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# An updated checklist of Chironomidae (Diptera) from the Amur River basin (Russian Far East)

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**ABSTRACT**

A long-term study implemented in the Amur River basin enabled us to generate an updated checklist of 606 valid species in Chironomidae (Diptera) which are composed of 129 genera and six subfamilies, with 98 (17%) described new species belonging to 46 genera. Among the 98 recently described species, 46 ones (45%), were considered as possible endemics and sub-endemics. The numbers of species and genera by subfamilies is as follows: Podonominae (3 species; 3 genera), Tanypodinae (17; 9), Diamesinae (25; 11), Prodiamesinae (7; 3), Orthocladiinae (307; 57) and Chironominae (247; 46). The higher numbers of species (421 and 410, respectively) were recorded in the Lower and Middle parts of the Amur River basin, as compared with the Upper part of the basin. Most of the recorded chironomids (387 species, 67%) are Palaearctic in distribution, while others (191, 33%) are widely Holarctic. Species with Palaearctic distribution mostly have the following range types: East Palaearctic continental (23%); East Palaearctic continental-insular (20%); Palaearctic transpalaearctic (14%); Palaearctic amphi-Eurasian (10%).

**Key words:** Diptera; Chironomidae; geographical distribution; subendemics; Amur River basin; Russian Far East.

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## INTRODUCTION

The Amur River is one of the longest (4416 km long) and the greatest rivers in East Asia. It is located in East Siberia, the Far East of Russia (Transbaikalia, Amur Region, Jewish Autonomous Region, Khabarovsk and Primorye Territories), NE Mongolia and NE China. The river is customary divided into three parts: the upper, middle and lower Amur. The Upper Amur begins at the juncture of the Shilka and Argun and ends at the mouth of the Zeya River near of Blagoveshchensk City. The Middle Amur extends from the Zeya River to Khabarovsk City. And the Lower Amur is part of river from Khabarovsk to the mouth (Fig. 1). Its basin includes 10,610 streams and 61,427 lakes.

The first studies of the chironomids of the Amur River basin are referred to the work of Soldatov (1915). He collected plankton and benthos in 1907-1913 and found that chironomid larvae were one of the main components of fish feeding and benthic communities, but information on the taxonomic composition was not given. The first work on the chironomid taxonomy was the paper by Goetghebuer (1933). Basing on materials collected by A.A. Stackelberg and S.I. Obolensky in the basin of the Khanka Lake, he recorded 16 species of subfamilies Tanypodinae, Orthocladiinae and Chironominae by adults and 6 species of them were new to science. During the hydrobiological study of the material collected in the Lower Amur by the Pacific Research Institute of Fisheries and Oceanography (TINRO), 24 genera of chironomids were identified by larvae (Mikulich, 1948). In 1945-1949, during the "Complex Amur Ichthyologic Expedition" huge hydrobiological studies in the Amur River basin were carried out. The material was collected from about 50 different water bodies in the Middle and Lower Amur and surrounding areas. As a preliminary result of this expedition, 127 species and 'larval forms' of chironomids belonging to 5 subfamilies were identified in benthic and entomological samples, which included material of both larvae and adults (Konstantinov, 1950, 1952a, 1952b; Shilova, 1954), and were described 8 new species. Further study on the food chains in fish populations conducted by the Amur branch of TINRO from 1948 to 1982 in the Amur River basin, as well as our investigations of 2004-2008 made it possible to compile and update a list of 275 chironomid, species. This list, first published by

Makarchenko *et al*. (2005), was then upgraded to 404 species by Makarchenko and Makarchenko (2008a) and Makarchenko *et al.* (2008). During the last decade, the new data were obtained on the fauna, taxonomy and distribution of chironomids in the Amur River basin and were described a news species by us, based on both traditional morphological and molecular genetic methods (Makarchenko and Makarchenko, 2007, 2008a, 2008b, 2008c, 2009a, 2009b, 2010a, 2010b, 2010c, 2010d, 2012a, 2012b, 2012c, 2014, 2015a, 2015b; Makarchenko and Semenchenko, 2014; Makarchenko *et al.*, 2005, 2014, 2015, 2017a, 2017b).

In the present paper, an updated and annotated checklist of chironomids for the Upper, Middle and Lower Amur basins is provided based on the original and recently published data, with a discussion of the taxonomic diversity and types of ranges of valid species.

## METHODS

The material summarized in this paper was collected between 2009 and 2017 from various standing and running waters in the Middle and Lower Amur River basins, mostly by the authors and Drs T.M. Tiunova and V.A. Teslenko (the Laboratory of Freshwater Hydrobiology, Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far East Branch of the Russian Academy of Sciences). The material of adults was collected during swarming of chironomids or from riparian vegetation, mostly using hand netting and net-sweeping and, in addition, using light traps and Malaise traps. The pupae and larvae were taken from hydrobiological samples of zoobenthos, or collected with standard drift nets. Adults of some species were reared from larvae in the field. In addition, DNA barcoding (COI



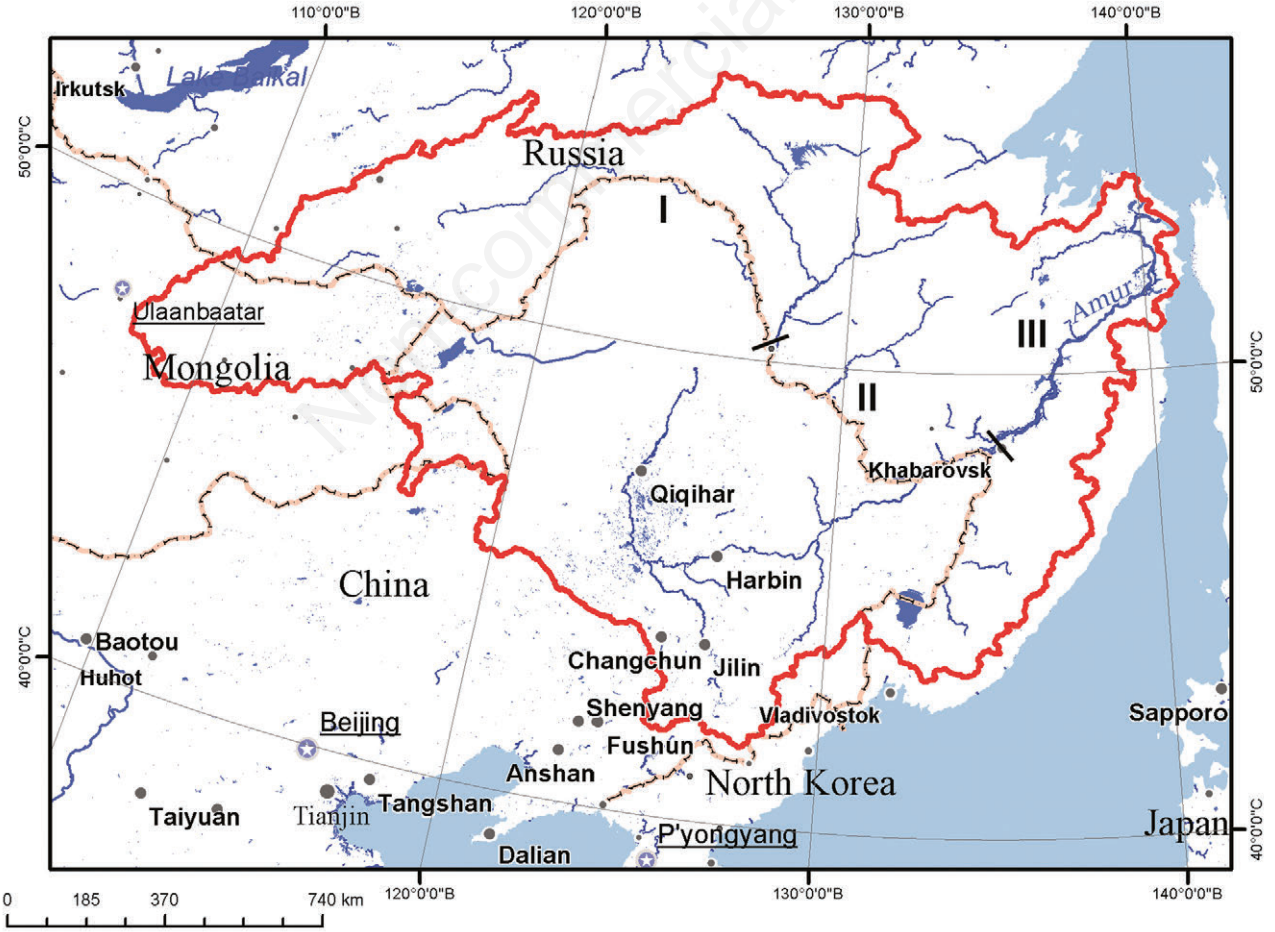


**Fig. 1.** The three major physiographic regions of the Amur River basin. I, Upper Amur; II, Middle Amur; III, Lower Amur.

sequences) was used to clarify the species identifications (Makarchenko and Semenchenko, 2014; Makarchenko *et al.*, 2015, 2017a, 2017b). The techniques of preservation of material, slide-mounting and identification were used as described by Makarchenko (2006). Geographical range types are considered according to Gorodkov (1984).

## RESULTS AND DISCUSSION

An updated checklist includes 606 valid chironomid species in 129 genera recorded from the Amur River basin (Tab. S1). This list is tabulated in six subfamilies: Podonominae (3 species in 3 genera), Tanypodinae (17 species in 9 genera), Diamesinae (25 species in 11 genera), Prodiamesinae (7 species in 3 genera), Orthocladiinae (307 species in 57 genera) and Chironominae (247 species in 46 genera). The numbers of species recorded from the Lower and Middle Amur River basins (421 and 410, respectively) were higher than that in the Upper Amur basin (only 66 spp.) (Tab. 1). The knowledge of chironomids in the Upper Amur basin is lower, it includes poorly explored areas and wetlands, which are difficult to access.

A taxonomic analysis of all new species found since 1933 to 2017 showed that some species described by Goetghebuer (1933) and Shilova (1952) in imago were synonymized, and the species described by Konstantinov (1952b) in the larvae were placed to the *nomena dubia*. Considering these data, the total number of new species for the Amur River basin currently is 98 of 46 genera (Tab. 2). About 50% of the listed species were previously known only from Japan; they are recorded for the first time from Russia. In the near future, we plan to describe at least 11 new species belonging to the genera *Georthocladius* Strenzke, *Hydrobaenus* Fries, *Polypedilum* Kieffer, *Robackia* Sæther, *Stictochironomus* Kieffer, *Cladotanytarsus* Kieffer, *Micropsectra* Kieffer, *Neozavrelia* Goetghebuer, *Paratanytarsus* Thienemann et Bause, *Rheotanytarsus* Thienemann et Bause and *Tanytarsus* v. d. Wulp. Additional DNA barcoding will be provided for some of the new undescribed species belonging to the genera *Micropsectra*, *Cladotanytarsus* and *Neozavrelia*. Of the 98 described new species, 43 mostly belonging to the Orthocladiinae are possible endemics or subendemics; they are considered as exclusive and biogeographic representative of the Amur River basin (Tab. S1), e.g. *Abiskomyia korbokhon*, *Propsilocerus amurensis*, *Paralimnophyes dolgikh, Hydrobaenus golovinensis, Tokunagaia logutini, Chaetocladius antipovae*, *C. egorych*, *C. fedotkin*, *C. yavorskayae*, *Parasmittia bidzhanica*, *Tsudayusurika safonikha* and *Tvetenia bidzhanica*. *Abiskomyia korbokhon* occurs only in oligotrophic Korbokhon Lake, which is situated at an altitude of 1160 m above sea level in the upper reach of the Bureya River (Middle Amur) (Makarchenko and Makarchenko, 2015b); *P. amurensis* is also known only from its type locality, the Kadi River near the Bolon Nature Reserve (Lower Amur) (Makarchenko and Makarchenko, 2009b); *P. dolgikh, H. golovinensis* and *T. logutini* are reported from running waters of the Bolshekhekhtsirsky Nature Reserve (Lower Amur) (Makarchenko *et al*., 2015, 2017b; Yavorskaya *et al.*, 2017). The other above-listed species occur only at the springs of the Bidzhan River basin (Middle Amur) (Makarchenko *et al*., 2014, 2017a). Three species of the subfamily Chironominae are known only from the single site: *Dicrotendipes ovaleformis* from the Ussuri River; *D. unicus* from the Kiya River (Lower Amur); *Paracladopelma urkanensis* from the Zeya River (Middle Amur) (Zorina, 2001, 2006).

Most of the recorded chironomids (387 species or 67%) are widely distributed in the Palaearctic Region, while others (191 species or 33%) are Holarctic in distribution. The listed Palaearctic species mostly represent the following range types: East Palaearctic continental (23% of species); East Palaearctic continental-insular (20%); Palaearctic transpalaearctic (14%); Palaearctic amphi-Eurasian (10%). Other types of geographical distribution are rare.

**Tab. 1.** The numbers of chironomid species in different subfamilies, known from the Upper, Middle and Lower basins of the Amur River.

| Subfamilies | Upper Amur River | | Middle Amur River | | Lower Amur River | |
|---|---|---|---|---|---|---|
| | Species | Genera | Species | Genera | Species | Genera |
| Podonominae | 1 | 1 | 3 | 3 | 2 | 2 |
| Tanypodinae | 4 | 3 | 10 | 6 | 16 | 8 |
| Diamesinae | 6 | 5 | 16 | 9 | 17 | 8 |
| Prodiamesinae | 1 | 1 | 4 | 2 | 6 | 3 |
| Orthocladiinae | 19 | 13 | 185 | 55 | 225 | 52 |
| Chironominae | 35 | 24 | 192 | 43 | 155 | 40 |
| **Total** | **66** | **47** | **410** | **118** | **421** | **113** |

**Tab. 2.** Numbers of species described in different genera of Chironomidae from the Amur River basin.

| Subfamily and genus | New species | Subfamily and genus | New species |
|---|---|---|---|
| **Tanypodinae** | | *Parasmittia* Strenzke | 1 |
| *Clinotanypus* Kieffer | 1 | *Prosmittia* Brundin | 1 |
| **Diamesinae** | | *Pseudorthocladius* Goetghebuer | 2 |
| *Arctodiamesa* Makarchenko | 1 | *Pseudosmittia* Edwards | 2 |
| **Prodiamesinae** | | *Rheocricotopus* Brundin | 1 |
| *Monodiamesa* Kieffer | 2 | *Smittia* Holmgren | 1 |
| *Prodiamesa* Kieffer | 1 | *Stilocladius* Rossaro | 1 |
| **Orthocladiinae** | | *Symbiocladius* Kieffer | 1 |
| *Abiskomyia* Edwards | 1 | *Thienemanniella* Kieffer | 1 |
| *Boreosmittia* Tuiskunen | 2 | *Tokunagaia* Sæther | 4 |
| *Bryophaenocladius* Thienemann | 4 | *Tsudayusurica* Sasa | 1 |
| *Chaetocladius* Kieffer | 7 | *Tvetenia* Kieffer | 3 |
| *Corynoneura* Winnertz | 3 | *Vivacricotopus* Schnell et Sæther | 3 |
| *Cricotopus* van der Wulp | 6 | **Chironominae** | |
| *Eukiefferiella* Thienemann | 2 | *Beckidia* Sæther | 2 |
| *Heterotrissocladius* Spärck | 2 | *Cryptochironomus* Kieffer | 1 |
| *Hydrobaenus* Fries | 8 | *Dicrotendipes* Kieffer | 3 |
| *Krenosmittia* Thienemann et Krüger | 1 | *Olecryptotendipes* Zorina | 1 |
| *Limnophyes* Eaton | 1 | *Paracladopelma* Harnisch | 3 |
| *Metriocnemus* van der Wulp | 3 | *Phaenopsectra* Kieffer | 2 |
| *Nanocladius* Kieffer | 1 | *Polypedilum* Kieffer | 4 |
| *Orthocladius* van der Wulp | 3 | *Stenochironomus* Kieffer | 2 |
| *Parakiefferiella* Thienemann | 2 | *Synendotendipes* Grodhaus | 1 |
| *Paralimnophyes* Brundin | 1 | *Constempellina* Kieffer | 1 |
| *Propsilocerus* Kieffer | 1 | *Zavrelia* Kieffer | 2 |
| *Parorthocladius* Thienemann | 1 | | |
| **Total: 98 species in 46 genera** | | | |



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