Zoosymposia 18: 063–071 (2020)
https://www.mapress.com/j/zs

ISSN 1178-9905 (print edition)
ZOOSYMPOSIA
ISSN 1178-9913 (online edition)
https://doi.org/10.11646/zoosymposia.18.1.10
http://zoobank.org/urn:lsid:zoobank.org:pub:E2D251BB-5588-4FF3-B098-55634D3C6435

Trichoptera of Saur and Tarbagatay Mountains (Kazakhstan)

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Abstract

A Trichoptera list compiled for the first time for the Saur and Tarbagatai Mountains, northeastern Kazakhstan, comprises 38 species of 24 genera in 13 families. The region is notable as a contact zone for Siberian, Boreal, and Central Asian Trichoptera faunas. The study reveals numerous limits of distribution for species comprising more than half of the local fauna at very low level of local endemism. The fauna is poor and probably resulted from post-glacial colonization through some zoogeographic barriers.

Key words: species, fauna, distribution, Saur Mountains, Tarbagatai Mountains, northeastern Kazakhstan, zoogeography

1. Introduction

The Trichoptera fauna is poorly studied in Kazakhstan. A total 153 species of caddisflies in 17 families are known, some of which require verification (Smirnova *et al.*, 2016). Three zoogeographic provinces meet each other in the Kazakhstan territory (de Moor & Ivanov 2008) representing Boreal, Siberian, and Central Asian faunas. Since the Trichoptera fauna has been studied inadequately in Central Asia, we have no opportunity to assess the faunistic similarity of local faunas.

Some parts of Kazakhstan were not studied previously. One of these unstudied areas is the region of the Saur and Tarbagatay Mountain Ranges in northeastern Kazakhstan at the border with the People's Republic of China (Xinjiang Province). These two ranges are situated in the putative border between the Siberian (Altai Mountains) and Central Asian (Dzungarian Alatau and Tian Shan Mountains) biogeographic regions, potentially serving as 2 high-altitude "stepping stones." This area was a part of a specially protected state border in Soviet times and is difficult to access because of poor roads and limited transportation facilities. Our data provide the first survey on the Trichoptera of this region. There are 2 principal questions to be answered: (a) What species inhabit the area of the Saur and Tarbagatay ranges? (b) Where does the South Siberian fauna of caddisflies end and where does Central Asian begin?

Previous studies of caddisflies of the adjacent territories have shown the affinities to neighboring faunas: The Altai caddisflies are derivative of the South Siberian fauna (Zaika 2011); Tian-Shan faunas are typically Central Asian (Brodsky 1976), and Kazakh Uplands (west of the Saur and Tarbagatay ranges) are inhabited by ubiquitous Transpalearctic Trichoptera species common to both Siberian and Boreal European Provinces (Sklyarova *et al.* 2018). Faunas of northwestern China (Xinjiang Uygur Autonomous Region) east of theTarbagatai Range are poorly studied, but apparently includes Transpalearctic and East Palearctic species (Yang *et al.* 2016; Chuluunbat, S. & Morse, J.C., 2007; Chuluunbat, S. *et al.*, 2016).

The Saur-Tarbagatay Mountain system is situated in the heart of Eurasia, east of the Kazakh Uplands (in

Submitted: 27 May 2019; Accepted by Pongsak Laudee: 10 Aug. 2019; published: 12 Jun. 2020

Kazakhstan) and west of Ulungur Lake between 2 intermountain basins, the Zaisan Lake Basin to the north and Alakol Lake Basin to the south. Climate and landscapes of this area are transitional between the South Siberian and Central Asian mountains. Winters are cold and dry, with the average winter temperature of the coldest month (January) below –15°C; the average temperature of the warmest month (July) is +23°C, with maximal monthly precipitation of 42 mm. The weather is sunny and windy for most of the year. The dominant landscape is dry steppe, with coniferous forests (*Picea schrenkiana* Fisch. & C.A. Mey and *Larix sibirica* Ledeb.) in higher parts of the Saur Mts. and deciduous gallery forests along some rivers at lower altitudes; the southern steep slopes of the Tarbagatay Mountains have small spots of occasional apple, willow, and poplar forests and extensive development of *Berberis* and *Rosa* shrubs. Dryer and colder northern slopes of both the Saur and Tarbagatay Mountains provide pastures for herders whereas the warmer southern slopes of Tarbagatay are also used for crop production agriculture. Glaciers occur on the highest pinnacles of the Saur Mountains whereas no glaciers are present on the Tarbagatay Mountains. This region serves as a transitional zone between some animal faunas of South Siberia and Central Asia; for example, the Tarbagatay Mts. are a biogeographic division for fish and mollusk faunas (Mitrofanov 1986; Uvalieva 1989).

2. Material and methods

Field collections were accomplished with the well-known methods of light trapping with small water-filled UV traps installed close to the water's edge, net sweeping during the daytime in the riparian vegetation, and hand picking. We collected material in the Kazakhstan part of the Saur and Tarbagatay ranges in August 2017 (Fig. 1). The material is preserved in 70% ethanol and is stored in the collections of the Zoological Institute of the Russian Academy of Sciences in St. Petersburg.

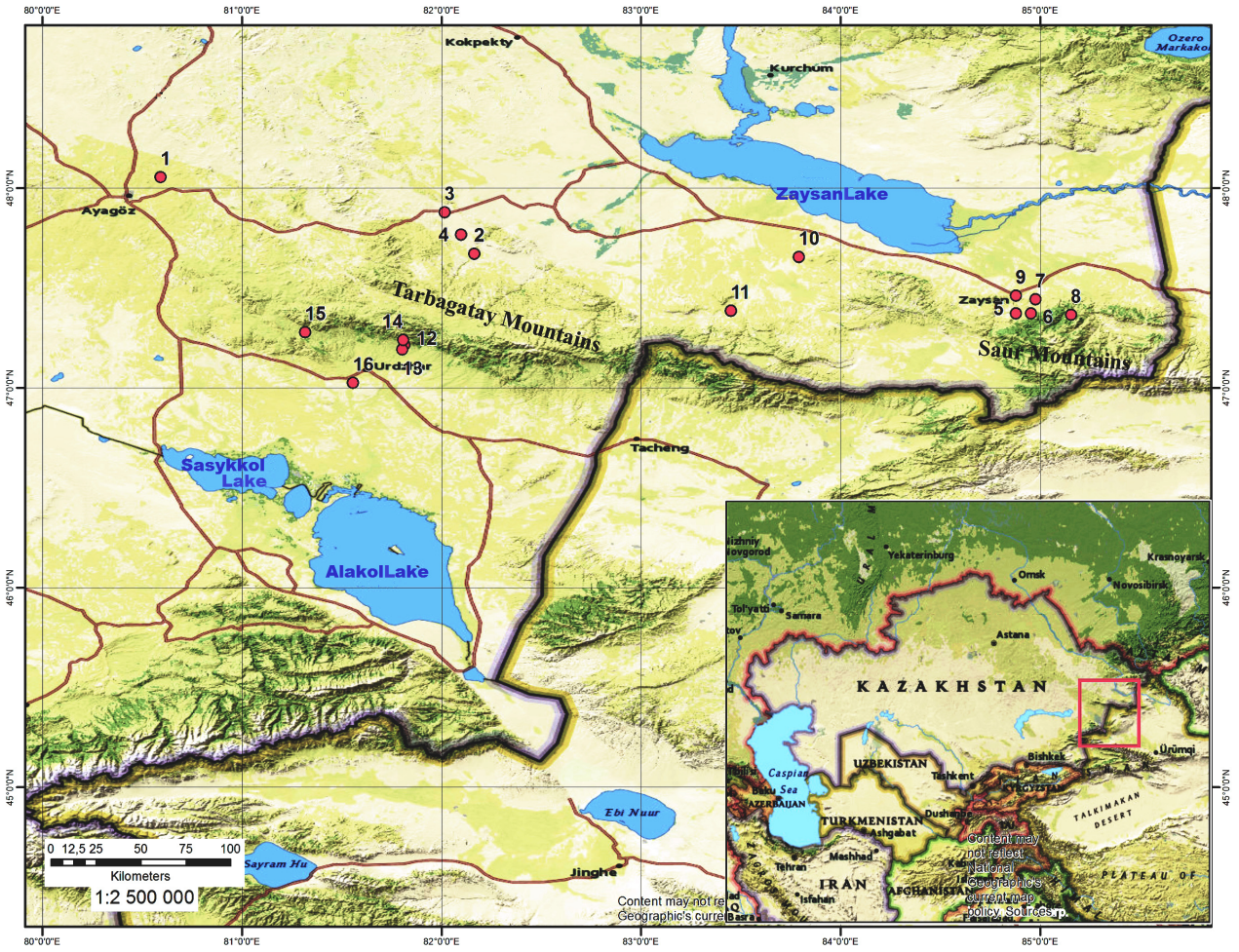

FIGURE 1. Sample localities (numbered) in the northeastern Kazakhstan.

3. List of sampling localities in northeastern Kazakhstan, Saur and Tarbagatay Ranges

Locality 1. Tarbagatay Range, Ayagoz River upstream Novyi Mailin village, 48°03’23”N; 80°35’29”E, elevation 674 m, 06.viii.2017, light trap, hand picking, leg. V.D. Ivanov, S.I. Melnitsky, D.A.Smirnova. Shallow, slowly running river with pebbles and stones at the bottom (Fig. 1A).

Locality 2. Tarbagatay Range, Bazar River, 47º40’20.4”N, 82º09’44.5”E, elevation 905 m, 07.viii.2017, light trap, hand picking, leg. V.D. Ivanov, S.I. Melnitsky, D.A.Smirnova. Relatively shallow, fast-running, clear river with stony bottom (Fig. 1B).

Locality 3. Kyzyl Kesik, Bugaz River, at bridge, 47°52’52.2”N, 82°00’55.0”E, elevation 800 m, 7.viii.17, net sweeping during daytime, leg. S.I. Melnitsky. Moderate-size river in deep valley in a village.

Locality 4. Tarbagatay Range, Sary-bulak Brook, 47º46’08.7”N, 82º05’49.6”E, elevation 892 m, 08.viii.2017, net sweeping during daytime, leg. V.D. Ivanov, S.I. Melnitsky. Small brook running across the dry steppe (Fig. 1C).

Locality 5. Saur Range, Bolshoy Jameney River, 47º22’21.9”N, 84º52’34.9”E, elevation 890 m, 8.viii.2017, light trap, leg. V.D. Ivanov, S.I. Melnitsky, D.A.Smirnova. Small, shallow, clear, cold, fast-running river with stony bottom (Fig. 1D).

Locality 6. Saur Range, Kyzylbulak Spring, 10 km SE Zaisan town, 47°22’23”N, 84°57’06”E, elevation 1080 m, 09.viii.2017, hand picking under stones, leg. V.D. Ivanov, S.I. Melnitsky, D.A.Smirnova. Small spring (Fig. 1E).

Locality 7. Saur Range, Temirsu River, 47°26’36”N, 84°58’28”E, elevation 660 m, 09.viii.2017, leg. V.D. Ivanov, S.I. Melnitsky, D.A.Smirnova. Small, shallow, clear, cold, fast-running river with stony bottom (Fig. 1F).

Locality 8. Saur Range, Terekty River, 47°21’56.3”N, 85°09’13.0”E, elevation 1340 m, 10.viii.17, net sweeping during daytime, leg. V.D. Ivanov, S.I. Melnitsky. Small, slightly muddy brook with stony bottom (Fig. 1G).

Locality 9. Saur Range, Jameney River in Zaisan town, 47°27’41.9”N, 84°52’35.5”E, elevation 649 m, 10.viii.2017, light trap, leg. V.D. Ivanov, S.I. Melnitsky, D.A. Smirnova. Shallow, clear, cold, fast-running river with stony bottom (Fig. 1H).

Locality 10. Tarbagatay Range, Shengelbay Creek near Akzhar, 47°39’21”N, 83°47’25”E, elevation 610 m, 11.viii.2017, net sweeping during daytime, hand picking under stones, leg. V.D. Ivanov, S.I. Melnitsky, D.A.Smirnova. Source of creek in a ravine of a dry steppe (Fig. 2A).

Locality 11. Tarbagatay Range, Lasty (Kuygan) village vicinity, Shet Lasty River, 47°23’14”N, 83°26’55”E, elevation 887 m, 11.viii.2017, light trap, leg. V.D. Ivanov, S.I. Melnitsky, D.A. Smirnova. Shallow, clear, cold, fast-running river with pebbles at the bottom (Fig. 2B).

Locality 12. Tarbagatay Range, 15 km NE Urdzhar village, spring, 47°12’53”N, 81°48’47”E, elevation 910 m, 13.viii.2017, net sweeping during daytime, leg. V.D. Ivanov, S.I. Melnitsky (Fig. 2C).

Locality 13. Tarbagatay Range, 15 km NE Urdzhar village, Taldy-Bulak Brook, 47°11’32”N, 81°48’10”E, 13.viii.2017, net sweeping during daytime, leg. V.D. Ivanov, S.I. Melnitsky. Small, slightly muddy brook in the foothills (Fig. 2D).

Locality 14. Tarbagatay Range, 15 km NE Urdzhar village, Kishkentau River, 47°14’28”N, 81°48’23”E, elevation 1148 m, 13.viii.2017, light trap, leg. V.D. Ivanov, S.I. Melnitsky, D.A. Smirnova. Small, shallow, clear river with pebbles at the bottom (Fig. 2E).

Locality 15. Tarbagatay Range, 1 km NW Blagodatnoe village, Kyzylbulak Spring and streams nearby, 47°16’44”N, 81°18’51”E, elevation 997 m, 14.viii.2017, net sweeping and benthos sampling during daytime, leg. V.D. Ivanov, S.I. Melnitsky. Source of spring, marsh (Fig. 2F), and small brooks.

Locality 16. Tarbagatay Range, Akzhar (Amangeldy) village vicinity, Urdzhar River, 47°01’32”N, 81°33’21”E, elevation 415 m, 14.viii.2017, light trap, leg. V.D. Ivanov, S.I. Melnitsky, D.A. Smirnova. Shallow, slowly running river with muddy banks (Fig. 2G).

FIGURE 2. Biotopes of the localities: 2A, Tarbagatay Range, Ayagoz River upstream of Novyi Mailin village (Loc. 1); 2B, Tarbagatay Range, Bazar River (Loc. 2); 2C, Tarbagatay Range, Sary-bulak Brook (Loc. 4) running across the dry steppe; 2D, Saur Range, Bolshoy Jameney River (Loc. 5); 2E, Saur Range, Kyzylbulak Spring (Loc. 6); 2F Saur Range, Temirsu River (Loc. 7); 2G, Saur Range, Terekty River (Loc. 8); 2H, Saur Range, Jameney River (Loc. 9).

FIGURE 3. Biotopes of the localities: 3A, Tarbagatay Range, Shengelbay Creek (Loc. 10); 3B, Tarbagatay Range, Shet Lasty River (Loc. 11); 3C, Tarbagatay Range, spring 15 km NE Urdzhar village (Loc. 12); 3D, Tarbagatay Range, Taldy-Bulak Brook (Loc. 13); 3E, Tarbagatay Range, Kishkentau River (Loc. 14); 3F, Tarbagatay Range, Kyzylbulak Spring (Loc. 15); 3G, Tarbagatay Range, Urdzhar River (Loc. 16); 3H, *Apataniana cornuta*, groups of pupae on a stone taken out of the water, Terekty River (Loc. 8).

4. Annotated list of the sampled Trichoptera

The Trichoptera families are listed here in roughly taxonomic system from Annulipalpia to Integripalpia. Data on the species' distribution are given. Abbreviations: loc. = localities, m = males, f = females, L = larvae, p = pupae; mm, ff = numerous males and females; ‡ = the first record for Kazakhstan.

ARCTOPSYCHIDAE Martynov 1924

Arctopsyche ladogensis (Kolenati 1859): loc. 15—2L. (Europe, Siberia, Mongolia, North America).

HYDROPSYCHIDAE Curtis 1835

Hydropsyche pellucidula (Curtis 1834): loc. 1—lp; loc. 2—l L?; loc. 5—ff; loc. 13—6m, 2f. (Europe, Siberia, Mongolia, China).

Hydropsyche kozhantschikovi Martynov 1924: loc. 1—mm, ff: loc. 2—1m; loc. 11—2f; loc. 14—6m; loc. 16—mm, ff. (Far East Russia, Siberia, Mongolia, China).

Hydropsyche sp. aff. *ornatula*: loc. 1—6f; loc. 16—ff.

Hydropsyche stimulans McLachlan 1878: loc. 2—2f; loc. 9—5f. The northernmost record of distribution. (Central, Southern Asia).

Cheumatopsyche capitella (Martynov 1927): loc. 1—mm, ff; loc. 2—3f; loc. 11—9m, ff; loc. 12—ff; loc. 16—mm, ff. The northernmost record of distribution. (Western, Central, Southern Asia; Europe).

POLYCENTROPODIDAE Ulmer 1903

‡*Plectrocnemia conspersa* (Curtis 1834): loc. 5—1m; loc. 7—3m,1f; loc. 14—2m. The easternmost record of distribution. (Europe).

Polycentropus flavomaculatus (Pictet 1834): loc. 2—4f; loc. 3—1m. (Europe, Siberia, Mongolia, Far East Russia).

STENOPSYCHIDAE Martynov 1924

Stenopsyche marmorata Navas 1920: loc. 2—LL; loc. 15—LL. The most southwestern record of distribution. (China, Siberia, Far East Russia).

PHILOPOTAMIDAE Stephens 1829

Dolophilodes ornata Ulmer 1909: loc. 5—1m; loc.7—1m; loc. 9—mm; loc.14—1m, 2f; loc. 15—l. The northernmost record of distribution. (Western, Central, Southern Asia; China).

RHYACOPHILIDAE Stephens 1836

Rhyacophila angulata Martynov 1910: loc. 5—1m, 1f; loc. 9—3m, 6f. The most southwestern record of distribution. (Siberia, Far East Russia, Mongolia, China).

Rhyacophila sibirica McLachlan 1879: loc. 14—1m. The most southwestern record of distribution. (Siberia, Mongolia, Far East Russia).

GLOSSOSOMATIDAE Wallengren 1891

Agapetus bidens McLachlan 1875: loc. 2—mm, ff; loc. 4—1m; loc. 5—mm, ff; loc. 7—2m, ff; loc. 9—63m, 13f; loc. 13—mm, ff, 2pm, 4pf, LL. ultimate northwestern record of this species.(Central Asia, Mongolia).

Agapetus kirgisorum Martynov 1927: loc. 5—1m. The northernmost record of distribution. (Central Asia).

‡*Glossosoma intermedium* (Klapálek 1892): loc. 7—4f. The southernmost record of distribution. (Europe, Siberia, Mongolia, Far East Russia, North America).

HYDROPTILIDAE Stephens 1836

Oxyethira falcata Morton 1893: loc. 4—10m. (Europe; Southern, Eastern Asia; China).

‡*Hydroptila vectis* Curtis 1834: loc. 2—1m. The easternmost record of distribution. (Europe, Southern Asia, Siberia).

Hydroptila sp. (*H. sparsa* Group): loc. 2—2f.
Hydroptila tineoides Dalman 1819: loc. 1—mm, ff; loc. 2—mm, ff. (Europe, Mongolia).
‡*Orthotrichia angustella* McLachlan 1865: loc. 1—mm, ff. The easternmost record of distribution. (Europe).
Hydroptila angulata Mosely 1922: loc. 1—mm, ff; loc. 2—1m. (Europe, Siberia, Southern Asia, China, Mongolia).
Hydroptila sp. (*H. occulta* Group): loc. 2—7m, 30f.

LEPTOCERIDAE Leach 1815
Ceraclea sp.n.: loc. 1—1m, ff.
Leptocerus similis McLachlan 1875: loc. 1—1f. The northernmost record of distribution. (China, Central Asia).
Mystacides dentatus Martynov 1924: loc. 1—4m, 8f. The most southwestern record of distribution. (Siberia, Far East Russia, Eastern Asia, China).
Oecetis ochracea Mosely 1953: loc. 1—1m. (Europe, Siberia, Mongolia, China, Far East Russia).
‡*Oecetis tripunctata* (Fabricius 1793): loc. 16—2f. (Europe; Siberia; Far East Russia; Southern, Eastern Asia; China).
Triaenodes (*Ylodes*) *internus* McLachlan 1875: loc. 1—1m, 3f; loc. 4—1 m. (Europe; Central Asia; Siberia; Mongolia; China).
Triaenodes kawraiskii Martynov 1909: loc. 1—1m, 2f; loc. 2—1m; loc. 4—4m, 1f; loc. 16—1m, 4f. (Europe, Caucasus, Western Asia).

APATANIIDAE Wallengren 1884
Apatania zonella (Zetterstedt 1840): loc. 9—1L; 1f: loc. 10—8p; loc.13—1p. (Europe, Siberia, Far East Russia, Kazakhstan, Mongolia, China, North America).
Apataniana cornuta Ivanov 1991: loc. 6—1m, 36pm, 27 pf, 25L; loc.9—lL, pp; loc.10—lL, pp; loc.12—12pm, 2pf, 4p, 10L. The northernmost record of distribution. (Kazakhstan only).

LIMNEPHILIDAE Kolenati 1848
Potamophylax rotundipennis (Brauer 1857): loc. 2—mm. The most southeastern record of distribution. (Europe, Siberia).
Micropterna muehleni McLachlan 1884: loc. 6—mm, ff. The easternmost record of distribution. (Caucasus, Western Asia, Kazakhstan).

GOERIDAE
Goera sp.: loc 15—larval cases.

BRACHYCENTRIDAE Ulmer 1903
Brachycentrus americanus (Banks 1899): loc. 2—3m, L ; loc. 5—1m, 1f; loc. 7—mm, ff; loc. 9—38m, 27f, L; loc. 11—mm, ff; loc. 13—4L; loc. 14—2m, 1f . (Siberia, Mongolia, Far East Russia, China, North America).

LEPIDOSTOMATIDAE Ulmer 1903
Lepidostoma (*Dinarthrum*) *kasachstanicum* Mey & Jung 1989: loc. 8—2m. The northernmost record of distribution. (Kazakhstan only).
Lepidostoma (*Dinarthrum*) sp. aff. *kazakhstanicum*: loc. 13—1pm, 1pf, 8L.
Lepidostoma (*Dinarthrum*) *reductum* Martynov 1915: loc. 5—1m, 1f. The northernmost record of distribution along with Xinjiang (China) . (Central Asia, China).
‡*Lepidostoma* (*Maniconeura*) *stubbei* (Mey 1980): loc. 2—3m, 2f. (Mongolia).

5. Discussion

The sampled Trichoptera comprise 38 species in 24 genera and 13 families. The most common species were

Hydropsyche kozhantschikovi, Agapetus bidens, *Brachycentrus americanus*, and *Dolophilodes ornata.* The following 6 species were recorded for the first time in Kazakhstan: *Plectrocnemia conspersa, Glossosoma intermedium, Hydroptila vectis, Orthotrichia angustella, Oecetis tripunctata*, and *Lepidostoma* (*Maniconeura*) *stubbei.* The samples reveal the presence of both East- and West-Palearctic species, e.g., *Hydropsyche kozhantschikovi* (eastern) and *Hydroptila tineoides* (western). Both the northern and southern slopes of the Tarbagatai Mts. are inhabited by Siberian genera such as *Arctopsyche*, *Stenopsyche*, and *Goera*, not known for Central Asia. On the other hand, such Central Asian species as *Agapetus bidens, Cheumatopsyche capitella*, and *Dolophilodes ornata* are common for this region.

The Saur and Tarbagatai region appears to be a special transitional zone between various types of Trichoptera distributions and can be considered as a border among the Siberian, Central Asian, and European faunas. A significant number of species, 19 of total 38 (50%) have their ultimate ranges of distribution in this area. Almost half of these species (9) have their northernmost distribution limits in the region; they migrated here from the south and belong to typical elements of the Central Asian faunistic region. It is notable that only a few families have these species: Hydropsychidae (2 spp., very abundant), Philopotamidae (1 sp., a single representative of this family in the region), Glossosomatidae (2 spp. of *Agapetus*), Leptoceridae (2 spp.), Apataniidae (1 sp.), and Lepidostomatidae (all 3 recorded spp.). Others have either eastern (5 spp.: 1—Polycentropodidae, 3—Hydroptilidae, 1—Limnephilidae) or southern/southeastern/southwestern distribution limits: Glossosomatidae—1 (S), Limnephilidae—1 (SE), Stenopsychidae—1 (SW), Rhyacophilidae—2 (all species known here, SW), Leptoceridae—1 (SW). It is also notable that the latitude-oriented mountains make no significant barriers for Trichoptera distribution: The north-related species like *Stenopsyche marmorata* and *Goera* sp. occur in streams of the southern mountain slopes, and south-related lepidostomatids, hydropsychids, and philopotamids are common in northern streams. Nonetheless, rhyacophilids are related to the Altai fauna and came from the north; they are found mostly in the northern rivers; West Palearctic species *Hydroptila tineoides, Orthotrichia angustella,* and *Triaenodes kawraiskii* occur in the western localities of the region. Hence one can assume the local disparities of habitats are probably influenced by the climatic conditions, with drier and cooler northern slopes and warmer southern slopes of the mountains.

The degree of endemism in the region is negligible. The samples reveal a peculiar species of Apataniidae, *Apataniana cornuta* occurring in both the Saur and Tarbagatay Ranges; previously this species was reported only for the Dzungarian Alatau Mountains. The emergence of this autumnal species just began at the time of our samples, although the larvae and mature pupae were very abundant in streams (Fig. 2H).

The fauna of the Saur and Tarbagatay Ranges and adjacent plains should be much more investigated because we collected only 1 month in the end of summer and could have missed the species emerging from May to July. Thus, this comparison of the caddisfly faunas of the region is preliminary. Nonetheless it is notable that we encountered a poor fauna with high abundances of the resident species; in some localities our traps were full of insects which had arrived in thousands. Apparently interspecific competition is minimal and resources are not shared in the habitats, allowing the development of dense populations.

The data seem to show that the Saur-Tarbagatay fauna of Trichoptera has Siberian relations with an abundant presence of Central Asian species. Some components of the fauna have western relationships and reveal some easternmost distribution limits. The borders of the Siberian and Central Asian faunas make a peculiar transitional zone with a probable barrier for spreading species between the Zaisan and Alakol Lake Depressions. The poverty of fauna might have been caused by both recent glaciation and rapid Pleistocene transformation of the landscapes. It is known that the landscapes in the Paleogene in this area were tropical and subtropical forests on flat or hilly plains. Subsequent orogenesis in the Neogene, and especially in Pleistocene and Holocene, transformed these plains to young mountains (Babkin 2018). The Pleistocene glaciation partly removed and partly transformed the Trichoptera faunas, so that the recent inhabitants of this area may be in the process of the post-glacial colonization. This region seems to be a very interesting spot for studies of faunal transformations and genesis.

Acknowledgements

The study was supported by St. Petersburg State University (SPSU) mobility grants No. 1.42.721.2017 and 1.42.722.2017, Kazakhstan Ministry of Education and Science grant No. 5004/GF4, and the Russian Foun-

dation for Basic Research (project No. 18-04-00312). Participation in the 16th International Symposium on Trichoptera and paper presentation was supported by grant CONF 2018 (Id: 27870985) from SPSU.

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