

A misleading representation of the Asian distribution of a most intriguing dragonfly, *Somatochlora sahlbergi* Trybom, 1889: a critique of KOHLI et al. (2018)

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Abstract. Recently KOHLI et al. (2018) published a phylogenetic analysis of *Somatochlora sahlbergi*, including extensive supplementary material listing global distribution records for the species. The compilation of literature data on records of *S. sahlbergi* in Siberia includes an unacceptable level of false pseudo-data and incorrect statements.

Further key words. Odonata, Anisoptera, Corduliidae, Russia, Siberia, geographical distribution, circumpolar species

Somatochlora sahlbergi Trybom, 1889, is considered to be the world's 'northernmost dragonfly'. It has a charismatic appeal for European and North American odonatologists as it is one most difficult species to encounter, especially in Europe (HÄMÄLÄINEN 2015). It was thought to be confined to high latitudes within or near the Arctic Circle until BELYSHEV & OVODOV (1961) discovered it at a latitude of 51°45'N in Irkutsk Province in Russia. Since then, evidence has accumulated indicating that the species' range extends to the mountains of southern Siberia and the northern Khabarovskiy Kray (KOSTERIN 1992; SCHRÖTER 2011). The geographical distribution of the species was thoroughly reviewed by SCHRÖTER (2011), who provides detailed and precise maps of its known localities for the northern hemisphere in general, including Europe, Siberia and North America. However, that review does not give text accounts of known localities for the species. Recently, a highly interesting insight into phylogeography of *S. sahlbergi*

in much of its range was published by KOHLI et al. (2018). This molecular study revealed (i) high genetic homogeneity of the species suggesting its rather recent – most probably during the last glaciation – spread from a single source and (ii) either occurrence as far south as Hokkaido (Japan) or introgression of its mitochondrial DNA into the local population(s) of *S. alpestris* (Selys, 1840), the latter remarkable discovery being based on analysis of sequences available in GenBank (AB708910.1, AB708909.1 and AB708908.1).

The authors provided an updated map of its geographic records (KOHLI et al. 2018: Fig. 1) and a supplementary table with corresponding details as a part of the paper (KOHLI et al. 2018: Supp. Table S1). Most of the indicated sites are located in Russia. In the introduction to their paper, KOHLI et al. (2018: 2) describe the Russian part of the distribution of *S. sahlbergi* as follows: »in Russia according to Belyshev¹⁰ [BELYSHEV 1973], it ranges throughout the Siberia. He recorded populations along the Yana, Indigirka, and Yenisey Rivers and farther south along the Amur and Shilka Rivers, and at Lake Baikal close to the Mongolian border. Additionally, there are populations along the rivers Ob and Lena that transect Russia from north to south«. **This statement is misleading since (i) the indicated source, the seminal two-volume monograph 'Dragonflies of Siberia' by BELYSHEV (1973; for the text on *S. sahlbergi* see pages 372–374, for the map see Fig. 128) indicates only four (!) localities of *S. sahlbergi* known to its author (Fig. 1) and (ii) *S. sahlbergi* has never been reported at Yana and Indigirka Rivers, along the Amur, Shilka and Lena Rivers. Figure 1 of KOHLI et al. (2018) is completely misleading since the great majority of the orange dots for »locations estimated from literature« have no basis in reality. However unprecise such estimations could be, three localities in North Kazakhstan, three localities along the Irtysh River, four localities along the upper Ob' River, two localities along the middle Yenisey River reaches, three localities at the Lena, Yana and Indigirka Rivers are false as such records were never made. The species could be expected at the mid-Yenisey, Lena and Indigirka but not in North Kazakhstan and not in the upper Ob' River area. Seven localities are indicated in the Altai and West Sayan, however, only three are known. Two localities near Lake Baikal are mentioned instead of one known and three in Transbaikalia instead of only one.**

Examination of Supplementary Table S1, »List of known localities for *Somatochlora sahlbergi*« explains the origin of the misleading claims in the text. This table contains 20 entries with reference to 20 different (!) figures in

Трувом. Приходится подчеркнуть и то обстоятельство, что и К. Валле (Valle, 1931) отмечает полупроточную воду как среду обитания личиночных фаз.

Таким образом, этот совершенно типичный северный вид проявляет в своих биологических особенностях южные черты. Явление интересное и стоит в противоречии с существующими закономерностями в этом вопросе. Единственное объяснение такого проявления может заключаться в том, что территорию

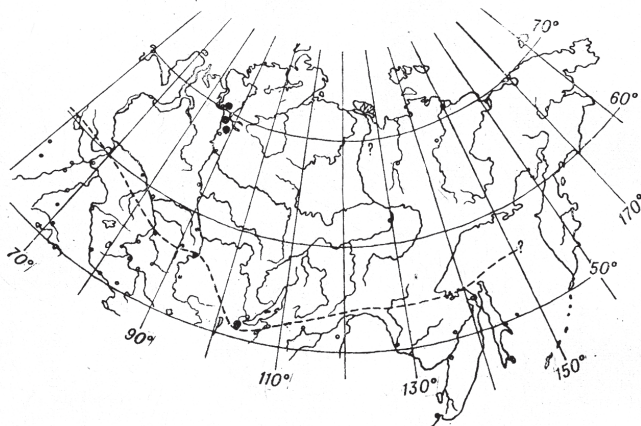


Рис. 128. Схематическая карта распространения и места встреч *Somatochlora sahlbergi* Трувом в Сибири. Оригинал.

южной части Сибири и Финляндию следует рассматривать как южные для вида, где он начинает приобретать особые биологические черты. Но и это противоречит всему известному, так как *S. sahlbergi* Трувом должен считаться видом северным, а не биологическим аналогом северного вида.

47. *Somatochlora alpestris* Selys, 1840 (рис. 129)

Систематические замечания. Описываемый вид несколько близок среди наших видов к *S. arctica* Zett. и *S. sahlbergi* Трувом, что особенно заметно на личинках: волосатость и малая

Figure 1. Page 374 in BELYSNEV (1973) with Figure 128 presenting a map of distribution of *Somatochlora sahlbergi* in Siberia known at that time.

BELYSHEV (1973): Figs 128–132, 134–135, 137–142, 144–150 (the continuous row of numbers is interrupted by three omissions). They are marked as »coordinates that were estimated from map figures in a publication and/or textual descriptions, and by comparing them [with] maps to those in Google Maps« (KOHLI et al. 2018: Supp. Table S1, p. 9). It should be noted that BELYSHEV (1973) provides only four localities for *S. sahlbergi*, shown in the map of his Figure 128 on page 374 (Fig. 1). His Figure 129 contains drawings of structural details of *S. sahlbergi* and Figures 130–150 have no relation to *S. sahlbergi*. They cover the rest of Corduliidae and the beginning of Aeshnidae to *Aeshna serrata* Hagen, 1856. As many as 14 of 20 of the figures in BELYSHEV (1973) referenced in Supp. Table S1 by KOHLI et al. (2018) show morphological details of different species, not maps.

The contents of these entries in Supp. Table S1 in KOHLI et al. (2018) are striking. They contain detailed and informative geographical information of certain localities that actually exist in Russia and Kazakhstan, most of which have no relation to *S. sahlbergi* yet, such as, e.g., »Kazakhstan, Zyryan District east of Irtysh River toward Kazakhstan-Russia border«, »Russia, Zabaykalsky Krai Ingoda River near Kenon Lake«, »Russia, Altai Krai Smolensky District, where Biya and Katun Rivers meet to form Ob River«, »Kazakhstan Pavlodar District Irtysh River near Pavlodar«, »Russia Altai Krai Ob River near Barnaul«. Many of these localities are well known as collection sites of common dragonfly species in Siberia.

Indeed, the monograph by BELYSHEV (1973) is in Russian. But the language barrier should not be a problem in these times of intensive international scientific cooperation, Internet, e-mail and powerful software for image recognition and machine translation. Furthermore, the figure captions in BELYSHEV (1973) contain internationally understandable Latin names of Odonata while morphological illustrations cannot be confused with maps.

There are two more incorrect records in the second page of Supplementary Table S1 by KOHLI et al. (2018). One is from »Russia, Novosibirskaya Oblast«, with reference to SCHRÖTER (2011: Fig. 4). This map contains no point in this region where I live and work, while the presence of *S. sahlbergi* here is highly improbable. Also two identical lines in the table contain a record from Kamchatka made in 2000 and referring to »Kalkman & Dijkstra 2000«, a source which is absent from the references. The only joint paper by

KALKMAN & DIJKSTRA (2000) is devoted to Poland and Belarus and does not mention *S. sahlbergi*. The (identical) coordinates provided in these two lines are identical to those six (!) lines below, of which four are identical to each other and the rest two also identical. These six entries actually refer to two records made very close to each other in Kamchatka in 2003 and have a correct reference to DUMONT et al. (2005).

Such a great amount of seemingly precise and well referenced, but actually misleading information suggests the data was haphazardly and mindlessly copied from some detailed but irrelevant English text(s) concerning Russian biogeography, and perhaps originate from database errors that remained unnoticed. Whatever the cause, the result is unacceptable.

Other spurious entries in Supplementary Table S1 by KOHLI et al. (2018) are perhaps less serious, although still deserve notice. Indications of coordinates with six digits after the decimal point estimated from small maps showing half of Eurasia pretend at non-existent accuracy. Too many entries refer to the same records retrieved from several sources and show somewhat different estimated coordinates. There are series of identical entries repeating the same record, e.g., lines 7–8, 9–10, 11–12 in page 2, etc. Unfortunately such sloppiness in the compilation of source and/or supplementary data tends to cast a shadow over the entirety of the research.

Any supplementary material is scientific information and must be as accurate as any other data. Supplementary Table S1 is circulated along the main text as included into the same PDF file (KOHLI et al. 2018). Moreover, corruption of these data leads to a false map and incorrect statement concerning the distribution, in this case of the charismatic flagship species *S. sahlbergi*.

The article by KOHLI et al. (2018) appeared in the respected journal, 'Scientific Reports', published by Springer Nature. By focusing on the charismatic dragonfly, *S. sahlbergi*, the paper finds broad interest among odonatologists. However, its credibility is seriously undermined by misinformation on the distribution of the species, which reduces the scientific value of the article as a whole. This is a seminal paper, prominently published, that will become a primary source of reference for years to come. It follows that the authors have an added responsibility to ensure any material associated with the paper, which will be recognized as the key reference on the species,

is in fact accurate. Carelessness in this regard is likely to result in the dissemination and acceptance of misinformation for generations.

It is to be hoped that the authors take the opportunity to publish a corrigendum. Otherwise for correct maps of the known distribution of this species in Russia, the review by SCHRÖTER (2011: Figs 2, 4, 5) should be consulted, which still remains up to date as no reports of *S. sahlbergi* from Russia have been published since 2011 except for that by STEPANOV (2016) from the Yamalo-Nenets Autonomous Region, also included into Supplementary Table S1 by KOHLI et al. (2018: 6). However, this is a larval record and hence should be treated with caution although the record is geographically plausible.

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