

A close-up photograph of a dragonfly perched on a green reed stem. The dragonfly has a dark, segmented abdomen, a blue and black thorax, and a reddish-brown head. Its four transparent wings are spread out, showing intricate vein patterns. The background is a soft-focus green field of reeds.

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Update to the knowledge of Odonata of Tuva and southern Krasnoyarskiy Kray, Siberia, Russia

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Abstract

Sympetrum fonscolombii is for the first time reported for Tuva (Tyva Republic, Russia), as found in the Ubsu-Nur Depression. New data are provided on Odonata of the Turan or Turan-Uyuk Depression of Tuva, including the first record of *Somatochlora exuberata* in Tuva beyond the Todzha Depression and *Coenagrion armatum*, *C. ecomutum*, *Aeshna juncea*, *A. grandis*, *Somatochlora graeseri* and *Libellula quadrimaculata* for the first time reported for the Turan Depression. New distributional data and comments on *Ophiogomphus spinicornis* Selys, 1878 are added. *Somatochlora alpestris* found at Lake Oyskoe is for the first time reported for the southern Krasnoyarskiy Kray.

Key words: Russia; Tyva Republic; Tuva; Odonata; dragonflies; damselflies; fauna; Ubsu-Nur Depression; Turan-Uyuk Depression; Turan Depression; Krasnoyarskiy Kray; West Sayan; Siberia; *Sympetrum fonscolombii* Selys, 1840; *Somatochlora alpestris* Selys, 1840; *Somatochlora exuberata* Bartenev, 1910; *Ophiogomphus spinicornis* Selys, 1878, diel phenology.

Introduction

The territory of Tyva Republic, a subject of Russian Federation, known in Russian under a more habitual (and officially equivalent) name Tuva, was nearly terra incognita with respect to Odonata until our extensive studies in 1990-2000s, which were summarised, together with extremely scarce data published before, in English (Zaika & Kosterin 2010) and Russian (Zaika & Kosterin 2011). The Russian paper was a more detailed version of the English one, as the examined specimens were enumerated for all rather than most interesting species, and had a more extended discussion on the two problematic western / eastern pairs of *Leucorrhinia* taxa of unclear status, *dubia* (Vander Linden, 1825) / *orientalis* Selys, 1877 and *rubicunda* (Linnaeus, 1758) / *intermedia* Bartenev, 1910.

The important update consisted in revealing that in the paper by Bartenev (1933) the ranges for these two pairs in his figures 1 and 5 swapped places, as it doubtlessly follows from the text. That was most probably overlooked by Belyshev, who tentatively drew the geographical border of the taxa in each pair along the Yenisey River and disregarded the fact that Bartenev (1933) correctly reported *rubicunda* as ranging eastwards up to Irkutsk and *intermedia* as ranging westwards to Baikal. Also Kosterin & Zaika (2011) confirmed occurrence of *rubicunda* at Irkutsk by a personal communication by A.N. Medvedev and reported and discussed an important finding of *orientalis* in the Kuznetskiy Alatau Mts. at Maizas village, Mezhdurechensk District, Kemerovo Province — (unfortunately, with incorrect dates 28-29.07.2011 which actually were 28-29.06.2011, as well as other mentions of July 2011 in those remarks in fact implied June).

Our reports (Kosterin & Zaika 2010; 2011) were based on data from as many as 82 localities all over Tuva, so few more have been examined since that. In this short communication we report: (i) a species for the first time recorded in Tuva. (ii) more data to the interesting but previously insufficiently studied Turan or Turan-Uyuk Depression and (iii) some distributional data on *Ophiogomphus spinicornis* Selys, 1878. Besides, some new data are included from a locality in the southern Krasnoyarskiy Kray Province

Results

Sympetrum fonscolombii (Selys, 1840) recorded in Tuva for the first time

A male of this species was collected and preserved in 70% alcohol by the second author on 7.07.2016 at a small (ca 350 m in diameter) and shallow freshwater lake surrounded with reed but with a sandy bank section (50.21° N 94.55° E, 904 m a.s.l.; nicknamed '1st lake; Fig. 1; loc. 1 in Fig. 2), one of a group of four small lakes near the SW bank of a large (5.8 × 1.5 km) salt lake Shara Nur (locality 51 in Kosterin & Zaika 2010; 2011).



Figure 1. “1st lake” at small lake at the SW bank of the large Lake Shara-Nur in the Ubsu-Nur Depression, loc. 6 in Fig. 2, 6.07.2017 (photo by V.Z.; all other photos by O.K.).

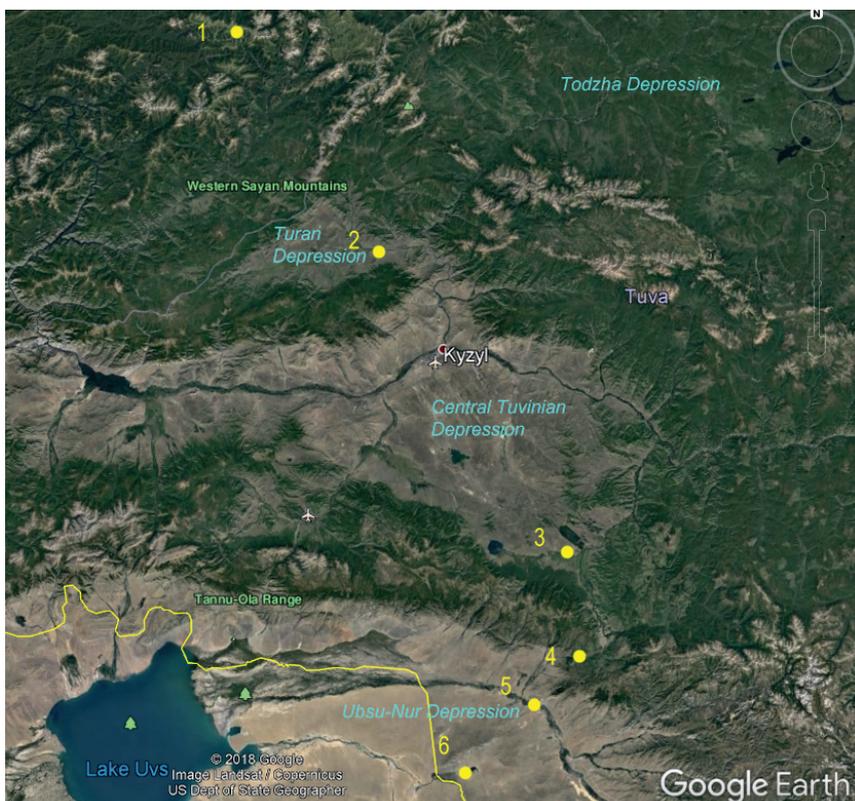


Figure 2. Localities mentioned in the text; in Krasnoyarskiy Kray: 1 – Lake Oyskoe; in Tyva Republic or Tuva: 2 – the Uyuk River at Uyuk village; 3 – the Mazhalyk River; 4 – the Shurmakskiy Pass through the East Tannu-Ola Mts'; 5 – the Tes Khem River; 6 – “1st lake” at Lake Shara-Nur.

Along with *S. fonscolombii*, the collection from the same site included 16 males and 7 females (some teneral) of *Enallagma cyathigerum risi* Schmidt, 1971 and a female of *Libellula quadrimaculata* Linnaeus, 1758.

Kosterin & Zaika (2003) reported an observation by the first author on 15.07.2000 of two large, bright-red and restless *Sympetrum* males at a shallow clayey bay of Lake Tore-Khol' near the Mongolian border in the same Ubsu-Nur Depression, which were supposed to be this species; that locality is just ca 40 km E of the above considered one.

S. fonscolombii was long known from Mongolia (Belyshev & Doshidorzhi 1958: 36), from a single female: “1, 13.VIII 1954, Lake Ovso”. Note that the latter means the large brackish Lake Ubsu-Nur (“Lake Uvs” in Fig. 2), which gave its name to the Ubsu-Nur Depression, the northernmost part of which is in Tuva (Fig. 2), where this species has now been found.

This species was only once reported for Siberia before: a teneral male on 12.09.2013 at Lake Shirokaya Kurya in Zdvinsk District of Novosibirsk Province, West Siberia (Popova & Eremina 2016).

Odonata of the Uyuk River valley at Uyuk village, Turan Depression

The area

Turan or Turan-Uyuk Depression is a small (100 × 40 km) intermontane depression (Fig. 3) in the northern part of Tuva (51.9-52.3° N 93.2-94.3° E, the lowest point, at the Uyuk River mouth, 670 m a.s.l.). This region is located between the Kurtushibinskiy Range of the West Sayans (which forms the northern border of Tuva) in the north and the low Uyukskiy Range (which separates it from the Central Tuvian Depression) in the south. It is characterised by a slightly more humid climate than the Central Tuvian Depression but still subarid, in contrast to the larger and more elevated, humid Todzha Depression to the north-east of it, behind the Taskyl Mountain Range (Fig. 2).

The fauna of the Turan Depression (localities No. 1-6 in Kosterin & Zaika 2010; 2011) is still insufficiently studied: only 12 species of Odonata have been recorded so far, namely *Lestes sponsa* (Hansemann, 1823), *Lestes dryas* Kirby, 1890, *Lestes barbarus* (Fabricius, 1798) (one female, the only specimen known from Tuva), *Sympecma paedisca* (Brauer, 1877), *Coenagrion hylas* (Trybom, 1889), *C. lunulatum* (Charpentier, 1840), *C. hastulatum* (Charpentier, 1825), *Enallagma cyathigerum* (Charpentier, 1840) (there is a transition zone between ssp. *cyathigerum* and *risi* Schmidt, 1961, as specimens are found at freshwater lakes with the cerci as in the former or transitory, and at a salt lake as in the latter), *Ophiogomphus spinicornis* Selys, 1878, *Sympetrum flaveolum* (Linnaeus, 1758), *S. danae* (Sulzer, 1776), and *Leucorhinia rubicunda* (Linnaeus, 1758). This list still did not include many widespread species which should be there.

At the same time, because of rather mild climate of the Turan Depression and its proximity of the Sayans, Kosterin & Zaika (2010; 2011) supposed that there can occur some rheophilic species still unknown from Tuva but inhabiting the West Sayan northern principle slope (such as *Calopteryx japonica* Selys, 1869, *Nihonogomphus ruptus* (Selys, 1857), *Shaogomphus postocularis* (Selys, 1869), *Stylurus flavipes* (Charpentier, 1825), or *Macromia amphigena* Selys, 1871). However, the landscapes of Turan Depression are predominantly steppes of a Central Asian type (Fig. 3), as elsewhere in Tuva but Todzha. The crest of Kurtushibinskiy Range (here representing the main axis of West Sayan) is not only the border of Krasnoyarskiy Krai and Tyva Republic, but also quite a sharp border of taiga at the northern principle slope and steppe on the southern slope (Figs. 2, 3). On the other hand those supposed rheophilic species inhabit forest or forest-steppe rivers. For their search we needed a forested valley of not so small a river flowing through Turan Depression at not so high an elevation.

The locality studied

The valley of Uyuk, the main river of the Depression, at Uyuk village (loc. 2 in Fig. 2), where it is crossed by the Federal Road M54 "Enisey" 22 km W of its mouth, fitted this aim best. This site was loc. 5 in Kosterin & Zaika (2010; 2011), for which as few as four



Figure 3. The Turan Depression as viewed from the Kurtushibinskiy Mountain Range in the north, 7.07.2017. Shivilig village and the Kislye Lakes are seen.

species were reported: *S. paedisca*, *C. hylas*, *C. lunulatum* and *S. flaveolum*. The first author examined this valley between the two functional bridges (there is another broken one in between), that is for the length of Uyuk village stretched along its northern board, on 30.06.2017 (12:30 – 14:40), 1.07.2017 (11:30 – 14:30) and 5.07.2017 (10:20 – 16:45). The second visit was after a strong night thunderstorm, the day was overcast with several weaker rains, on the two other visits the weather was fine.

At that place the Uyuk valley is 500-800 m broad (Fig. 4), with the river meandering at its northern board leaving a number of oxbow lakes (Fig. 4, 5). It is occupied by alternating spruce (*Picea obovata* Ledeb.) and/or birch (*Betula microphylla* Bunge) forest, willow bush thickets (vast and continuous in the eastern 1/3 of the studied area) and damp meadows, mostly tall herb but somewhat grazed by cattle at the broken bridge. There are numerous deep pools with dark bottom in the forest and meadows, the bush thickets hide a lot of shallow sluggish pools with warm water, slime of filamentous algae and flowering bladderwort (*Utricularia* sp.). At ca 94.035-040°E there is a 400x400 m patch of a thick spruce forest, the southern part of which is inundated



Figure 4. The Uyk River valley and an oxbow lake at Uyk village, 1.07.2017.

with huge tussocks of *Carex caespitosa* L. under spruces and willows and pools of open cold water of various size and depth with *Carex* spp. (mostly *C. limosa* L., *C. rostrata* L. etc.), *Menyanthes trifoliata* L. and *Calla palustris* L. A larger deep swamp, surrounded by willow bushes and huge tussocks, is adjacent to this forest from the east. On 1.07.2017, after the strong rain, the water between the tussocks rose up to knee- to waist-deep, became ice-cold (as groundwater fed), and some current appeared along certain routes through pools and among tussocks.

The Uyk River (Figs. 6, 7) is rather fast, has a stony brown bottom, ankle-to-waist-deep with some riffles (Fig. 7), with huge bundles of *Potamogeton lucens* L. and *P. (Stuckenia)* cf. *pectinatus* L. in the water and patches of floating *Sagittaria natans* Pall. at small shallow bays. The banks are walls of tall grass, mostly *Glyceria* sp., *Carex* spp., *Calamagrostis neglecta* (Ehrh.) Gaertn., sparse to dense rough horsetail (*Equisetum hyemale*



Figure 5. An Uyuk River oxbow lake at Uyuk village, a habitat of *Coenagrion hylas*, *C. armatum*, *C. lunulatum*, *Aeshna juncea*, *Somatochlora graeseri*, *Leucorrhinia rubicunda*, *Libellula quadrimaculata*, 5.07.2017.



L.), sparse *Scirpus* (*Schoenoplectus*) *lacustris* L., a remarkable amount of flowering cowbane (*Cicuta virosa* L.), and with spruce, birch and willow trees (Fig. 6, 7).

Observations

At sunny weather, numerous males of *Somatochlora exuberata* Bartenev, 1910 ranged low over the Uyuk River water; one was observed ranging rather high above a glade between the river, spruce forest and willow thickets. Quite many males of *O. spinicornis* perched on prominent dead branches, trunks or riparian grass

Figure 6. The Uyuk River at Uyuk village, a habitat of *Ophiogomphus spinicornis* and *Somatochlora exuberata*, 30.06.2017.

Figure 7. A riffle at the Uyuk River at Uyuk village, a preferred habitat of *Ophiogomphus spinicornis*, 30.06.2017.

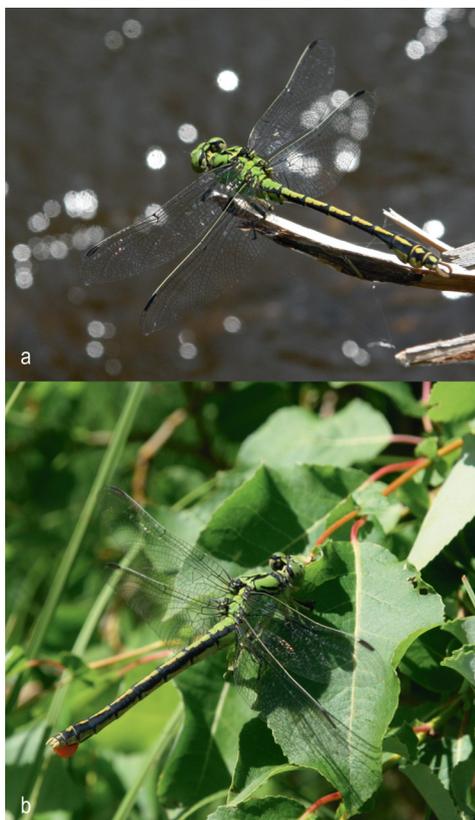


(Fig. 8a), mostly at riffles (as in Fig. 7), ranged nearby over the water and chased each other; on 30.06.2017 a teneral male was seen, proving reproduction in this river section. On 5.07.2017 both species were encountered also at small openings between the dry and inundated parts of spruce forest nearby (some dozens of metres from the river); three females of *O. spinicornis* and two males of *S. exuberata*. One of those males ranged between trees; the second appeared and started to range at the same place after 20 min since I had collected the first. The collected one was obviously teneral. On the rainy 1.07.2017, just hatched male

(Fig. 9) and female of *S. exuberata* were found at a narrow river right arm with warmer water flowing among meadows (Fig. 10). At the same arm, a female of *O. spinicornis* was observed with a drop of eggs (Fig. 8b) ovipositing for a while under a grassy bank. In the bank grass along the river, *C. hylas* (Fig. 11) were frequent and few *S. paedisca* (only on 30.06.2017) and *E. cyathigerum* (Fig. 12) were found, but these damselflies were there most probably at dispersal from lotic breeding habitats, as well as *Aeshna juncea* (Linnaeus, 1758) and *A. grandis* (Linnaeus, 1758) (30.06.2017) sometimes flying above the river.

At sunny weather, any pool, swamp or slow river arm in the floodland was patrolled by males of *A. juncea*, usually one at each small pool and many at swamps. Few females (one teneral) were startled from sedge, also in the inundated spruce forest. Also *L. quadrimaculata* was found at various lentic water bodies but those dragonflies not too abundant.

On 5.07.2017 in the dry part of the spruce forest several *C. hylas* (mostly females), a female of *E. cyathigerum* and several females of *L. rubicunda* (Fig. 13b) were found. In sedge in the inundated spruce forest there were scarce *L. sponsa*, *C. hylas* (mostly females) and few territorial *S. flaveolum* (5.07.2017) and *L. rubicunda*. At 13:25 of the overcast ay of 1.07.2017 the first author twice saw a *Somatochlora* male flying and hovering through entangled spruce and willow branches and examining sedge tussocks, but could not catch it because of a broken net. A following search for an hour did not



reveal it again. The sedge swamp near the inundated spruce forest, revealed many *C. hylas*, *A. juncea*, *L. quadrimaculata*, few *L. rubicunda*, and two species of *Sympetrum*: on 1.07.2017 one immature *S. danae* and few teneral *S. flaveolum* while on 5.07.2017 one mature (so early!) *danae* and numerous freshly emerged *flaveolum*.

At sunny weather, oxbow lakes and larger pools with open bank attracted males of *Somatochlora graeseri* Selys, 1877 which ranged above their surface and hovered for quite a long time (Fig. 14). There were also some *L. rubicunda*, *L. quadrimaculata* and, in bank sedge, many *C. hylas*, *C. lunulatum* and few *C. armatum* (Charpentier, 1840). Several tandems of *C. hylas* (Fig. 11b,c) and one of *C. armatum* (Fig. 16a,c) were observed ovipositing into floating dead, brown grass stems.

Figure 8. A male (a; 30.06.2017) and female (b; 5.07.2017) of *Ophiogomphus spinicornis* at the bank of the Uyuk River at Uyuk village.

At a very shallow grassy pool with *Acorus calamus* L. and *Equisetum fluviatile* L. at the broken bridge there were plenty of *L. dryas* including tandems and somewhat less abundant *L. sponsa* (Fig. 15), many males and some tandems and females of *C. armatum* (Fig. 16), several males of *C. lunulatum* (Fig. 17) and *C. hastulatum* and one male of *Coenagrion ecornutum* (Selys, 1872). There were also many males (Fig. 13a) and some copulae of *L. rubicunda* and few *L. quadrimaculata* at any shallow pool.

In sum 18 species observed (1 unidentified) for three days; the number of collected specimens is provided in brackets: *L. dryas* (1 ♂, 2 ♀♀), *L. sponsa* (2 ♂♂), *S. paedisca* (2 ♂♂), *C. armatum* (1 ♂, 1 ♀), *C. ecornutum* (1 ♂), *C. hastulatum* (1 ♂), *C. hylas* (5 ♂♂, 2 ♀♀), *C. lunulatum* (3 ♂♂, 1 ♀), *E. cyathigerum* (2 ♂♂, 4 ♀♀), *A. grandis*, *A. juncea* (11 ♂♂, 3 ♀♀ in alcohol, for molecular studies by J. Ware and G. Sahlén.), *S. exuberata* (5 ♂♂, 1 teneral ♀), *S. graeseri* (2 ♂♂), *Somatochlora* sp., *L. rubicunda* (6 ♂♂, 3 ♀♀), *L. quadrimaculata*, *S. danae* (1 ♂), *S. flaveolum*. The exact label is as follows:

Russia, Central Siberia, Tyva Republic, Piy-Khem Kozhuun, the Uyuk River valley S of Uyuk village, 52.069-075° N 94.014-050° E, 791-806 m a.s.l., 30.06, 1,5.07.2017.



Figure 9. A just hatched male of *Somatochlora exuberata* at the bank of an arm of the Uyuk River at Uyuk village. 1.07.2017



Figure 10. The right narrow arm the Uyuk River at the broken bridge at Uyuk village where just hatched male and female of *Somatochlora exuberata* were found, 1.07.2017.

Discussion

No rheophilic Odonate species unknown from Tuva were found for which some probability of presence in the Turan Depression was supposed by Kosterin & Zaika (2010; 2011). At the same time we made one considerable, in the Tuvinian scale, extension of a known range: for *S. exuberata*, which was known before only from the elevated, humid and forested Todzha Depression. There it co-occurred with seven other species and one subspecies not found in Tuva beyond Todzha: *Calopteryx splendens* (Harris, 1872), *Coenagrion johanssoni* (Wallengren, 1894); *Erythromma najas najas* (Hanse-mann, 1823), *Ophiogomphus obscurus* Bartenev, 1909, *Epitheca bimaculata* (Char-pentier, 1825), *Somatochlora alpestris* (Selys, 1840), *Somatochlora arctica* (Zetterstedt, 1840) and *Somatochlora metallica* (Vander Linden, 1825)). Although situated in a steppe depression, the forested Uyuk River appeared to provide a good habitat for *S. exuberata* which inhabits similar, rather fast medium-size forest rivulets in Todzha (Zaika & Kosterin 2010; 2011). Other above mentioned Todzhian species still can be expected for the Turan Depression (while *S. alpestris* may have been already observed, see below).

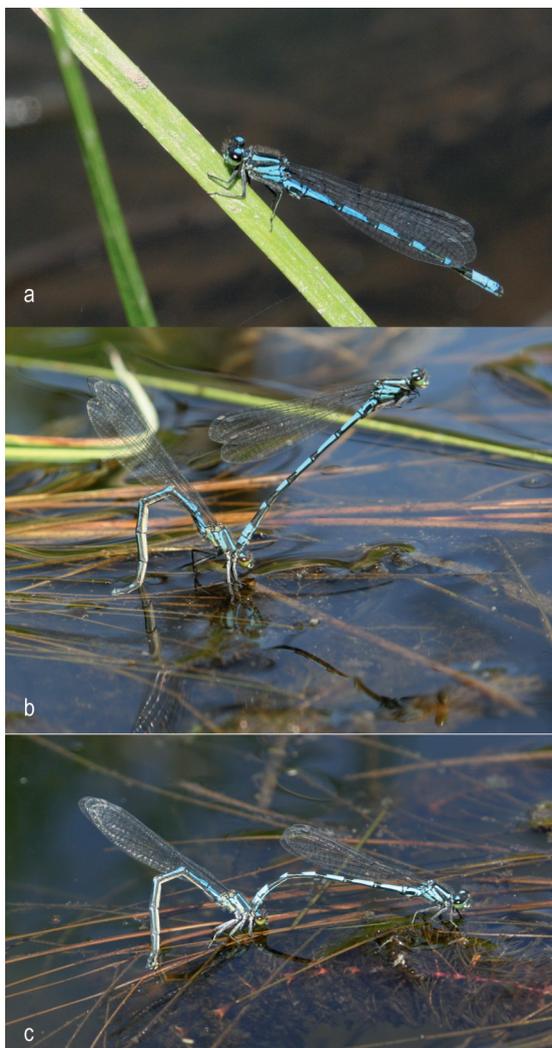


Figure 11. *Coenagrion hylas* at the Uyuk River (a) and its right oxbow lake (b, c) at Uyuk village; a – a male, 30.06.2017; b-c – an ovipositing tandem, 5.07.2017.

Besides, *C. armatum*, *C. ecornutum*, *A. juncea*, *A. grandis*, *S. graeseri*, *L. quadrimaculata* are formally new for the Turan Depression, and *C. hastulatum*, *E. cyathigerum*, *O. spinicornis*, *S. danae*, *L. rubicunda* – for the very locality, the Uyuk village environs.

Somatochlora males are quite strict in habitat preference for their territorial activity. Those over quite fast forest river of *S. exuberata* and over oxbow lakes of *S. graeseri* were exactly as observed earlier elsewhere in Tuva (Kosterin & Zaika 2010; 2011). The searching behaviour of an unidentified male among sedge tussocks and tree branches in an overcast weather suggests *S. alpestris* as the best option.

Figure 12. A female of *Enallagma cyathigerum* at the Uyak River bank at Uyak village, 30.06.2017.



Figure 13. A male (a) and female (b) of *Leucorrhinia rubicunda* at a shallow pool and a glade in a spruce forest, respectively, at the right floodland of the Uyak River at Uyak village, 5.07.2017.



Figure 14. A male of *Somatochlora graeseri* hovering over a right oxbow lake of the Uyuk River at Uyuk village, 5.07.2017.

Both collected males of *E. cyathigerum* have the cerci structure of ss. *risi* (with the yellow lip beneath the apical tooth), as could be expected in a Tuvinian depression, although males with the cerci as in ssp. *cyathigerum* and transitory between the subspecies (with yellow lips both beneath and at the top of the apical tooth) were earlier found at Arzhaan village and the Kislye Lakes in the same Turan Depression (Kosterin & Zaika 2010; 2011). Of course, two collected males are too insufficient to characterise the Uyuk River population. One of the collected females has aberrational, irregular and asymmetrical melanisation of the synthorax sides.



Figure 15. A tandem and male of *Lestes sponsa* at a shallow grassy pool at the Uyuk River right bank near the broken bridge at Uyuk village, 1.07.2017.

Notes on distribution of *Ophiogomphus spinicornis* Selys, 1878

According to our long-term investigations in Tuva (Kosterin & Zaika 2010; 2011), the eastern Central Asian species *O. spinicornis* breeds in abundance in the Tes-Khem River in the Ubsu-Nur Depression in the south of Tuva, and in the Khemchik River, both in the Khemchik Depression (which is the western continuation of the Central Tuvianin Depression) and in the West Sayan Mountains. At the same time it appeared nearly absent from the Central Tuvianin Depression in the narrow sense (not including the Khemchik Depression), where for 25 years of regular monitoring only one just hatched and deformed male has been found at the bank of an island at the Kaa Khem River at its mouth in the city of Kyzyl.

In the taigaous Todzha Depression in the north-east of Tuva the genus *Ophiogomphus* is represented by another species, *O. obscurus* Bartenev, 1910, which is associated with taiga forests throughout its range.

The major rivers of Biy-Khem (Big Yenisey) and Kaa-Khem (Small Yenisey) and the product of their junction Ulug-Hem (Great Yenisey) can be too big and powerful for breeding of the larvae of *O. spinicornis* (although the Khemchik River is as powerful



Figure 16. A tandem (a, c) and male (b) of *Coenagrion armatum* at the shallow grassy pool (b, c) and a right oxobow lake (a) of the Uyuk River at Uyuk village, 1.07.2017 (b, c) and 5.07.2017 (a).



Figure 17. A male of *Coenagrion lunulatum* at a shallow grassy pool at the Uyuk River right bank near the broken bridge at Uyuk village, 1.07.2017.

at Idig-Khonchu terrain where the species breeds) but it is unclear why this species was not recorded from smaller rivers of the Central Tuvinian Depression, like Barlyk, Elegest, Buren, Mazhalyk, Ter'ga, Kyzyl-Aryg, Uzun-Kharagan, Shuurmak etc. From this point of view it was remarkable that on 4.07.2017 we found quite many individuals of both sexes (Fig. 18; 1 ♀ collected) of *O. spinicornis* at large glades among larch forest on the Shurmakskiy Pass (~1440 m a.s.l., 50.621° N 95.193° E, 13 km ENE of Samagaltay village; loc. 4 in Fig. 2) through East Tannu-Ola Mts. which divides the Central Tuvinian and Ubsu-Nur Depressions. Our previous studies in the Ubsu-Nur Depression (Kosterin & Zaika 2010; 2011) showed that *O. spinicornis* breeds in abundance at the main river draining the depression, Tes-Khem (Fig. 19).

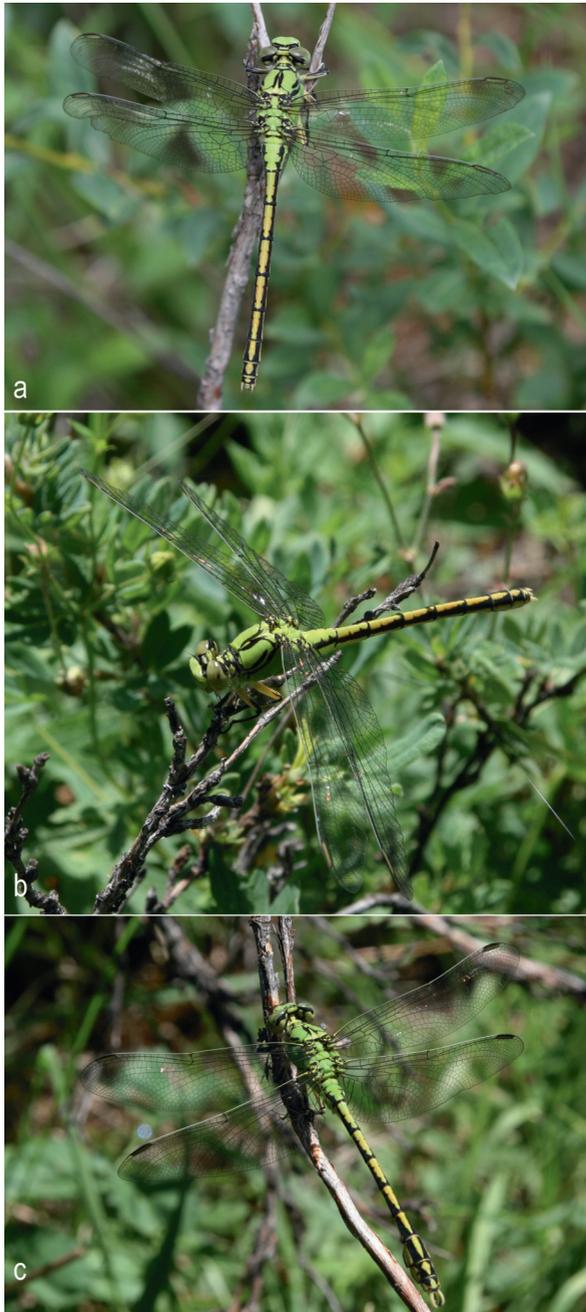


Figure 18. A female (a, b) and male (c) of *Ophiogomphus spinicornis* at a large glade at the pass of the Federal Road M54 'Yenisey' through the East Tannu Ola Mountain Range, ~1440 m a.s.l., 13 km WSW of Samagaltay village, 4.07.2017.



Figure 19. The Tes-Khem River 16 km SW of Samagaltay village, 4.07.2017.

At the same time only mature dispersal individuals occur in valleys of smaller rivers descending to the depression from the southern slopes of the East Tannu-Ola, such as Shivilig-Khem (Kosterin 2009; Kosterin & Zaika 2010; 2011). Those small fast mountain rivers are never inhabited by Odonata in Siberia as being too cold, while The Tes

Khem, meandering in flatland (Fig. 19), is definitely warmer. The small mountain streams close to the Shurmakskiy Pass, e.g. the Dytytg-Khem River situated 6 km to the west, surely did not fit dragonfly breeding as well. So those individuals of *O. spinicornis* at the Shurmakskiy Pass had most probably bred in the major Tes-Khem River which was situated 24 km to the south-west (16 km SW of Samagaltay village, 50.47° N 94.89° E, 1015 m a.s.l.; loc. 5 in Fig. 2, we did observe this species there on the same day, see Fig. 20), and reached the pass on their pre-breeding dispersal along the Dytytg-Khem River valley. Pre-breeding dispersal of Odonata from lowlands to mountains is not uncommon in arid regions, e.g. in Central Asia (Borisov 2010) or Algeria (Samraoui et al., 1998). We may add that the Ubsu-Nur Depression is forestless and the southern slope of the East Tannu-Ola are partly forestless, that would facilitate the dispersal, as well as the valley breeze, the wind blowing from the depression up the mountain slopes at daytime.



Figure 20. A female of *Ophiogomphus spinicornis* near the Tes Khem River right bank 16 km SW of Samagaltay village, 4.07.2017.

It seemed quite possible for those dragonflies to reach from the Shurmakskiy Pass the medium-sized Mazhalyk River (Fig. 21) situated 40–41 km to the north (880 m a.s.l.; 50.98° N 95.18° E; loc. 2 in Fig. 2), thus crossing the East Tannu-Ola Mts. Nevertheless, we did not find *O. spinicornis* at the Mazhalyk River on the same day, as well as at

any of the medium-sized rivers of the Central Tuvian Depression any time before. So, for the time being the known situation remains the same: in Tuva *O. spinicornis* is widespread and abundant to the north, west and south of the Central Tuvian Depression (in a narrow) but for some reason not in that depression itself.

Note that a male identified as *Ophiogomphus spinicornis* from "Russland, Oblast Novosibirsk, Iskitimsky Distrikt, Novososedovo" collected by A.Y. Haritonov on 22.06.2002, mentioned by Schorr (2012: 188 and fig. 5, right) was in fact a misidentified *Ophiogomphus cecilia* (Fourcroy, 1785). From one hand this is evidenced by the epiproct as long as the cerci (considerably shorter in *O. spinicornis*, see Asahina ; Kosterin 2004: 54 and fig. 4), thinner and less curved cerci (thicker and more curved in *O. spinicornis*), from the other hand Novosibirsk Province is well known as inhabited by *O. cecilia* (Kosterin et al., 2001; Kosterin 2004; Kosterin & Zaika 2010; 2011). Novososedovo village is among the favourite excursion places of the first author who knows its fauna well and used to observe *O. cecilia* as common there. Besides, the correct identification by Schorr (2012) of the *Ophiogomphus* specimens collected in Mongolia by G. Peters as *Ophiogomphus reductus* (Calvert, 1898) and *O. spinicornis* had been published before (Kosterin 2004: 66) as follows: "... based on photographs provided by R. Seidenbusch, of specimens collected in Mongolia by Prof. G. Peters and mentioned in PETERS (1985) as *Ophiogomphus cecilia*. The specimens from SW Mongolia (Bulgan, Dzhungarian Gobi) and W Mongolia (Uljastain-Go, Chovd gol tributary) are undoubtedly *O. reductus*, while the female from N. Mongolia (Selenga, Ich-nul steppes) is *O. spinicornis*."



Figure 21. The Mazhalyk River valley where it is crossed by Federal Road M54 'Yenisey', loc. 3 in Fig. 2, a habitat of *Erythromma najas humerale* and *Sympetrum flaveolum*, as observed on 4.07.2017.

The second locality for *Erythromma najas humerale* in the Central Tuvian Depression

Of interest was an observation made on 4.07.2017, of one male of *Erythromma najas humerale* at a grassy open bank of Mazhalyk River (Fig. 21; loc. 2 in Fig. 2). This is the second known locality in the Central Tuvian Depression, in addition to the well-known one, Kaa Khem left bank oxbow in the Kyzyl City Park (the other one known in Tuva is at the Tes Khem River in the Ubsu-Nur Depression) (Kosterin & Zaika 2010; 2011).

Odonata at Lake Oyskoe, West Sayans

Locality and observations

On 29-30.06.2017 the first author had an opportunity to examine Lake Oyskoe and its vicinities, situated to the north from Tuva over the West Sayan (loc. 1 in Fig. 2) and representing typical landscapes of the humid, taigaous northern principle slope of the Sayans. This is a large (1,46 × 0,57 km; area of 52-57 ha) and deep (to 25 m) lake (Fig. 22) from where the large Oya River, a right tributary of the Yenisey, starts. It is situated at 1414 m a.s.l. on the plateau at the junction of Kulumys and Ergaki Mountain Ranges and surrounded by lush flowery subalpine meadows and open fir (*Abies sibirica* Ledeb.) forests with participation of Siberian stone pine (*Pinus sibirica* Ledeb.) (Fig. 22). From this lake the famous picturesque peaks of Ergaki are seen (shown in Fig. 23 as viewed from the opposite side from the lake) and there is a large tourist base at



Figure 22. Lake Oyskoe, 1414 m a.s.l., at the junction of the Kulumys and Ergaki Ranges of the West Sayan Mountains, loc. 1 in Fig. 2, a habitat of *Enallagma cyathigerum risi*, 29.06.2017.

its bank. The water edge is formed by stones but the banks are entirely covered with tall meadows, with sparse young fir and Siberian stone pine trees, somewhere with peat-moss patches. During our visit the water unexpectedly was not cold.

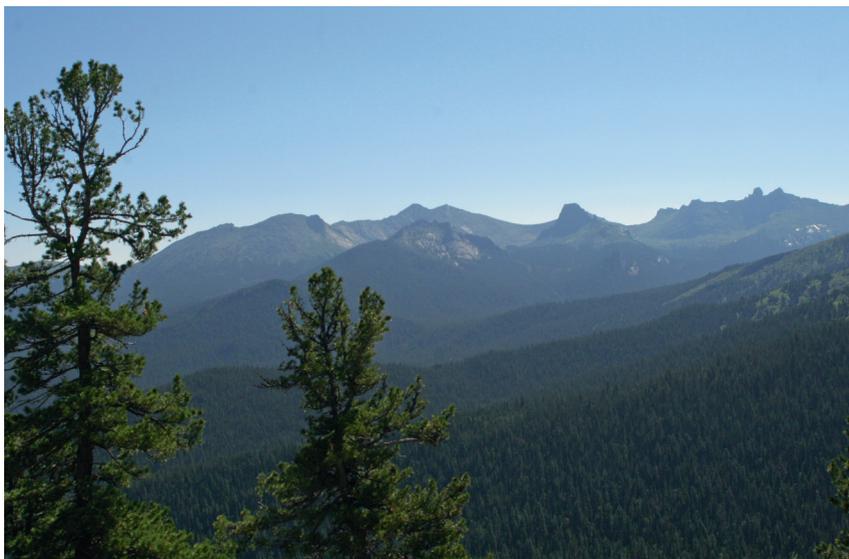


Figure 23. The Ergaki Mountain Range as viewed from the northern side, opposite to Lake Oyskoe (Fig. 22), 29.06.2017.



Figure 24. A copula of *Enallagma cyathigerum risi* at the SE bank of Lake Oyskoe, 29.06.2017.

Only one species of Odonata was observed at the lake, rather abundant in grass at its banks – *Enallagma cyathigerum risi* Schmidt, 1961, including tandems and copulae (Fig. 24).

At the southern end of the lake, at the right bank of the nascent Oya River at its very outflow of the lake, there is an open peat-moss bog ca 130 × 50 m, with sedge and sundew, soaking with water but allowing walking. It has two small water “windows” margined with floating bog not holding a human, with sparse emerging *Carex* spp., surrounded by spruce/fir/Siberian stone pine forest (Fig. 25). This bog was examined at 13:20-14:00 and 18:20-19:50 and 20:40-21:00 on 29.06.2017 and at 8:00-8:42 on 30.06.2017. There were many males and tandems of *C. johanssoni* (Fig. 26), one female of *C. hastulatum* and quite a few males (including tenebrals) and few copulae of *Leucorrhinia dubia dubia* (Fig. 27) and one male of *S. flaveolum*.



Figure 25. A small peat-moss bog at the SW bank of Lake Oyskoe, on the right bank of the nascent Oya River, a habitat of *Coenagrion johanssoni*, *C. hastulatum*, *Aeshna caerulea*, *Somatochlora alpestris*, *Leucorrhinia dubia*, *Sympetrum flaveolum*, 29-30.06.2017.



Figure 26. A female in cobweb (a) and a tandem (b) of *Coenagrion johanssoni* at the small peat-moss bog at the SW bank of Lake Oyskoe, 29.06.2017.



Figure 27. A male of *Leucorrhinia dubia* at the small peat-moss bog at the SW bank of Lake Oyskoe, 29.06.2017.

The *Coenagrion* species disappeared exactly at sunset at ca 18:50 but did not appear in the morning at least for an hour after sunrise. *Leucorrhinia dubia* disappeared shortly after sunset and reappeared at sunrise.

On 29.06.2017 at ca 13:30 a male of *Aeshna caerulea* (Ström, 1783) appeared to range over a water opening, and at ca 14:00 and 18:00 two ovipositing females arrived.

A male of larger *Aeshna* sp. (*juncea* or *subarctica* Walker, 1908 judging by the size) repeatedly appeared at ca period 17:00-18:00 on 29.06.2017 and twice at 8:00-8:40 next day to widely range with irregular trajectories ca 1.5 m over the bog for short period of time; a female ovipositing among sedge was found just after the sunset at ca 19:00. All these larger darners were missed.



Figure 28. A female of *Somatochlora alpestris* ovipositing among sedge at a pool at the small peat-moss bog at the SW bank of Lake Oyskoe at 8:30-8:34, 30.06.2017.

Two males of *Somatochlora alpestris* patrolling sedge appeared at ca 18:00 and 19:30 on 29.06.2017 (both checked in hand), and several patrolled for the observation time 8:00-8:42 next day (two checked in hand). In the morning also a female twice oviposited among sedge, once for 4 minutes 8:30-8:34 (Fig. 28), the second appearance for a very short time.

In sum 8 species observed (1 unidentified) for two days; the numbers of collected specimens are provided in brackets:

E. cyathigerum risi (3 ♂♂);

Exact label: Russia, Krasnoyarskiy Kray, Ermakovskoe District, Lake Oyskoe SW bank, 52.835-839° N 93.244-250° E, 1414 m a.s.l., 29-30.06.2017.

C. johannsoni (1 ♂, 2 ♀♀), *C. hastulatum* (1 ♀), *A. caerulea* (1 ♂, 2 ♀♀), *Aeshna* sp., *L. dubia dubia* (5 ♂♂), *S. alpestris* (2 ♂♂ dry, 1 ♀ in alcohol), *S. flaveolum*;

Exact label: Russia, Krasnoyarskiy Kray, Ermakovskoe District, a peat-moss bog at the Oya River right bank at its very start from Lake Oyskoe, 52.835-836° N 93.2428-2435° E, 1417-1421 m a.s.l., 29-30.06.2017.

Discussion.

S. alpestris was known only in Krasnoyarskiy Kray only from the north. There is a record as northerly as 67.93° N 86.40° E at Plakhino (an abandoned village at the Yenisei right bank, not to confuse with a large village Plakhino at the Biryusa River in the southern Krasnoyarskiy Kray); curiously, this was the female from the type series of *Somatochlora sahlbergi* Trybom, 1889, later reidentified as *S. alpestris* by Valle (1931; see also Trybom 1889; Hämäläinen 2015). The map for this species by Belyshev (1973) contains a dot at ca Yeniseysk (67.93° N 86.40° E). The source of this datum is unclear, there is no such specimen in Belyshev's collection at the Institute of Systematics and Ecology of Animals (Sergey Borisov's pers. comm.), so there should have been some literature source, unknown to the authors. Perhaps this was a misinterpretation of the information from Trybom (1889). Sergey Borisov also kindly informed us that in the untreated collections at the above mentioned Institute he found an unpublished male of *S. alpestris* from Krasnoyarskiy Kray, Boguchan District, Chunoyar station [57.45° N 97.32° E], Sosnovka camp, mixed taiga, 24.07.1975, Velizhanin leg. Other records from the Upper Yenisey basin were ours from Lake Many-Khol' enirons in the Todzha Depression of Tuva (Kosterin & Zaika 2010; 2011). Hence, hereby *S. alpestris* is for the first time reported for the southern Krasnoyarskiy Kray Province.

The above reported observations, made at excellent weather, looked as if this species would manifest an amphicrepuscular activity or at least avoids direct sun. However, observations from elsewhere do not support this. The first author observed *S. alpestris* active in midday in Tozdha Depression of Tuva and above the tree line in the Katurgunbulak valley in the Yuzhno-Chuyskiy Mountain Range of Altai (unpublished). Knaus (1999) reported activity of *S. alpestris* in good weather conditions in the Swiss Alps from ca 8:30 to 19:00, with the maximum at 16:00-17:00. Unfortunately, further observations in the morning of 20.06.2017 to clarify the timetable of the species' activity at that bog near Lake Oyskoe were impossible. There were more and larger peat-moss bogs at Lake Oyskoe which, unfortunately, remained unexamined due to a short time of stay.

Belyshev (1973) considered two cubitoanal veins on the fore wing to be a diagnostic character of *S. alpestris*, but we (Kosterin & Zaika, 2010; 2011) reported that one of the three females collected in Todzha Depression had one vein in one of its fore

wings. Of the two males collected at Lake Oyskoe one has two cubitoanal veins on both fore wings while the other male had three on both wings (an additional one is distally positioned of the arculus), while the female has one on both fore wings (other characters fitting the species).

The status and geographical ranges of *Leucorrhinia dubia dubia* and *L. dubia orientalis* is still unclear. *L. dubia orientalis* is reliably known as westerly as Kemerovo Province, at least at Mezhdurechensk District, while the eastern limit of *L. dubia dubia* is still unknown. The specimens from the bog at Lake Oyskoe have the following characters of *L. dubia dubia*: dorsal abdominal spots in the distal part of the abdomen orange (yellow in *L. dubia orientalis*), and the dark basal hindwing spots convex (Fig. 27) (almost triangular in *orientalis*). The incision of the epiproct is shallow to medium, roundish to bluntly subtriangular, while shallow roundish in *dubia* s. str. and deep triangular in *orientalis*. Four of five males have dorsal abdominal spots at S6 and S7 (two also a pair of very small spots at the proximal margin of S8) - a pattern which can be found in both taxa. However, *dubia* s.str. usually has also spots on S5 while most specimens of *orientalis* have only a spot on S7 (Kosterin & Zaika 2010; 2011); the latter condition is found in the fifth male of the collected series. (At the same time, about half of males of *orientalis* from Maizas village environs in Kemerovo province had the second spot on S6, however both spots on S6 and S7 being small and lemon yellow as should be in *orientalis*, see Kosterin & Zaika 2011). Thus, the small series collected at the bog at Lake Oyskoe is somewhat transitory with respect to the characters differentiating *L. dubia dubia* and *L. dubia orientalis* but can arbitrarily be identified as the former. *L. dubia dubia* is thought to inhabit the West Siberian Lowland and replaced by *L. dubia orientalis* in the mountains of South Siberia (Kosterin 2010; 2011). The present finding suggests that populations inclining towards *L. dubia dubia* can be found in these mountains as well.

Expectations as to the subspecies of *E. cyathigerum* for Lake Oyskoe would be rather equivocal. On one hand, *E. cyathigerum risi* does prefer large lakes, including freshwater ones e.g. in Tomsk Province (Bernard & Kosterin 2010). On the other hand, in the nearby Tuva this subspecies as a rule occurs at brackish steppe lakes while in the Todzha Depression, with landscapes somewhat similar to those at Lake Oyskoe, only *E. cyathigerum cyathigerum* was recorded, although at smaller lakes (Kosterin & Zaika 2010; 2011).

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