whose work he described as 'very erratic', noting the 'very uncertain' concepts of genera, paucity of illustrations and redescription of the same species 'over and over again not only in different papers but even in the same one' (Freeman 1955: pp. 5–6). Although Freeman examined as many of Kieffer's types as could be found (many are lost amongst the 300 Kieffer described from the region), and he disentangled the taxonomic confusion as best he could, he concluded that more collecting was needed in type localities, picking out Kribi (tropical Cameroon) as especially important. Sadly this situation remains essentially as true today as it was during the 1950s.

Freeman's African studies were important in placing the midges of a large continent into more modern generic (including subgeneric) concepts, yet he published at a time of turn-over in our ideas and methods. Freeman used pinned adults, but prepared hypopygial mounts and drew quite detailed and accurate figures of these structures. The days of routine slide mounting of the complete adult were yet to come, but the warning that Freeman gave of the tendency of coverslips to 'distort' genitalia remains as pertinent today as then. The post-WWII years was the time when European entomologists were building on an increased understanding of the significance of the immature stages in classification – led by what has been termed the 'Thienemann school' of ecologists-turned-taxonomists. These disciples often reared their larvae to adulthood, retained the immature stages (the larvae and the quite critical pupal exuviae) and had sent the adults to Kieffer for description. The outcome became a more synthetic (and coherent) generic concept, often parallel to that derived from adults alone, but generally narrower. What is more, the Hennigian revolution was starting 'on the continent' with early adherents amongst some of the chironomid workers. One could cite Strenzke's (1960) explicit application to the chironomids (for *Clunio* and relatives), and phylogenetic thinking was evident earlier amongst the Thienemann group. Actually such thinking pre-dated Willi Hennig, as F.W. Edwards, one of Freeman's predecessors in studying Nematocera in the British Museum (Natural History), was remarkably prescient about these issues (Edwards, 1926). However Freeman's African studies were at the cusp of this transformation, and his higher level taxonomic work remained closer to the traditional adult-based scheme of Goetghebuer. This is not to criticise these studies for not being 'ahead of their time' from an ecological or phylogenetic perspective – history certainly has been kind to Freeman's species concepts: his keys work, there is little or no synonymy, and the 'tidying-up' of so much of Kieffer's African concepts was of immense value to later taxonomists. For a more modern allocation of the taxa to genera, Freeman (with some help from an acolyte) did this in the *Catalogue of the Diptera of the Afrotropical Region* (Freeman & Cranston 1980) – his last publication on the family.

After the major African publication, Freeman continued to receive additional chironomids of interest, notably an Afromontane *Diamesa* from Mount Kenya, the southernmost representative of the genus (Freeman 1964a) and the first African species belonging to the 'cool stenothermic' subfamily Podonominae (Freeman 1964b). Paul recounted to me his astonishment when he referred Arthur Harrison's specimens of this first African podonomine from Zimbabwe – the genus *Afrochlus* – to Lars Brundin who was revising the subfamily. Lars' postcard thanking Paul for the material was mailed from South Africa where Lars was already seeking more material. I am not sure if Freeman's astonishment concerned the ease with which the Head of Zoology at the Stockholm Museum could head south, or the cost, or both, but Lars was not only Head, but also in charge of the Museum's travel budget.

By this time Freeman had completed his immersion in Australasian Chironomidae – having produced first the study on New Zealand (Freeman 1959) and then his *Chironomidae of Australia* (Freeman 1961). These works differ from the African studies in several ways: the nomenclatural issues were more tractable (less of Kieffer), incompleteness of the survey material available to him was acknowledged (no Arthur Harrison!), more genera were described as new in the works (3 from New Zealand, 12 for Australia), and there was a strong visibility of some modern biogeographic thinking. Although Freeman did not publish on South American Chironomidae, he understood Edwards (1931) studies, and thus was able to recognise Neotropical elements in both New Zealand and Australia (e.g. *Stictocladius*, *Riethia*). Further, he reallocated some African species of Chironomini to groupings that he recognised and described as new from Australia, notably *Conochironomus* and *Skusella*. In the short summary in the introduction to the Australian work ('Distribution and affinities of the Australian Chironomidae'), there is scarcely an incorrect idea. Studies in both countries since Freeman's publications have extend the biogeographic ideas, notably through Brundin (1966) who encountered a much more diverse Podonominae fauna than Freeman had available to him, and to myself including with Don Edward (e.g. Cranston & Edward 1999), who delved into the 'little black orthoclads' of the austral continents. Never-the-less, Freeman's new Antipodean genera hold up, including against the molecular data becoming available.

That Paul Freeman's research on Chironomidae slowed down, albeit almost ceased in the late 1960s was due to his promotion to lead the Entomology Department of the Natural History Museum (termed 'keeper'). His leadership skills were well demonstrated in 1964 when he organised the International Congress of Entomology, held in London. Further, he had a truly hands-on involvement in the sorely-missed 'new' Insect Gallery of the Museum that lured many a child, and perhaps adults too, with a celebration of insect diversity long before the term became popular. This was all before my time – when I interviewed for a lowly technical position in the Museum in the 'summer of mass unemployment' (1971) Freeman already had occupied the top floor Keeper's Office for 3 years. However he was the Departmental representative on the recruitment panel established for some vacancies, including the one that I had applied for: assistant scientific officer in the Ornithology section. On being told that the vacancy in birds was filled already, the Keeper put the 'soft sell' on me to consider working with insects, leveraging the Museum's generous policy on work release to pursue higher education and extolling the pathways that an enthusiastic junior member of the staff could pursue as a career. My negative experiences with entomology teaching during an incomplete undergraduate degree were no match for this persuasiveness, and so I declined other offers to control yeast quality in a brewery or culture cells in a cancer research hospital. Obituaries for Paul Freeman in the Guardian (http://www.guardian.co.uk/environment/2010/aug/25/paul-freeman-obituary) and the Telegraph (http://www.telegraph.co.uk/news/obituaries/science-obituaries/7960471/Paul-Freeman.html) both point to his support for his younger staff – he is quoted as stating "It is important to look after the junior staff, as the senior staff can look after themselves". I can affirm that this was especially so in my case – shortly after entry I was given the position of technical support for the nematocerous Diptera families, already a budding career trajectory for two assistants that later became Keepers – Dick Vane-Wright and Richard Lane. After familiarisation with the Diptera families and some work with both Tipulidae and Mycetophilidae I was encouraged, surely with the guiding hand of Paul Freeman, to curate the collections of Tanypodinae (which existed as pinned adults) in the light of Sepp Fittkau's *Die Tanypodinae* (Fittkau, 1962). There was a steep learning curve – it was in German (without Google translator to assist), dealt with features that could only be seen on good slide mounts with high power magnification, and described a plethora of genera compared to what was currently in use in English language guides. The visit to London of Arthur Harrison to review the African Tanypodinae against Fittkau's work assured me not only that I was on the right track, but that I was not the only one interested in getting the subfamily into a modern framework.

When it came time to undertake a Ph.D., it was natural to stay with the Chironomidae, and I chose to work with the immature Orthocladiinae with guidance from ecologist Alan Hildrew and from Paul Freeman. This was before the days when Museums and like institutions saw a role for themselves in higher education, and certainly I was early into the system of having formal approval for Museum research to be directed towards the goal of a higher degree. As he had promised at outset, Paul Freeman was very supportive throughout the study and although not very conversant with immature stages he knew the broad and specific literature extremely well. Perhaps what has stayed with me most was his questioning of 'publishability' of research, long prior to the 'publish or perish' days. Simply put, he felt that if the taxpayer has paid for the research then there was an obligation to complete the work by publishing it. With the Keeper coming from a background in Diptera, I often heard it said that the cluster of staff Dipterists were the recipients of some favouritism. Although those were the days when budgets seemed to increase each year, and the Diptera section surely was blessed with a stream of very able technicans and some more senior recruits, Paul argued his strong support for the group was based on their publishing productivity. Amongst these was the multi-collaborative project led by Roger Crosskey's editing of the *Catalogue of the Diptera of the Afrotropical Region* and for which Paul and I co-authored the Chironomidae contribution.

My career owes its entirety to that recruitment promise made by Paul Freeman, and delivered upon – support his junior staff he surely did, by deeds and example.

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Short comment on chironomid assemblages and stratigraphy of high altitude lakes from Tibet

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Abstract

A recent chironomid record of three shallow, high altitude lakes in southern Tibet, as well as a short palaeolimnological history of one lake, are presented. The recent chironomid assemblages consisted of 13 taxa; one of the Orthocladiinae taxa recorded most likely represents a new species. In spite of the low head capsule concentration in the sediment core of Lake Karuugema, probably due to physical disturbance, redistribution and outwash of head capsules, there was a trend from assemblages composed of stenothermal/rheophilic taxa to eurythermal/limnophilic taxa. This shift in assemblage structure suggests that changes in monsoon precipitation and catchment hydrology may have influenced the habitat conditions of the chironomids.

Introduction

Our knowledge of chironomids of Tibetan Plateau, whether recent or subfossil, is fairly limited. In this short note, we aim to report the composition of recent chironomid assemblages of three shallow, high altitude lakes in southern Tibet, and to investigate a short palaeolimnological history of one of

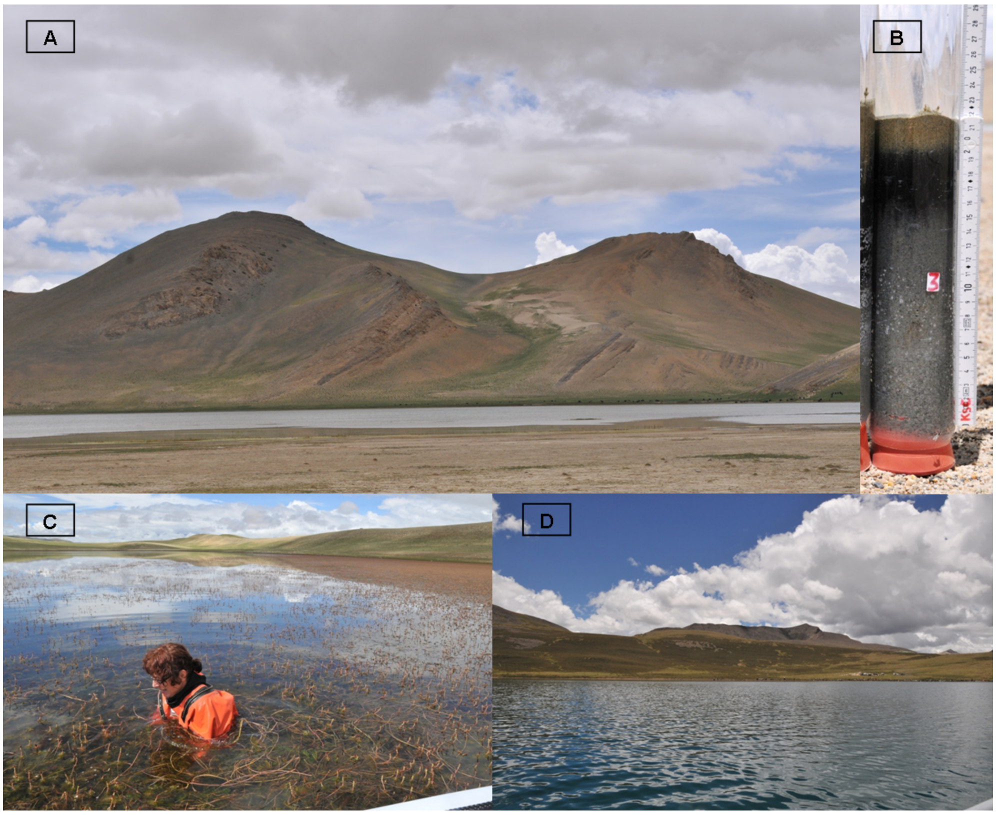

Figure 1. Photography of Lake Karuugema (A) and the sediment core (B) that was used for the chironomid analysis. The two other lakes, Sharmar tso (C) and Sijing la tso (D) are also pictured. Photo: K. S. Christoffersen.

Table 1. Basic parameters of the lakes surveyed.

Parameter	Karuugema	Sharmar tso	Sijing la tso
Coordinates	28º42.793'N 85º53.441'E	30º02.056'N 90º24.355'E	29º46.613'N 82º22.887'E
Altitude (m asl)	4,654	4,401	4,925
Average depth (m)	0.4	4.6	6.5
Conductivity (µS/cm)	855	220	18
O_2 (mg/L) (top/bottom)	8.2	9.3/7.2	2.3/2.1
pH	9.1	8.9	7.2

the lakes as it is situated in an area with extreme climate (cold winters and hot summers).

Material and methods

Three shallow lakes (Fig. 1A, C, D) located on the Tibetan Plateau were surveyed during July 2009. The basic lake parameters were measured using a multiprobe (YSI-556) and are presented in Table 1. The sediment cores were retrieved from the middle part of the lakes with a Kajak corer by hand and sectioned on site into 1 cm slices using standard equipment. Samples were collected in zip lock bags and stored cold for transportation to the laboratory.

To assess the recent chironomid assemblages, the uppermost 4 cm layers of the sediment cores were used. Furthermore, a 19 cm long sediment core of Lake Karuugema was used to carry out a palaeoecological reconstruction (Fig. 1A, B). Lake Karuugema is situated on a large plateau with small moraine hills surrounded by larger mountains. The surrounding bedrock consists of carbonate and clastic deposits of Triassic-Jurassic age. The area is seasonally frozen and the catchment is characterized by sparse, high–altitude desert vegetation. The lake is permanent but undergoes seasonal changes in water level. At the time of visit the max depth was approx. 1.2 m and the mean lake depth was estimated to be ~40 cm. The bottom consists of sandy sediment with very sparse vegetation. Calcium precipitation was observed on the plants. Given the low lake depth, wind exposure, physical disturbance and winter freezing will influence the biota directly, but also indirect influence through in-lake processes will occur.

The samples were processed for chironomid analysis according to standard methods: freeze-dried sub-samples were deflocculated for 10–20 min in 10% KOH heated to 75 ºC (Walker & Paterson 1985). The sediment was passed through a 90 µm mesh sieve. The chironomid head capsules were hand picked under a binocular microscope (40×), dehydrated in 99% ethanol and mounted in Euparal®. Identification was performed under a compound microscope at 400× magnification, with reference to Wiederholm (1983), Roback & Coffman (1987) and Brooks et al. (2007). Most of the specimens were identified to genus level, and, in some cases, to species-morphotype level. Fragments that consisted of more than half the mentum were counted as a whole head capsule, fragments that consisted of half the mentum were counted as half a head capsule and smaller fragments were

Table 2. Relative abundances of chironomid taxa recorded in the uppermost 4 cm of the lake sediments.

Taxon	Karuugema (%)	Sharmar tso (%)	Sijing la tso (%)
Procladius (H.) sp.	8	-	-
Orthocladiinae indet.	7	-	5
Paracladius sp.	8	-	-
Psectrocladius sordidellus-type	-	-	12
Smittia/Parasmittia sp.	-	11	-
Tvetenia discoloripes gr.	1	-	-
Rheocricotopus sp.	-	11	-
Chironomus plumosus-type	4	-	2
Chironomus anthracinus-type	3	67	5
Corynocera oliveri-type	1	-	-
Micropsectra sp.	66	11	29
Paratanytarsus sp.	1	-	48
Tanytarsus sp.	2	-	-

excluded. β-diversity of the sediment sequence was expressed as DCA gradient-length in SD (ter Braak & Šmilauer 2002).

Results and discussion

Recent chironomid assemblages

Altogether, 13 taxa were recorded in the uppermost 4 cm sediment layers of the three lakes sampled (Table 2). The most frequent were *Chironomus anthracinus* type and *Micropsectra* sp. occurring in all three lakes, followed by Orthocladiinae indet., *Chironomus plumosus* type and *Paratanytarsus* sp. Taxa of the subfamily Chironominae (such as *Micropsectra* sp., *C. anthracinus* type and *Paratanytarsus* sp.) dominated numerically in all three lakes.

According to Williams (1991), *Chironomus reductus* (as *Tendipes reductus*) was the most important chironomid and formed a significant part of the total benthic biomass of the high altitude saline lakes of Quinghai region (China).

During the investigation of 42 lakes of the Tibetan Plateau, species of the *Psectrocladius* genera (especially *P. sordidellus* type), *Cricotopus/Orthocladius* sp., *Paratanytarsus* sp., *Tanytarsus* spp. and *Chironomus* spp. were the dominating taxa (Zhang et al. 2007). Surprisingly, species of *Cricotopus/Orthocladius* genera were not recorded and both *Tanytarsus* sp. and *P. sordidellus* type were relatively rare in our samples. Moreover, the most abundant taxon of the present study, *Micropsectra* sp., was not recorded by Zhang et al. (2007). However, the genus *Micropsectra* is the dominant Tanytarsini in Nepalese Himalayas, especially above 2000 m asl (Roback & Coffman 1987). According to the head capsule characteristics, (dark brown head and first two antennal segments, very short spur on the antennal pedestals and short pedicels of Lauterborn organs) the morpho-type dominating in our sediment cores seems to be the same as described in Roback & Coffman (1987) and also found widespread in the lakes of the Nepalese Himalayas by Manca et al. (1998). According to the imagos found by Manca et al. (1998), this larva type could belong to a species close to *Micropsectra nepalensis* Säwedal.

One taxa of the Orthocladiinae subfamily was recorded which did not resemble known genera and which most likely represents a new species. The morpho-type called Orthocladiinae indet. (Fig. 2) has also been recorded from other lakes in Tibet (Tang, pers. comm.). The head capsule has plumose S1 setae, 5-segmented antenna and simple premandibles. Mandibles bear 3 inner teeth and 2 robust dorsal teeth, partially obscuring the inner teeth. The mentum is very characteristic with 3 pale median teeth and markedly darker lateral teeth, which are folded back (resembling e.g. *Corynocera ambigua*); there is also a little rounded basolateral tooth on the mentum, which is characteristic for *Limnophyes* and relative species. The shape of the mandibles and the mentum suggests that this species is most likely a collector-gatherer, feeding on fine organic particles of the detritus. This combination of the head capsule characteristics did not allow us to place this type to the existing genera with certainty. However, some characteristics indicate that it might be a species close to *Limnophyes* or *Thienemannia* (Cranston, pers. comm.).

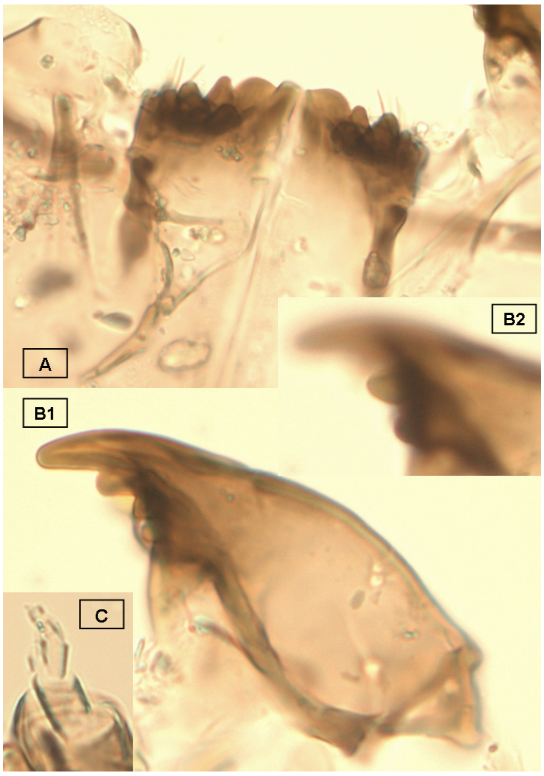

Figure 2. Photographs of the mentum (A), inner (B1) and dorsal teeth (B2) of the mandible, and the 5-segmented antenna (C) of the unidentified specimen (Orthocladiinae indet.) found in the sediment core.

Chironomid stratigraphy of Lake Karuugema

The age of the 19 cm long sediment core was not identified; however, given the high altitude of the lake and the very low amount of the fine organic accumulation in the sediment, the sedimentation rate of the lake is most likely similar to that of other arctic and/or high altitude lakes and is consequently very low. In our estimation, the sediment core may represent several hundred years. There was a great amount of fine mineral sediments, such as sand, mica and quartz throughout the sediment

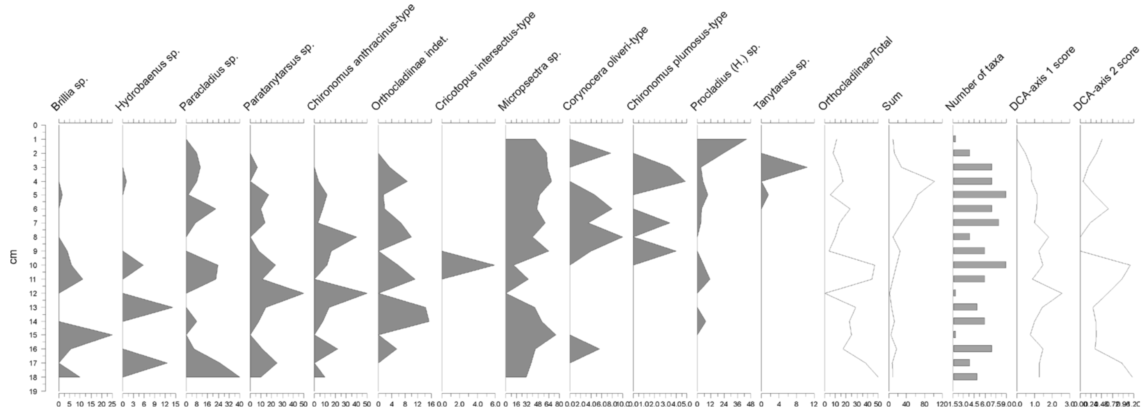

Figure 3. Chironomid stratigraphy of Lake Karuugema. Chironomid taxa are given as percentages of the total number of head capsules; sum represents the total number of head capsules per sample. Taxa are ordered according to weighed average score.

core. It is probably originated from soils and bedrock as well as from the surrounding glaciers and is transferred to the lake through its intense inlets.

In total, 13 chironomid taxa of 3 subfamilies were recorded (Fig. 3). Besides the head capsules, also the larva of *Tvetenia discoloripes* group was found in the uppermost sediment layer, however, given the only occurrence of this taxon, it was excluded from the analysis. Generally, the sediment core was fairly poor in chironomid head capsules and their density varied markedly from layer to layer. A maximum of 100 head capsules was counted per sample, however, at some layers only 10 head capsules were found. From the bottom up to 7 cm, the abundance was constantly low, without obvious oscillations. From the 7-8 cm layer, however, the abundance increased rapidly to 3-4 cm, where it reached the maximum and started to decrease to the same low abundance level as before. Taking the whole core into account, the most abundant taxa were *Micropsectra* sp. (54% of all head capsules), *Paracladius* sp. (9.5%), *Paratanytarsus* sp (8.7%), *Chironomus anthracinus*-type (8.3%), *Procladius* (*H.*) sp. (5.9%) and Orthocladiinae indet. (4.9%). These taxa were also the most constant along the sediment core, occurring at least in the half of all samples. Despite of its low total abundance, also *Brillia* sp. had high frequency occurring in 40% of all samples. Most of the above taxa have been found previously in lakes of the Tibetan Plateau (Zhang et al. 2007, Chen et al. 2009).

The species turn-over was relatively high (DCA gradient length 2.5 SD) and there was a gradual but obvious shift in taxonomic composition. Most of the taxa were represented throughout the sediment core, however, some taxa were characteristic at the base, while others for its upper, most recent portion. Orthocladiinae *Brillia* sp. and *Hydrobaenus* sp. occurred mainly towards the base, for which also very low abundance was characteristic. Species of the genus *Hydrobaenus* are mainly cold stenothermal, but ecologically rather diverse, dwelling the littoral of oligotrophic lakes, ponds, puddles, rivers and streams. Some species aestivate during the summer season (Sæther 1976). Species of the genus *Brillia* are considered to be primarily rheophilic, but also occur in littoral and hygropetric zones of lakes (Wiederholm, 1983). High frequency of both taxa mentioned in the bottom layers linked with low total abundance could be an indicator of strong influence of inlet streams.

On the contrary, taxa only occurring in the upper portion of the core were Chironominae and Tanypodinae, such as *Corynocera oliveri* type, *Chironomus plumosus* type, *Tanytarsus* sp. and *Procladius* (*H.*) sp. Moreover, in these layers, the proportion of Orthocladiinae was lower then in the deeper layers. Appearance of Chironominae (especially *C. plumosus* type) and Tanypodinae preferring fine sediments, linked with increasing abundance suggests lower intensity of inlet streams, higher sedimentation rate, more stable environment, supporting higher abundance and occurrence of taxa preferring fine sediments. There is likely to be a linkage of inflow intensity and the amount of monsoon precipitation, found by Morrill et al. (2006) in another Central Tibetan lake. They found significant differences in monsoon precipitation linked with lake depth since early Holocene, with recently increased precipitation following a late Holocene dry period, which is in accordance with our results.

Conclusion

The new records of chironomids from the three studied lakes extend the taxa-list of the region and will be valuable for taxonomists and limnologists aiming for future studies in high altitude lakes in

Tibet. In spite of the low head capsule concentration in the sediment core of Lake Karuugema, probably due to physical disturbance, redistribution and outwash of head capsules, there was a trend from assemblages composed of stenothermal/rheophilic taxa to eurythermal/limnophilic taxa. This shift in assemblage structure suggests that changes in monsoon precipitation and catchment hydrology may have influenced the habitat conditions of the chironomids.

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Chironomidae (Insecta, Diptera) from Alto Paranapanema Basin, southeastern Brazil

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Abstract

We investigated the community of Chironomidae from three rivers belonging to the same river basin in Southern Brazil. Our objective was to analyze if the Chironomidae communities from rivers of the same basin were similar and relate this to land-use and water quality variables. Samples of insects were taken using artificial substrate baskets and left 44 days in the field for colonization during the dry season in 2002. Study reaches with the relevant land-use category present for at least 500 m along both river banks above and alongside the study reach were selected and land-use, terrain slope of the river basin and chemical and physical variables of the water were analysed. Faunal data were analyzed by number of individuals, richness of genera and community indices. Statistical analyses were performed in order to investigate the relationship between abiotic variables and the Chironomidae communities. Twenty-two genera were identified; *Rheotanytarsus* (Thienemann & Bause) was the most abundant in all assemblages. Some genera showed preferences in their distribution, and were observed in only one of the rivers. Land-use and slope of the terrain were similar for all rivers, while the water quality variables were different for the Taquari River compared to the two other sites. This may explain the differences in the Chironomidae community observed for this locality.

Introduction

The ever increasing human population has induced a need for more agricultural land to provide food and sources for bioenergy. The Southeastern Brazilian region is now over-exploited as a result of recent deforestation (also of the riparian forests) and replacement by crop plantations or pastureland for cattle (Loureiro 1998).

The importance of the riparian forest to aquatic systems and their biota has been described extensively (Casatti et al. 2006; Matthaei et al. 2006). The usual conclusions in such studies focus on the negative aspect of the conversion of riparian forest to agricultural land (Cetra and Petrere 2007; Galbraith et al. 2008). Their presence is important for the maintenance of temperature equilibrium, as continous food supply for aquatic animals, as source of organic material and stabilization of stream banks (Marinho Filho and Reis 1989; Rodrigues 1992; Aguiar et al. 2002).

Because of their widespread distribution and the sensitiveness to pollution observed for some species, chironomids are used worldwide as biological indicators of environmental quality (Bacey and Spurlock 2007; Chessman et al. 2007; Smith et al. 2007). Several projects around the world demonstrate their application as bioindicators (WRC 2001; MDFRC 2007).

In Brazil, several studies have been conducted in order to analyse the influence of the surrounding land-use on the aquatic fauna (Sonoda 2005; Corbi and Trivinho-Strixino 2008). The interaction of terrestrial and aquatic systems is often analysed in small watersheds in an attempt to reduce the influence of extraneous environmental factors that, consequently, make it more difficult to detect the effects of differences in catchment land-use (Siqueira and Trivinho-Strixino 2005; Roque et al. 2008). Studies conducted on large Brazilian aquatic systems are rare in the scientific literature; as the velocity of river flow and sudden changes in the water level are some of the difficulties encountered.

As stated by Vinson and Hawkins (2003), streams within similar biomes support similar number of taxa. This implies that the physical and biological environment of streams are a strong selective force on insect stream communities.

The rivers studied here are similar with regard to land-use and cover, terrain slope, river channel morphology and climate. Our objective was to analyze if the Chironomidae communities from

Figure 1. Map of São Paulo State, with the location of the sampling sites (white dots). The insert shows the location of São Paulo State in Brazil.

rivers of the same basin were similar and if possible to explain reasons for differences if these were found.

Material and Methods

Study Area

Our study was carried out in the Alto Paranapanema River basin, State of São Paulo (Brazil) (Figure 1), which has a drainage area of 22,550 km^2. The rivers selected for the study were Paranapanema, Apiaí-Guaçu and Taquari; a description of the sampling sites is given in Table 1.

Based on previous methodological studies (Lammert and Allan 1999; Solimini et al. 2000; Cuffney et al. 2002), the following criterion was used when selecting our study reaches: the land-use analyzed (pasture or forest) had to be present for at least 500 m length along both river banks, both above and alongside each study reach (Figure 2).

Sampling procedure

Six baskets (30 cm × 15 cm × 8 cm, mesh size 2.0 cm) filled with artificial substrates [clay rocks of particle size 16-32 mm, classified as coarse gravel after Gordon et al. (1992)] were placed under water along the river banks during the dry season. After the 44 days of colonization, the baskets were removed, placed in 80 % alcohol and carried to the laboratory. There, they were washed under flowing water over a sieve of mesh size of 0.2 mm. The chironomid larvae were sorted and identified to genus following the key provided by Trivinho-Strixino and Strixino (1995).

Land-use and water quality variables

LANDSAT imagery was used to generate digital maps from which percentages of land-use distribution and terrain slopes upstream of the sampling areas were calculated.

Chemical and physical variables were surveyed by Salomão (2004) who analyzed the following water variables: fine suspended solids (FSS), coarse suspended solids (CSS), total suspended solids (TSS), water temperature, pH, conductivity, dissolved oxygen, dissolved organic carbon, dissolved inorganic carbon, free CO_2, chloride, NO_2, NO_3, NH_4, SO_4, Na, K, Mg, Ca (Table 2).

Data analysis

The chironomids were analyzed as total number and percentage of individuals per genus, number of genera, taxon richness, Shannon-Wiener's diversity index, Margalef's richness, evenness index (Odum 1984; calculated using 2 as the base for the logarithm) and Sørensen's modified index (Dise-

Table 1. Basic description of the sampling sites in the Alto Paranapanema River Basin.

Parameter	Paranapanema River	Apiaí-Guaçu River	Taquari River
Area of sub-basins (km^2)	710.39	899.74	828.08
Depth (m)	0.5	1.4	1.8
Width (m)	17.5	15	17
Latitude	23º90'79"	23º93'11"	23º96'91"
Longitude	48º25'96"	48º65'78"	48º94'61"

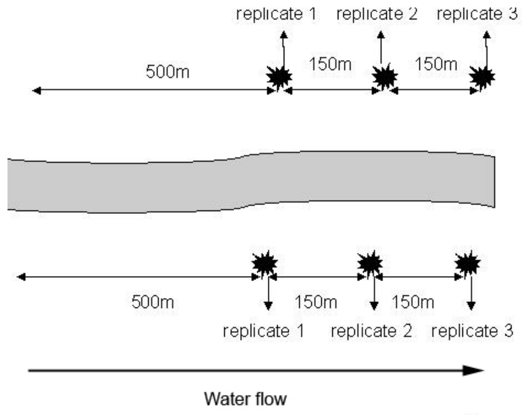

Figure 2. Schematic drawing of the experimental design in each of the three rivers. Colonisation baskets were placed along both river margins at each of the three sampling points at all study sites.

rud and Ødegaard 2007) that permits the integrated analysis of all sites.

The X^2 test was used to analyze the influence of location (rivers) on individual abundance and diversity indices. We utilized Pearson's correlation and two-way ANOVA to integrate abiotic and biotic data, to analyze the interactions among them. All statistical analyses were performed using SAS® (version 9.1.2, The SAS Institute, Cary, NC) (Wright and Covich 2005).

Results

Watershed and water features

The analysis of land-use and terrain-slope showed similar patterns at the sampled rivers within the watershed (Table 2); native vegetation was the main land-use followed by pasture and areas of reforestation. The percentage of the adjacent land-use was slightly different for the Apiaí-Guaçu River, showing the least reforestation (6.2 % of the area) and the most pasture land-use (39 %) when compared to the other rivers (Table 2).

The slopes were divided into seven classes with

Table 2. Main land-use and main slope-class of the river sub-basins upstream of the sampling sites.

Land-use/ terrain-slope	Parana-panema	Apiaí-Guaçu	Taquari
Pasture	22.6%	39%	25.3%
Native vegetation	56.7%	43.7%	47.2%
Reforestation	16.2%	6.2%	17.9%
<2 %	21.4%	23.2%	21.1%
5% - 10%	14.1%	13.4%	13%
10% - 15%	16.4%	12.7%	17.7%
15% - 45%	41%	40.3%	41.9%

the four most common are shown in table 3. All rivers showed similar values with 40-42% of the area upstream of the sampling sites belonging to the fourth class (15 % to 45 % slope). About 22% of the area belonged to the first class with less than 2% slope.

Despite the similarities in land-use and terrain-slope, the chemical and physical variables of the sampled rivers (Table 3) showed great differences with higher values for most variables in the Taquari River. The ANOVA identified significant differences in some of the water quality variables between sites and identified SO_4, Na, FSS, CSS, and TSS as characteristic for the Taquari River.

The Paranapanema River showed the lowest values for most variables, the ones which showed statistically significant differences to the other sites and characterized the river were pH, CO_2, NO_2 and Cl. Variables such as conductivity, DIC, HCO_3, NO_3, K, Mg, Ca showed statistical significant differences between all the rivers.

Chironomidae fauna

A total of 2,642 individuals of Chironomidae were collected, comprising twenty-two genera. The highest number of individuals was collected at the Paranapanema River (1,065 specimens). The generic richness was quite similar at the three sites with seventeen genera collected from both the

Table 3. Values of chemical and physical variables of water from the rivers studied (sed = sediment).

Parameter	Parana-panema	Apiaí-Guaçu	Taquari
FSS (mg sed/L)	8.0	28.3	93.7
CSS (mg sed/L)	1.0	3.3	13.4
TSS (mg sed/L)	9.0	31.7	107.1
TEMP (^{o}C)	19.6	19.8	20.1
PH	6.5	7.3	7.3
COND (µS/cm)	31.0	81.0	111.7
OD (mg/L)	8.5	8.6	8.1
DOC (mg/L)	4.5	4.9	4.0
DIC (mg/L)	7.3	32.3	40.0
Cl (µM)	96.7	53.7	50.5
NO_2 (µM)	0.0	22.1	23.8
NO_3 (µM)	19.0	14.6	29.2
SO_4 (µM)	8.0	11.9	75.2
Na (µM)	110.3	99.8	218.1
NH_4 (µM)	1.0	0.6	1.9
K (µM)	13.4	34.1	50.4
Mg (µM)	36.6	129.0	156.9
Ca (µM)	33.0	196.8	258.7

Paranapanema River and the Apiaí-Guaçu River; and 15 genera from the Taquari River (Table 4).

Chironominae was the sub-family with highest number of individuals and also the greatest taxon richness; Tanytarsini was the most abundant tribe in all rivers. This was due to the high number of *Rheotanytarsus*, the numerically dominant genus, always representing more than 59 % of the assemblages and reaching 71.4 % in the Taquari River. In contrast, Procladiini was the rarest tribe represented only by two individuals belonging to *Djalmabatista* at the Apiaí-Guaçu River.

At the Paranapanema River, *Nanocladius* and *Ablabesmyia* were frequent too, and at the Apiaí-Guaçu River, *Nanocladius* was the second most abundant genus after *Rheotanytarsus* (Table 4).

Some genera were rare in all environments: *Chironomus* and *Endotribelos* were sampled only at the Paranapanema River, while *Tribelos* and *Djalmabatista* were found exclusively at the Apiaí-Guaçu River. The Taquari River had no unique taxa.

The communities from the Paranapanema River and the Apiaí-Guaçu River had similar values for diversity and evenness indices (Table 5), the differences seen in the richness index was due to the greater number of individuals in the Paranapanema assemblage. Taquari's community showed lower values for all indices due to the marked dominance of *Rheotanytarsus*. The Sørensen's modified similarity index indicated a medium level of similarity among communities from the three rivers (S=0.55).

Table 4. Relative distribution (%) of genera in each community.

Genus	Paranapanema	Apiaí-Guaçu	Taquari
Beardius	2.35	3.71	0.33
Chironomus	0.56	0.00	0.00
Endotribelos	0.09	0.00	0.00
Fissimentum	0.28	0,00	4.10
Goeldichironomus	0,00	0.15	0.00
Harnischia	0.85	0.15	1.33
Lauterborniella	1.97	1.19	0.00
Parachironomus	0.00	0.15	0.11
Pol. (*Asheum*)	3.85	0.59	0.33
Pol. (*Polypedilum*)	0.00	1.34	1.99
Stenochironomus	0.09	0.00	0.11
Tribelos	0.00	0.30	0.00
Rheotanytarsus	59.81	59.50	71.43
Corynoneura	3.38	4.15	3.54
Lopescladius	0.19	0.00	1.33
Nanocladius	10.33	16.77	3.32
Ablabesmyia	11.27	1.48	9.63
Labrundinia	2.54	8.01	1.11
Larsia	0.19	0.15	0.22
Nilotanypus	0.85	0.59	0.00
Pentaneura	1.41	1.48	1.11
Djalmabatista	0.00	0.30	0.00

Table 5. Biotic indices of the communities from the three rivers.

River	Diversity	Richness	Evenness
Paranapanema	0.74	1.59	0.18
Apiaí-Guaçu	0.75	1.70	0.18
Taquari	0.53	1.43	0.13

Discussion

Watershed and water features

As the aquatic ecosystems are tightly coupled with their catchments (Maloney et al. 2008, Lamberti et al. 2010), the selection of three rivers from the same basin permitted us to minimize variation in catchment-scale features such as surrounding land-use, terrain-slope, climatic conditions, and channel morphology. Such variation can confound the influence of water quality on the aquatic biota and should be eliminated if possible. Some studies have emphasised the great importance of land cover as the main factor defining the structure of the aquatic entomofauna (e.g. Corbi and Trivinho-Strixino 2008). Our analysis of land-use upstream of the sampling sites (Table 2) showed minimal differences among the rivers and led us to believe that the dissimilarity in chironomid community structure was influenced by other factors.

Despite similarities in catchment features, water quality variables showed great differences between the rivers, where the Taquari River showed higher values of NO_3, SO_4, K, Mg, Na and Ca (Table 3). Conductivity is highly influenced by a range of chemical variables. For the Taquari River, sodium, magnesium and calcium ions were the ones with highest concentrations, however, the statistical analysis only returned a positive association of sulphate to this river. High values of limestone and sulphate are recorded in the soil surrounding the Alto Paranapanema River basin (Milléo et al. 2008; CPRM 2009) and this might explain the high values of calcium ions and sulphate measured there.

There is restricted urban development in the area, thus, the main source for the high levels of ions probably is related to local agricultural practice. However, additional studies probably should be conducted to explore the source of the high ion-level at this site. The high level of TSS at the Taquari site probably is not controlled by land-use as the watershed showed the same percentage of forest cover as the Paranapanema River, where the quantity of suspended solids was significantly lower (10 % of the TSS recorded at Taquari).

Chironomidae fauna

The subfamilies Chironominae, Orthocladiinae and Tanypodinae are quite common in Neotropical streams (Sanseverino and Nessimian 2008). The Chironominae frequently are described as the most abundant Chironomidae subfamily in the region (Suriano and Fonseca-Gessner 2004; Trivinho-Strixino and Strixino 2005; Mendes and Pinho 2009) while Orthocladiinae is the most common subfamily in lotic systems with high frequency in rapids of streams and rivers (Coffman and Ferrington 1984, 1996).

The genus *Rheotanytarsus*, showed numerical dominance in all three rivers, with a remarkable abundance of individuals at the Taquari River; however no statistical significant correlation to any water variable was made that could explain the high abundance. The reason for the high abundance is not quite clear, but authors have found a positive relationship of the genus to high pollution level (Simião-Ferreira et al., 2009) of water bodies at Anápolis (GO) in the Brazilian Cerrado biome. On the other hand, authors have also established a direct correlation of its presence to good water-quality environments (Corbi and Trivinho-Strixino, 1999). It is described as typical of lotic environments and prefers rapid flux water due to its filtering habits (Higuti and Takeda, 2002).

A high abundance of *Rheotanytarsus* was also recorded by Sonoda et al. (2009) in the study of the influence of land-use on the chironomid fauna of rivers of São Paulo State, Southeastern Brazil. In this study, the high abundance of *Rheotanytarsus* showed no correlation to land-use, occurring in rivers with both adjacent forests and pasture-land. Hepp et al. (2008) also recorded a high proportion of *Rheotanytarsus* in rivers of southern Brazil. In contrast, Jorcin and Nogueira (2008) found no *Rheotanytarsus* but a high number of *Djamabatista* in the waterfall of the Paranapanema reservoir. A high abundance of *Djamabatista* larvae was also recorded by Trivinho-Strixino and Strixino (2005) who analyzed the Chironomidae community in the Ribeira River, spatially near the Paranapanema River Basin. *Djamabatista* larvae are good swimmers and prefer shallow water (Nessimian and Henriques-de-Oliveira 2005). As the rivers here studied showed no waterfall and rapids, this might explain why larvae of this genus were relatively rare in our study where only two individuals were sampled in the Apiaí-Guaçu River.

As seen in our study, once the main landscape variables are fixed the observed divergence in the chironomid communities can be associated with significant differences in water quality variables. A genus that exemplifies this relationship well is *Nilotanypus*. The genus is considered to be intolerant to pollution (Smith and Cranston 1995) and its absence from the Taquari River could be a response to the poorer water quality at this site. Some Brazilian studies has shown how water quality variables can influence the entomofauna. Melo (2009) found distinctly different macroinvertebrate communities in nearby sites (streams) in Southeastern Brazil and concluded that these were a result of different levels of conductivity and stream size (orders). Futhermore, Roque et al. (2010) analyzed the Chironomidae fauna from 61 streams and discussed the importance of both local (conductivity) and broad (riparian forest cover) scales on the aquatic community composition in streams of São Paulo State. They observed a negative relationship between the percentage of riparian forest and generic diversity. Similar results have been reported from analyses of land-use and macroinvertebrate diversity in southeastern Brazil (Corbi 2006; Corbi and Trivinho-Strixino 2006; Sonoda et al. 2009).

A lower generic richness and a dominance of only one taxon was observed at the Taquari River. Such characteristics are often observed in impacted systems (Stone et al. 2005) and influence the values of biotic indices. This is also seen in our results (Table 5). The use of diversity and richness indices as appropriate metrics to evaluate stream conditions is defended by Suriano et al. (2010) who analyzed 49 metrics to assess the conditions of streams of São Paulo State. Similarity measures are among the most common (and accepted) metrics for comparing sites or samples (Diserud and Ødegaard 2007). The value of the Sørensen index indicated a medium degree of difference among the communities analysed here.

In conclusion, this study demonstrates that rivers belonging to the same basin, with similar land characteristics may not necessarily support similar midge communities and that poorer water quality can be reflected in the chironomid community.

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Short Communications

Aberration in *Chironomus* pupa

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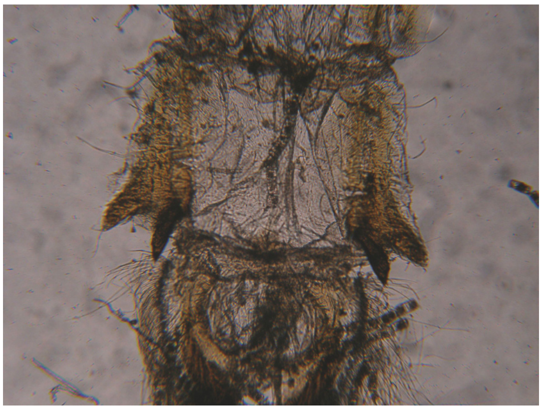

I have long been interested in chironomid pupal aberrations (Langton, 1989) as indicators of how new forms can arise in an animal which is unable to compete in Darwinian terms. The photograph shows a *Chironomus nudiventris* pupal exuviae with four spurs on segment VIII; two dorsal, two ventral. The dark spurs are the usual ventral spurs for the genus and the light coloured ones are dorsal, the spurs diverging from each other by about 90° in the unmounted specimen. I have also recently seen a few *Chironomus plumosus* male exuviae from one site without any trace of genital sacs. The adults obviously eclosed successfully, but what had they got (or not got) at the back end?

Reference

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Cricotopus annulator with blue wing tips

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Daniel Mengella took a number of photographs of a chironomid in mid-October 2009 by his pond in Yorkshire, England, showing distinct blue tips to the wings. He mailed me for an identification and received the standard reply: please send a specimen. On April 28, 2010 he again noticed chironomids with blue tips to the wings, photographed them, and sent specimens for identification. The species is *Cricotopus (C.) annulator,* despite the strange appearance of the thoracic dorsum in the photograph. In alcohol and when mounted in Euparal, the blue disappears. Presumably it is a diffraction colour. I have never observed this phenomenon and wonder how widespread it is in the Chironomidae. CHIRONOMUS readers are encouraged to look out for it and report their findings to the journal.

(The camera used was a Nikon D90 with a 80-200mm lens, which includes optical stabilisation)

Trends in Chironomid Research

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Each model organism is favoured for its own forte, for instance, the Zebra fish, the Chick, *Xenopus* and *Aplysia*, all have been attracting a larger community of biologists for developmental biology, neurobiology and behavioural studies. Whereas, *Drosophila* could succeed in keeping researchers glued to vast areas of biological research apart from genetics for more than a century. On the other hand, chironomid midges have been witnessing a fluctuating research history. During their early days they were employed as pioneering models in developmental biology and chromosome studies. However, later the attention shifted towards studies on taxonomy and systematics and further the course of flow of chironomid research changed its trend to ecology, palaeolimnology and ecotoxicological research. In taking stock of the literature highlighting the use of *Chironomus* sp. as a model, there seems to be no room for divergent opinions that chironomid midges could never bag a top rank involving research driven by 'model-oriented' agenda. As evident from the numerical count of publications on midge-centered research topics, as models, they have always been restricted to only few groups of workers.

In an attempt to look at the trend of research using chironomid midges as model organisms, we have carried out a thorough sampling of literature with the help of the bibliography listed by Hoffrichter (2000-2009) that appeared in the issues of *Chironomus* Newsletters as a standard for the survey. In the interest of brevity, we have considered the past one decade i.e. between 1999 and 2008 as a reference for the evaluation of the number of publications encompassing the diverse areas of chironomid research.

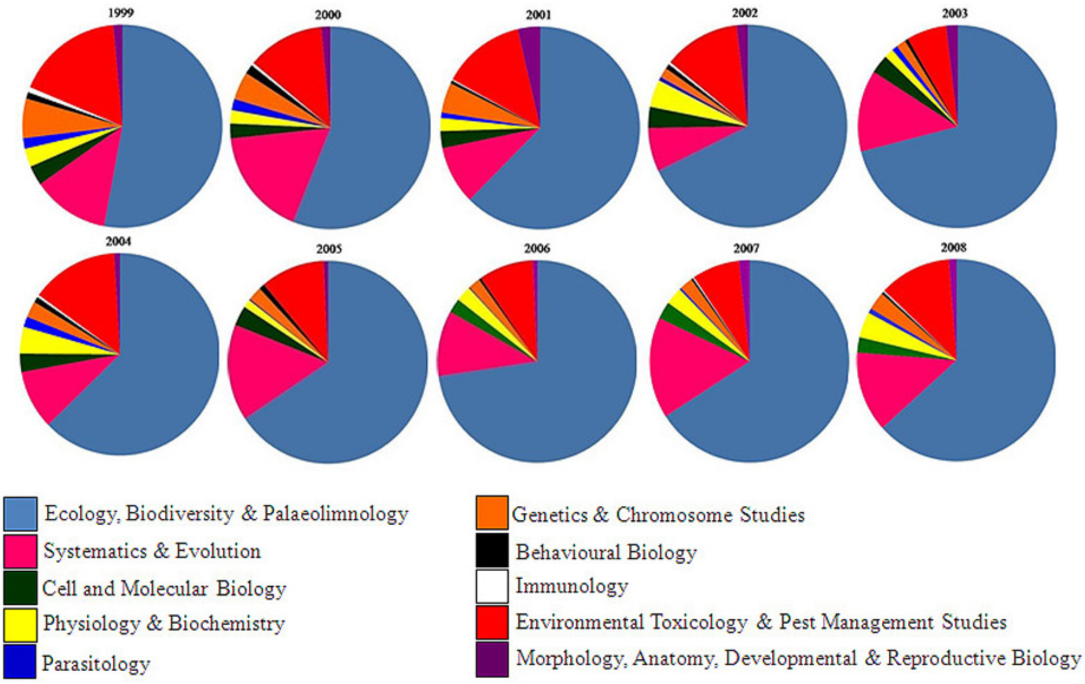

Figure 1. Percentages of covered topics in Chironomidae literature

The present survey reveals the dominance of mainly three distinct, inter-dependent interests in chironomid models which is reflected through their number of publications (Fig. 1). Throughout the decade under the present consideration, unequivocally, studies focusing on the ecological role of chironomid midges in intra-faunal and faunal-floral interactions and palaeolimnology have topped the rank. Being a major group of macro invertebrate fauna, reports addressing their role in different aquatic ecosystems have been evolving even prior to 1999 and have always had a major contribution in the community of Chironomidologists. Concomitantly, investigations concerning climate change and other environmental issues stimulated a large group of palaeolimnologists to adopt midges as test animals for studies predicting the past and future palaeoclimatic changes. The second largest field in the list is environmental toxicology that has grown along with the growing concern for ecological issues. Being one of the potent bioindicators of the aquatic biota, midges have become one among the few widely studied models for the examination of cause and effect studies in response to different kinds of toxic stressors circulating in the habitat. The third interest of Chironomidologists that has modestly frequented the score is the branch of systematics and taxonomy. With more and more new species of *Chironomus* being explored, chironomid taxonomy too saw its rise. However, it must be emphasized that in the present scenario, the list of chironomid taxonomists is fewer than what may be actually needed by the *Chironomus* research community. In most cases, prior knowledge of taxonomy is a pre-requisite before proceeding with investigations at the molecular level that involve DNA barcoding, molecular phylogeny and the like. This fact rings an alarm that in the near future, a huge number of species of *Chironomus* may become extinct before exploration, thus calling for the need of well trained taxonomists. The other branches like cell and molecular biology, genetics and chromosome studies, morphology and anatomy, developmental and reproductive biology display a uniform trend with a moderate score throughout the past ten years. In contrast, publications on immunology, parasitology and behavioural studies have been extremely scanty.

This article that aims to highlight the quantitative estimation of the progress of chironomid research indicates that although possessing versatile potential, the chironomid midge has failed to embrace all the major areas of biological research. The technique-driven age of the 21st century demands the broadening of research horizons that will in turn popularize the chironomid midge as a model organism. Nevertheless, the interdependent nature of ecology, systematics, paleolimnology and environmental toxicology that causes them to intersect, points out a promising continuum and growth in these studies using midges, which is indeed a boon for the understanding of implications of the changing ecological scenario of the globe as a whole.

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News from chironomid research in India, University of Burdwan

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The research project, TAXONOMY OF DIPTERA under the aegis of the “All India Coordinated project on Insect Taxonomy” funded by the Ministry of Environment & Forests, Govt. of India under Prof. P.K. Chaudhuri & Dr. A. Mazumdar implemented in 2002 is in progress in its second phase. New habitats have been explored and several new species have been identified that will be published in due course. Assistance in the form of material and literature is solicited for its successful execution.

M.Phil. thesis: Effect of temperature and food on the developmental period of *Glyptotendipes barbipes* (Stæger), an abundant pond-dwelling chironomid.

Mrs. Sharamita De (Chakravarti)
Supervisor: Dr. A. Mazumdar,

Summary: The midges were grown under three temperature regimes (22˚C, 26˚C, 30˚C) and food ratios [Ratio (I) 25 mg fish food and 2.5 mg Baker’s Yeast in 12 ml (IX) Martin Solution and Ratio, (II) 50 mg fish food and 5 mg Baker’s Yeast in 12 ml (IX) Martin Solution]. Photoperiod was maintained as 14:10 (L: D) within the rearing chamber. Correlating with studied parameters indicate that the maximum growth occurred at 30˚C and with food regime (i). With food regime (ii) results were not very encouraging.

New Chironomidologist:
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Implementing interactive identification keys is important for accurate and effective chironomid identification

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Computer based interactive identification programs have been developed recently, for instance the CD-key of Klink and Moller-Pillot (2003) and other identification programs developed using Lucid key software available on http://www.lucidcentral.com. They all assist the identification of chironomids in a flexible and interactive manner by means of classical dichotomous or multiple access keys. This helps a lot, but unfortunately those programs don't allow the easy extension of their content. An attempt to do so was made in Plank (2010) with the development of the Chironomidae Identification Program CHIP, whose content pages can be altered in a similar manner to Wikipedia. But CHIP doesn't have the facility to combine work online and, for instance, share photographs with other authors.

An EU-Project "Key to nature" funded three years ago focused on paper-free identification tools for use within schools and universities across Europe, in which a few new alternatives were developed for determinations that can be shared and improved online. Based on contributions having a creative common license on the one hand, and a Wiki-platform with shared image repositories on the other, authors can contribute either keys restricted to editing or with open collaboration. Currently most available keys on that platform are just for plants, but hopefully over time more scientists will consider contributing identification keys for chironomids, making chironomid keys accessible also to expert assessment or monitoring.

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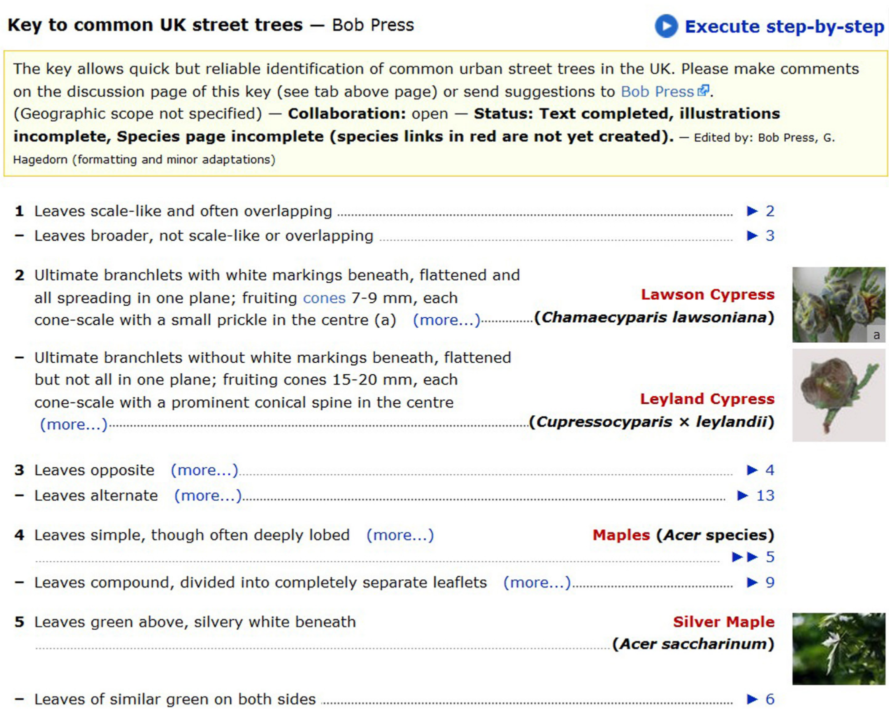
Plank, A. 2010. *Chironomid-based inference models for Tibetan lakes aided by a newly developed chironomid identification key.* Thesis, Freie Universität Berlin. Available from: http://www.diss.fu-berlin.de/diss/receive/FUDISS_thesis_000000017941.



Screen shot of a classical determination key on www.keytonature.eu with the possibility of step-by-step identification (not shown).

Announcement and Invitation to the

18th International Symposium on Chironomidae
Trondheim Norway 4-6 July 2011

Dear colleagues,

The NTNU Museum of Natural History and Archaeology would like to invite you to the 18th International Symposium on Chironomidae.

The Symposium will take place at the Norwegian University of Science and Technology in Trondheim, July 4-6, 2011, with a post-conference tour on July 7.

We attempt to bring scientists and students from all over the world to Trondheim and hope many of you will consider this a great opportunity to present and discuss recent developments in Chironomidae research.

Read more about the conference and register your interest by using the preregistration form at the symposium website (http://www.ntnu.no/vitenskapsmuseet/chironomidae-symposium). Please visit this site for regular updates on the available scientific and social programs. Preregistration will be open until the end of 2010 while formal registration will start in January 2011. As we depend on the preregistration to estimate the approximate number of delegates, we kindly ask you to preregister as soon as possible. This will also give us an opportunity to inform you directly about updates in the symposium program per e-mail.

Looking forward to see you in Trondheim!

For inquiries, please contact the symposium committee: Chiro2011@vm.ntnu.no

The Symposium Committee,
Elisabeth Stur, Torbjørn Ekrem & Kaare Aagaard.

A World Catalogue Of Chironomidae (Diptera). Part 2. Orthocladiinae

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[2]National Museum of Ireland, Kildare Street, Dublin 2, Ireland

Part 2 of A World Catalogue of Chironomidae (Diptera) is expected to be published in early 2011 (probably April or May). The number of pages will be approximately 1,000 and due to the large size will be printed in two sections (A & B) of about 500 pages each. The two sections will each weigh about 1.3 to 1.4 kg and to save on postage costs each section will be posted separately. A quote from the publisher has not yet been requested but the price for Part 2 copy is likely to be about Euro 84 to which the relevant amount of postage must be added. It is possible therefore to estimate the postage cost (Airmail only) to anywhere in the world. The estimated total cost of a copy of Part 2 plus postage and packing can be determined from the table given below.

	Ireland (incl. Northern Ireland)	Britain	Europe	Rest of the world
Postage	Euro 16.00	Euro 26.00	Euro 26.00	Euro 36.00
Catalogue Part 2	Euro 84.00	Euro 84.00	Euro 84.00	Euro 84.00
TOTAL	Euro 100.00	Euro 110.00	Euro 110.00	Euro 120.00

The Catalogue is being published by The Irish Biogeographical Society in association with The National Museum of Ireland. Once Part 2 of the Catalogue is published and available for sale it will be announced on the website of the Irish Biogeographical Society: http://www.irishbiogeographicalsociety.com/

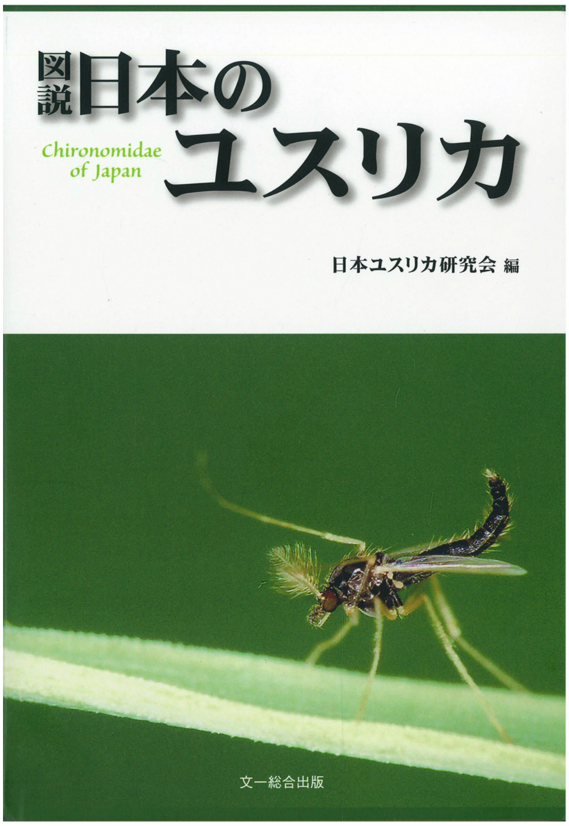
The International Electronic Payment System from your Bank account to our Bank account (The Irish Biogeographical Society account) worked very well for Part 1 and will be used for Part 2. Money received from the sale of Parts 1 and 2 will be used to help pay some of the cost of Parts 3 and 4.

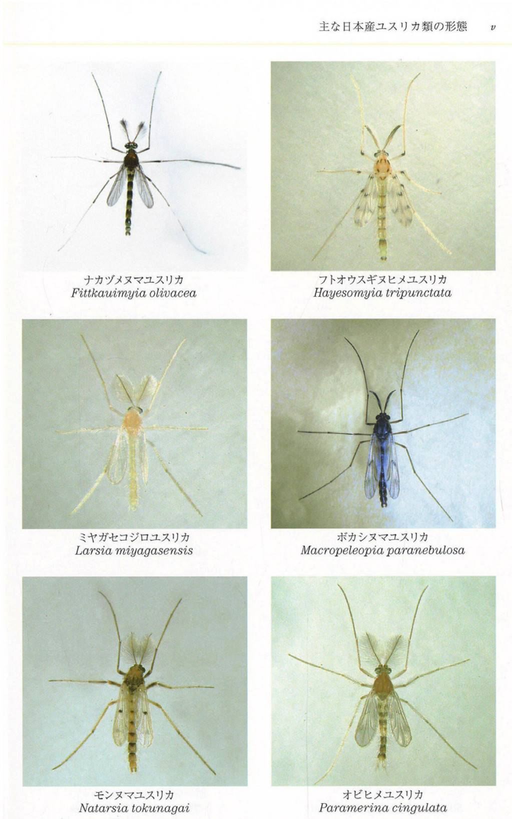
Anyone wishing to order a copy of either Part 1 or Part 2 can contact the senior author, Dr. Patrick Ashe by e-mail: patrick.ashe@upcmail.ie

New book

Illustrated guide to the Chironomidae of Japan

This new comprehensive book on Chironomidae contains detailed descriptions of morphology and methodology (collection, rearing, mounting, SEM, molecular taxonomy) as well as notes on habitats, ecology and the use of chironomids as biological indicators. The book also includes keys to subfamilies, genera and main species, diagnoses and numerous detailed drawings and photographs of adult males, larvae and pupae.





Front and sample page of *Illustrated guide to the Chironomidae of Japan.*

Language: Japanese
Editor: Japanese Association of Chironomidae Studies (JACS)
Editorial board: S. Kondo, M. Yamamoto, T. Kobayashi, K. Hirabayashi, and K. Kawai
Book size: A5 (W 148mm, H 210mm), 356 pp. + color plate 48 pp.
ISBN 978-4-8599-1172-3
Price: ¥ 12,600 (including sales tax 5%)
Publisher: Bun'ichi-sôgô-shuppan Ltd.
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CURRENT BIBLIOGRAPHY: 21 OCT. 2009 - 15 NOV. 2010

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In addition to supplements to the last two preceding years the publications of the present year are shown: almost one citation per day, which gives the average speed of publishing with regard to chironomids. The compilation was achieved, as usual, from many sources: databases, tables of contents of journals, references and citations of papers, inspection of many periodicals, lists and pdf's provided by authors (thanks to you!). In particular, publisher issued search alerts proved to be rich in results. As a rule, only printed titles are reported here with the occasional, but obviously increasing, exception of online-only journals (PLoS or BioMed Central journals, e.g.). Titles announced "in press", even with available DOI numbers, are not considered before printing. In general, online information should be retrieved elsewhere; best check the chironomid home page for eventual references regularly, or use individual websites with a host of chironomid-related data. Publications using chironomids as prey or food for animals are not treated comprehensively; in particular, studies with frozen midge larvae only for use to feed experimental animals are totally disregarded.

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