



Single syntypes of *Somatochlora exuberata* Bartenev, 1910 (Odonata: Corduliidae), discovered in both the Milwaukee Public Museum and the University of Michigan Museum of Zoology, U.S.A., with designation of the lectotype

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Abstract

A male syntype of *Somatochlora exuberata* Bartenev, 1910, from Kavykuchi Gazimurskie village, Transbaikalia, Siberia, June 24 (in Julian Calendar, July 7 in Gregorian Calendar) 1909, was discovered in the Milwaukee Public Museum, Wisconsin, U.S.A., as received in exchange from A.N. Bartenev by Richard Anthony Muttkowski. Another male syntype with the same data later was found in the University of Michigan Museum of Zoology, Michigan, U.S.A. The latter specimen is designated as the lectotype of *S. exuberata*. The description of *Somatochlora vera* Bartenev, 1914, a name currently considered a junior synonym of *S. exuberata*, is critically evaluated.

Key words: dragonfly, Corduliidae, syntypes, A.N. Bartenev, *Somatochlora exuberata exuberata*, *Somatochlora exuberata japonica*, *Somatochlora metallica*, *Somatochlora vera*, lectotype

Introduction

Alexandr Nikolaevich Bartenev (1882–1946) arguably was the first prominent Russian odonatologist. He described about 80 species and subspecies, although only ca 18 of the names he proposed are considered valid at present, others being junior subjective synonyms (Bridges 1994). Medvedev *et al.* (2013) came to the conclusion that most of Bartenev's type specimens were lost in the 1920–1930s, a troubled period in Russian history. Only two type-series given in Bartenev (1912a, 1956) were located in Russia (namely in Zoological Institute of the Russian Academy of Sciences, Saint-Petersburg): the holotype of *Trigomphus anormolobatus* Bartenev, 1912 (a junior synonym of *Trigomphus nigripes* (Selys, 1887)), and the wings from the syntypes of *Denticnemis bicolor* Bartenev, 1956 (a junior synonym of *Pseudocoptera rubripes* Navás, 1934). Fortunately, Bartenev intensively exchanged collections with leading odonatologists globally. Consequently, some syntypes could exist abroad. On this basis, a pair of syntypes of *Leucorrhinia intermedia* Bartenev, 1910, were found in the collection of Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt/Main, Germany (FMS), and the male was designated as the lectotype, to restrict the type locality (Medvedev *et al.* 2013). Later a pair of *L. intermedia* sent by Bartenev to Kenneth J. Morton was discovered in Morton's collection in Edinburgh, but it was labeled only as “Sib. Or.”, without date, so there is no means to infer if this pair belonged to the type-series, although this is very likely [Seehausen *et al.* 2023].

Near the beginning of his odonatological career, Bartenev (1910a) described *Somatochlora exuberata* from Transbaikalia, Siberia, Russia. Much confusion in the subsequent literature gave conflicting publication dates of 1910, 1911, and 1912 for the original description of *S. exuberata*. Medvedev *et al.* (2013) disentangled this convoluted taxonomic history and ascertained the specific relevant publication was Bartenev (1910a). The closely allied taxon, *Somatochlora japonica* Matsumura, 1911 was described from southern Sakhalin Island. Bartenev (1914) described *Somatochlora vera* from Primorye, Russia, on the basis of a single adult male. He indicated that it was closely related to *S. exuberata* but provided no illustrations.

Asahina (1938) suggested that *S. exubelans* [sic] “appears to be identical” with *S. japonica* but provided no additional comment. An additional closely related taxon, *Somatochlora coreana* (Doi, 1938) was described from Korea. Asahina (1942) listed several *Somatochlora* spp. from Manchuria plus adjacent regions including *Somatochlora alpestris* (Selys, 1840), *Somatochlora arctica* (Zetterstedt, 1840), *S. exuberata*, *Somatochlora graeseri* (Selys, 1887), and *S. vera*. This section of his paper is a compilation of literature records from various authors and publications.

Belyshev & Kurentzov (1964); Belyshev (1973); and Belyshev *et al.* (1989) demoted *S. exuberata* to subspecific rank under *Somatochlora metallica* (Vander Linden, 1825), as *S. metallica exuberata*, and also synonymized *S. vera* with *S. m. exuberata*. Lohmann (1994) surmised that *S. m. exuberata* and *S. japonica* “... are in all probability conspecific...” He suggested it then would follow that *S. exuberata* should be accorded specific rank with *S. japonica* as a junior synonym. In addition, he also treated both *S. vera* and *S. coreana* as junior synonyms of *S. exuberata*.

Malikova (1995), noted that both the morphological and color pattern diagnostic characters of *S. exuberata* provided by Bartenev (1910a) were constant and reliable, and so restored its specific rank. Later, Malikova (2006) determined *S. exuberata* to have been described in 1911 and so was a junior synonym of *S. japonica*. As the third author in (Medvedev *et al.* 2013), after considering new evidence, she also concluded that *S. exuberata* had priority.

Kosterin & Zaika (2010) confirmed that *S. exuberata* is a distinct species from *S. metallica*, based upon morphological and ecological evidence. Both *S. metallica* and *S. exuberata* segregate ecologically where sympatric. Karube *et al.* (2012) corroborated the specific status of *S. metallica* and *S. exuberata* using both molecular and morphological analyses. They also concluded that *S. japonica* should be treated as a subspecies *S. exuberata japonica*.

The description of *S. exuberata* was based on a series of syntypes collected by Bartenev himself in 1909 in Transbaikalia [Siberia between Lake Baikal and the Amur River origin (confluence of the Shilka and Argun' (Hailar) Rivers)], which was presented as follows (Bartenev 1910a: 22; translated verbatim by the second author):

- “a) Chernovskaya, 1 ♂; 10. VI. 09.
- b) Verkhniy Alenuy, ♂♂ and ♀♀; 19. VI. 09.
- c) Kavykuchi Gazimurskiya, ♂♂ and ♀♀; 22–24. VI. 09.
- d) Uktycha, ♂; 28–29. VI. 09.”

All of these localities are extant villages within the Zabaykal'skiy Kray Province of Russia. Decimal degree coordinates are as follows: a) 51.97 N 113.23 E, Chitinskiy District, 18 km SW of Chita City; b) 51.14 N 117.97 E, Aleksandrovo-Zavodskoy District; c) 51.36 N 118.19 E, Gazikursko-Zavodskoy District; d) 52.33 N 118.27 E, Sretenskiy District. Thus, the total area from where the syntypes originated was ca 325 (W–E) × 136 (N–S) km. Three things should be noted about this type-series: 1) The number of syntypes originating from localities b) and c) is unknown, although presumably there was more than one of either sex. 2) The dates are given in the Julian Calendar (Russ. ‘old style’), which was 13 days later as compared to the contemporary Gregorian Calendar (see Medvedev *et al.* 2013), accordingly the span of collection dates would be 23 June to 12 July. 3) The correct modern spelling of the village name is ‘Kavykuchi Gazimurskie’, or ‘Gazimurskie Kavykuchi’.

The original description was issued under different covers and later translated to German (Medvedev *et al.* 2013). Further literature contained no evidence of critical examination nor the existence of these syntypes. Those in Russia most probably were lost or destroyed. Potentially, those sent to foreign colleagues could still exist, as with the pair of *L. intermedia* syntypes (Medvedev *et al.* 2013). Fortunately, existing syntypes of *S. exuberata* in the U.S.A. have been located, one in the Milwaukee Public Museum, Wisconsin (MPM) and one in the University of Michigan Museum of Zoology, Ann Arbor, Michigan (UMMZ).

Syntypes discovered

While studying Odonata specimens at MPM, the first author examined two Riker mounts, filled with cotton, containing several specimens of *Somatochlora* spp. collected by A.N. Bartenev. These specimens were evidently donated or exchanged with Richard Anthony Muttkowski, the author of “Catalogue of the Odonata of North America” (Muttkowski 1910). Suspecting some of these specimens could be of taxonomic significance, he contacted the second author. The second author quickly realized the importance of the *S. exuberata* specimen and determined it was a syntype.

One of the two mounts contained five males of *Somatochlora flavomaculata* (Vander Linden, 1825), Nos. 60352, 60353, 60354, 60356, and 80357 with a printed narrow label “*Somatochlora flavomaculata*” and individual geographical labels in Russian. Specimens No. 60353, 60354, and, 60357 had the same printed geographical label “Кобулеты Кутаиск. г. / VII.10. А.Бартеневъ” [Kobulety Kutaisk. g. / 20 VII.10. A. Bartenev], which refers to the town Kobuleti in Georgia and July 1910. The July dates were handwritten with 12 for specimens No. 60353, 60354, and 21 for specimen No.60357. Specimen No. 60352 had a handwritten label in Latin letters “Kabulety / Russia.” Bartenev (1930) mentioned mass quantities of *S. flavomaculata* at Kobuleti observed from July 15 to August 3, 2010 (perhaps the paper published in 1930 already referred to the dates according to the Gregorian Calendar).

Specimen No. 60356 had the handwritten label “Екатеринодар / 31. VI.07. А.Бартеневъ [Ekaterinodar / 31.VII.07. A. Bartenev]”; Ekaterinodar is presently known as Krasnodar City. Curiously, Bartenev (1911: 33) reported for this place and date a juvenile male of *S. metallica*, with the following note: “Wings of a specimen with a yellowish tint; pterostigma blackish”, but did not mention *S. flavomaculata*, although that paper was especially devoted to the fauna of ‘Kubanskaya oblast’ (presently Krasnodarskiy Krai), with the capital in Ekaterinodar. Specimen No. 60356 is no doubt *S. flavomaculata* (and correctly placed in Milwaukee Public Museum), not juvenile but with a yellowish tint at the wing bases and blackish pterostigma. Mislabeling by Bartenev prior to mailing, or by someone else after the specimen’s arrival, are plausible explanations.

The second Riker mount (Fig. 1) contained five specimens of *Somatochlora*, with four narrow, typewritten labels representing these five specimens. There is a single male specimen of *Somatochlora williamsoni* Walker, 1907, from the Eagle River, Wisconsin, and four specimens of *Somatochlora* by Bartenev, No. 60350, 60351, 60355, and 60358, all having individual handwritten labels in Russian. The female No. 60350 and the male No. 603055 both have an arrow label “*Somatochlora borealis*”. This appears inconsistent for *Somatochlora borealis* Bartenev, 1910, which was described based upon two females (Bartenev 1910b) and had been known by females only until Matsumura (1911) supposed and Belyshev (1953) established the identity of this taxon as synonymous with *Somatochlora graeseri* Selys, 1887, known only by males. The controversy was easily resolved, as specimen No. 603055 appeared to be just a misplaced male of *S. flavomaculata* with the same label “Кобулеты Кутаиск. г. / 20 VII.10. А. Bartenev” (with a written in day 20) as above. This specimen is to be transferred into the first Riker mount, to join the others from the same series. Specimen No. 60350 was a doubtless female of *S. graeseri* (= *S. borealis*) with the characteristic basal amber on the hindwings and a pair of triangular yellow dorsal spots on S3. It had a handwritten label “Уктыча. За- / байкальск. об. Нерч. окр / 22/VI.09 / А. Бартенев”, that means “Uktycha (see loc. d) above), Zab[aykal’skaya] Obl[ast] (Zabaykal’skaya Province), Nerch[inskiy] okr[ug] (Nerchinskiy District), June 22, 1909, A. Bartenev.” Bartenev (1910a) did mention females (of unknown number) of *S. borealis* collected at Uktycha but on 28 June rather than 22 June. Specimen No. 60351 was labeled correctly as *S. graeseri*, with a handwritten label “д. Кавыкучи Га- / зимурскія, р. / Кавыкучи / Нерч. <unclear>. б. Забайк. /об. 21/VI.09 / А. Бартеневъ” (note the old Russian spelling), that means “Kavykuchi Gazimurskie v[illage], Kavykuchi River, Nerch[inskiy District], Zabayk[al’skaya] Ob[last’] (Province), June 21, 1909, A. Bartenev”, which is the locality c) above. Bartenev (1910a) did mention an unknown number of males of *S. graeseri* collected on June 21–24, 1909, at Ukrycha.



FIGURE 1. Riker mount with *Somatochlora* specimens by A.N. Bartenev (all but the upper left).

Finally, specimen No. 60358 (with a partially fractured synthorax and with detached, damaged legs) had a narrow label “*Somatochlora exuberata* Bart.” beneath it (Figs. 1–2) and two handwritten labels, “Transbaikal / District” (in Latin letters) and “Кавыкучи Га- / зимурскія / Нерч. окр. / Забайк. об. / 24/VI.09 / А. Баргеньевъ” [Kavykuchi Ga- / zimurskiya / Nerch. okr. / Zabayk. ob. / 24/VI.09 / A. Bartenev] (Fig. 2), that means “Kavykuchi Gazimurskie, Nerch[inский District], Zabayk[al’skaya] Ob[last’] (Province), June 24, 1909, A. Bartenev” (the date is in the Julian Calendar, in the modern Gregorian Calendar it would be July 7). As previously mentioned, Bartenev (1910a) did mention a non-specified number of male and female syntypes of *S. exuberata* from this locality and date. The specimen obviously is *S. exuberata*, exhibiting the following diagnostic characters, relative to the clearly related species *S. metallica*:

—the characteristic shape of the male terminalia, similar to those of *S. metallica* but differing in the proportionately shorter epiproct (ca 54% of the length of the cerci, Fig. 2) and blunter cerci with more basally placed lateral projections.

—two lateral yellow spots across the frons (unlike a contiguous yellow stripe of *S. metallica*).

—dull blackish abdomen, although the thorax is glittering metallic (Fig. 2).

Therefore, the male specimen No. 60358 in the MPM is a genuine syntype of *S. exuberata*.

Examination of *Somatochlora* adults at UMMZ by the first author, revealed another potential male syntype of *S. exuberata*, which soon thereafter was also again confirmed by the second author. This specimen (Fig. 3) is kept in a triangular paper envelope with its wings folded, the head was detached, and the first author later displayed, without detachment, the hamules and vesica spermalis. This specimen had the typewritten label “*Somatochlora exuberata* from Bartenev” and the original label handwritten in Russian, likely by Bartenev, “Кавыкучи Гази- / мурскія, Забай- / кал. обл., Нерчин. окр. / 24/6. 09 / а. баргеньевъ”, that means “Kavykuchi Gazimurskiya, Zabaykal’skaya Oblast’ (Province), Nerchin[skiy] District, June 24, 1909, A. Bartenev”. This specimen has the label corresponding in all detail, including the collection date, as specimen No. 60358 from the MPM, and that both belonged to the same series. As noted above, in that place and date, Bartenev collected unknown numbers, but probably more than one of

both sexes of *S. exuberata*. The male specimen from UMMZ exhibits the same diagnostic characters of *S. exuberata* as MPM specimen No. 60358. The Michigan syntype was overlooked in the ‘Catalog of the name-bearing types of species-group names in Odonata preserved in the UMMZ (Garrison *et al.* 2003). This is not surprising since it was not designated as a type specimen. Also, one would have had been able to read or otherwise recognize the handwritten data labels in Russian plus had sufficient familiarity with Bartenev’s original description.



FIGURE 2. Syntype of *S. exuberata* from Gazimurskie Kavykuchi village, Gazimurskiy District, Zabaykal’skaya Oblast’, 24 VI 1909 (according to the Julian Calendar), preserved in MPM, and its labels. Scale bar 1 cm.



FIGURE 3. Syntype of *S. exuberata* from Gazimurskie Kavykuchi village, Gazimurskiy District, Zabaykal'skaya Oblast', 24 VI 1909 (according to the Julian Calendar), preserved in UMMZ and its labels. This specimen has been designated as the lectotype of *Somatochlora exuberata* Bartenev, 1910. Scale bar 1 cm.

Discussion

Despite being comparatively detailed for that era, Bartenev did not indicate which character(s) he considered reliably diagnostic for *S. exuberata*. Although not required by the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999) (ICZN), designation of a lectotype seems prudent when evaluating the totality of all pertinent circumstances.

Further, the historical taxonomy of *S. exuberata* itself was complicated by a publication (Bartenev 1914) reporting from the current Primorskiy Krai (the southern Far East of Russia) two very close *Somatochlora* spp.: *S. exuberata* (7 ♂♂ and 2 ♀♀) and a new species *S. vera* (1 ♂). The specimens of those two species were received by him from different collectors and with different labels: 'Yuzhno-Ussuriyskiy Krai, the Odarka River valley (the Lake Khanka basin), 25 versts from Evgenyevka Station of the Ussuri Railroad" for *S. exuberata* and very rough coordinates 44°33' N, 133° E for *S. vera*. However, both sites referred to the same small Spassk District in the eastern vicinity of Lake Khanka.

The original description of *S. vera* is not illustrated and is so short that translation by the second author can be virtually verbatim (Bartenev 1914: 16): "To describe this specimen would mean to repeat the description of *S. exuberata*¹² [(Bartenev 1910a)], to which it is similar even in detail (literally in all characters which are provided in my description of *S. exuberata* and the comparative table with *S. metallica*). Therefore, I will limit myself to the enumeration of differences with the specimen of *S. vera*. 1) At the bases of the fore and, especially, hind wings of *S. vera*, there is a bright yellow color, occupying the entire anal triangle on the latter while limited just to the first cell of the postcostal margin [sic]. In *S. exuberata* traces of yellow at wing bases are rare. 2) Pterostigma dark brown; in *S. exuberata* it is black. 3) Pterostigma length about 3 mm (2.9 mm), while in *S. exuberata* not more than 2.3-2.5 mm. 4) In place of the scarcely protruding, often at all missing projection below and sides of the upper appendages (fig. 11a in paper 59 [(Bartenev 1910a)]) of *S. exuberata*, in *S. vera* there is an uneven, somewhat rounded projection is distinctly protruding (look in profile). 5) The lower anal appendage is longer than in *S. exuberata* and reaches the

end of the downward bend (look in profile) of the upper appendages, where the latter change their direction and start to curve upwards. In *S. exuberata* the lower appendage is comparatively shorter and does not reach the end of the bent of the uppers.”

Belyshev & Kurentzov (1964) reported a male and two females of *Somatochlora metallica exuberata* (they treated this taxon as a subspecies, an opinion with which we do not agree) from the southern Far East of Russia. They stated that “We failed to reveal characters of *S. vera* in either specimen but the pterostigma length, which was 2.9 mm.” However, later they noted that “Our male specimen is not distinguishable from *S. m. exuberata* in everything, but the yellow color at the wing base.” This is puzzling since that yellow color was a character of *S. vera*. They proceeded: “As to the nuances of the pterostigma coloration or pterostigma size, these characters are variable and do not determine the systematic position of a specimen”. As a result, they synonymized *S. vera* with *S. metallica exuberata* (Belyshev & Kurentzov 1964: 74–75). They also noted that the female vulvar lamina was somewhat skewed behind that, in their opinion, made them similar to the Japanese subspecies *S. metallica japonica*. Currently, the latter taxon is assumed to be *S. exuberata japonica* (Matsumura, 1911) and the direction of the vulvar lamina is not considered as a diagnostic character (Karube *et al.* 2012). Belyshev & Kurentzov (1964) also supposed that the ‘Ussurian’ specimens potentially could belong to a putative *S. m. japonica* as well.

Females with extensive wing basal amber often occur in the southern Far East of Russia (but not in Transbaikalia) (Malikova 1995; Onishko & Kosterin 2021), although such males are still unknown to us. This is an obvious aberration, named *ab. graeserioides* by Malikova (1995) (an infrasubspecific name, unavailable and not regulated by ICZN). At the same time, available specimens from that region seem to differ from both *S. e. exuberata* from Siberia (including Transbaikalia, its type locality), and *S. e. japonica*. It is not excluded that they may represent a continental Far Eastern subspecies of *S. exuberata*, which would then have the valid name *Somatochlora exuberata vera* Bartenev, 1914. This problem is to be re-examined and the existence, distribution, and diagnostic characters of this potentially widespread taxon are still to be revealed, which is a matter of further studies.



FIGURE 4. Specimen No. 39690 from “Amasia / Asia Minor” received in exchange from Kenneth J. Morton and belonging to the same general series as the type-series of *Calopteryx amasina* Bartenev, 1912. Scale bar 1 cm.

The type locality of *S. vera* is situated ca 1,350 km SE of the type locality of *S. exuberata* in SE Transbaikalia and resides within a different landscape environment (moist Pacific prairies and broad-leaved forests versus continental forest-steppe, respectively). Nevertheless, it is unknown how close to the respective type localities of both taxa the putative border between the presumed subspecies comes. The diagnostic characters of the presumed subspecies (if any) may appear different from the characters considered by Bartenev (1910a; 1914), and, thus, not mentioned in the original description of *S. exuberata*.

In this situation, it is reasonable to restrict the name-bearing type of *S. exuberata* to a single specimen, in good condition and available for study, by designation of its lectotype. The UMMZ syntype is in better condition (lacks cotton fibers, occurring on the surface of the MPM syntype) and more readily reveals more characters (e.g., hamules and vesica spermalis). It is chosen for the lectotype designation and is supplied with the following label: *Somatochlora exuberata* Bartenev, 1910 / LECTOTYPUS / Designated T.E. Vogt et O.E. Kosterin, 2023

Note on another valuable specimen found in MPM

It should be noted that the MPM also contains 37 more specimens of 20 species (excluding the *Somatochlora*) received from A.N. Bartenev, but no more actual or potential syntypes of his taxa. There is, however, a specimen of *Calopteryx amasina* Bartenev, 1912 (currently *Calopteryx splendens amasina*): the specimen No. 39690 from “Amasia / Asia Minor” (Fig. 4) received in exchange from Kenneth J. Morton and obviously belonging to the same general series, a subfraction of which, containing 5 males and 2 females with the same label, was sent by Morton to Bartenev, which later become the type-series of *C. amasina* (Bartenev 1912b).

Conclusion

The herein-reported findings of two more Bartenev syntypes in two different museums beyond Russia, in the U.S.A. (in addition to the syntypes of *Leucorrhinia intermedia* found in Germany, as reported in Medvedev *et al.* 2013), should encourage further search of such syntypes in other foreign collections that could contain Bartenev’s specimens, perhaps received in exchange.

Acknowledgments

The work by O.K. was partly supported by the scientific project FWR-2022-0019. The authors are grateful to Dennis Paulson for his comments and suggestions on an early draft of this paper and to Malte Seehausen and Akihiko Sasamoto for their careful reviews, corrections and comments, thus improving the manuscript.

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