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Odonata collected in 2021 in Azerbaijan, including new data on *Gomphus schneiderii* Selys, 1850 and *Libellula pontica* Selys, 1887

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Abstract

This paper presents the results of a study on the odonate fauna in Azerbaijan The survey was conducted in the summer of 2021 and covered 24 localities in twelve districts. A total of 34 species from 9 families was recorded. New localities for *Gomphus schneiderii* Selys, 1850 and *Libellula pontica* Selys, 1887 are reported. A formerly published record of *Gomphus vulgatissimus* from Khachmaz, Nabran village, has to be corrected into *G. schneiderii*.

Keywords: Odonata, fauna, Azerbaijan, *Gomphus schneiderii, Libellula pontica*.

Introduction

In 2021, we continued our surveys of the dragonfly fauna of Azerbaijan (Fig. 1). The following areas were covered – Absheron, Lenkoran, Yardimli, Balaken, Zagatala, Gazakh, Agstafa, Khizi, Shemakha, Guba and Nakhichevan AR (Julfa and Ordubad districts). 2021 was characterized by a fairly dry spring and a very hot and dry summer. For this reason, many small reservoirs and rivers dried up and, accordingly, both the abundance of dragonflies and the number of species decreased. Nevertheless, we were able to find interesting and rare species.

Material and Methods

Sampling sites

Odonate specimens were collected from May to October 2021. All photos were taken by the author using Canon EOS 5D Mark III, with Tamron SP 90mm, F/2.8 Macro lens, under natural conditions. All photos were made in 2021. Specimens are deposited in the Laboratory of Terrestrial Invertebrates of the Zoological Institute NAS of Azerbaijan, Baku.

Localities (Fig. 1)

Absheron district:

Loc. 1. Pirekeshkul (Pirekeşkül) village (N40°31'17.34" E49°31'55.25"; 56 m a.s.l.) (Fig. 2). A small canal-like reservoir with tamarisks (*Tamarix* sp.) and silverberry (*Elaeagnus*

commutata Bernh. ex Rydb.) bushes along the banks, the shores are sandy. The Sumgaitchay river flows nearby, the banks are also sandy, with areas of tamarisks and silverberry (Fig. 3). A little higher on the hills there is a brackish lake with clayey shores, herbaceous vegetation and rare low tamarisk bushes along the shores (Fig. 4).

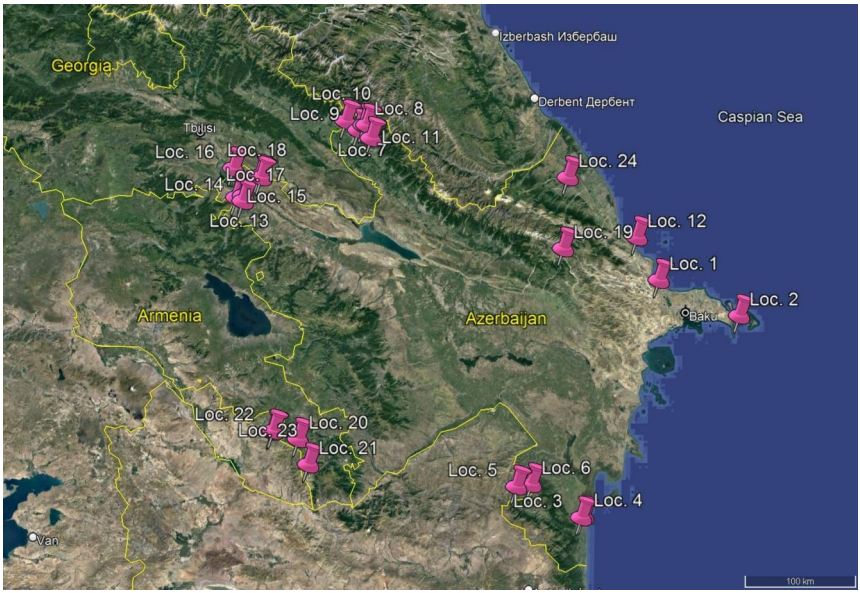

Figure 1. Map of localities.

Figure 2. Absheron district, Pirekeshkul (Pirekeşkül) village, a small canal-like reservoir with tamarisks (*Tamarix* sp.) and silverberry (*Elaeagnus commutata* Bernh. ex Rydb.) bushes along the banks.

Figure 3. Absheron district, Pirekeshkul (Pirekeşkül) village, Sumgaitchay river with sandy banks with areas of tamarisks and silverberry.

Figure 4. Absheron district, a brackish lake with herbaceous vegetation and rare low tamarisk bushes along the shores near Pirekeshkul (Pirekeşkül) village.

Figure 5. Absheron Peninsula, a small reservoir with reed (*Phragmites* sp.) and in some places silverberry in the Absheron National Park.

Figure 6. Absheron Peninsula, a channel with reed (*Phragmites* sp.) in the Absheron National Park.

Figure 7. Lenkoran district, a forest stream, along the banks of which there are small reeds and thickets of blackberries (*Rubus* sp.) near Dashtatuk vill. (Daştatük).

Figure 8. Lenkoran district, a small stream with sandy banks and pebble bottoms near Azfilial settlement.

Figure 9. Lenkoran district, a large meadow with tall grasses and areas overgrown with blackberry bushes near Azfilial settlement.

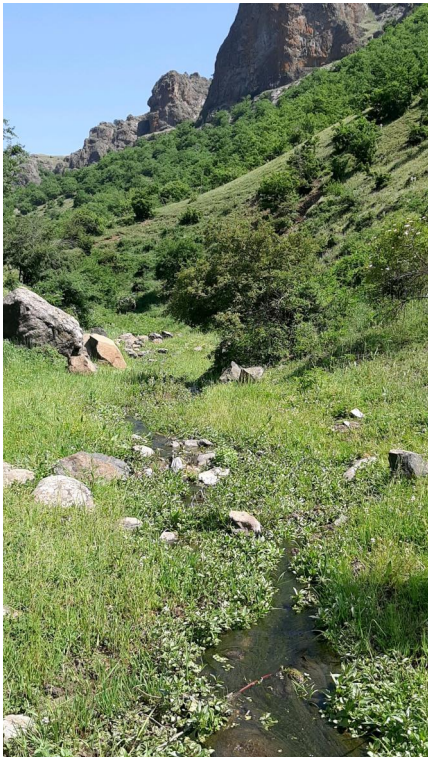

Figure 10. Yardimli district, a small rivulet flowing in a depression between the hills near Shefekli village.

Loc. 2. Absheron National Park, (N40°14' 28.98" E50°22'4.94"; -28 m a.s.l.) (Fig. 5). A small reservoir in the Absheron National Park and a canal coming from this reservoir. On the other side, the channel emerges from the brackish water spills. A pond and a canal with reed thickets (*Phragmites* sp.) and in some places silverberry (Fig. 6).

Lenkoran district:

Loc. 3. Dashtatuk village (Daştatük) (N38°-40'32.92" E48°45'42.16"; 103 m a.s.l.). A forest lake, located between trees. The banks are partly overgrown with reeds, bushes and thickets of blackberries. Below the lake there is a stream, along the banks of which there are also small thickets of reeds and blackberries (*Rubus* sp.) (Fig. 7).

Loc. 4. Azfilial settlement (N38°40'56,5" E48°46'58.5"; 51 m a.s.l.). A small area of forest behind the village with glades, a small stream with sandy banks and pebble bottoms runs along the entire area (Fig. 8). Adjacent to the forest area there is a large meadow with tall grasses and areas overgrown with blackberry bushes (Fig. 9).

Figure 11. Yardimli district, Khamargol (Xamargöl) lake near Dashkend vill. (Daşkənd), Yardimli district.

Figure 12. Balaken district, an open plot near the village Chichikhana (Çiçixana) village.

Figure 13. Balaken district, Beshbulag, areas with walnuts (*Juglans regia* L.) and other trees.

Yardimli district:

Loc. 5. Shefekli village (Şefekli) (N38°54'56.17" E48°6'12.59"; 1184 m a.s.l.). (Fig. 10). A small rivulet flowing in a depression between the hills. In places, it flows between thickets of blackberries, in places between trees and bushes, in places in open space.

Loc. 6. Dashkend village (Daşkənd), Khamargol (Xamargöl) (N38°56'4.77" E48°15'4.82"; 1248 m a.s.l.) (Fig. 11). A fairly large body of water, open on all sides but surrounded by a patch of forest. The shores are clayey, overgrown in places with grass; near the shores, there are thickets of blackberries.

Balaken district:

Loc. 7. Chichikhana (Çiçixana) village (N41°40'33.9"; E46°29'34.8"; 316 m a.s.l.), A small river flowing through the forest. On the banks of the river there are trees, bushes, in the open part there are thickets of elderberries (*Sambucus nigra* L. (1753) (Fig. 12) and blackberries.

Loc. 8. Beshbulag (Beşbulaq) (N41°40'31.5"; E46°27'54.11"; 259 m a.s.l.). The site of the Zagatala National Nature Reserve, where open meadows alternate with thickets of blackberries, elderberries and areas with walnuts (*Juglans regia* L.) and other trees (Fig. 13).

Loc. 9. Peshtatala (Peştatala) village (N41°38'2.29" E46°24'39.89"; 172 m a.s.l.). A small reservoir (Fig. 14) and a small rivulet that flows into this reservoir on the way to the village. The reservoir is overgrown with reeds and cattails (*Typha* sp.), the banks of the rivulet are clayey, the vegetation along the banks is grassy.

Loc. 10. Gabagchol (Gabağçöl) settlement (N41°42'09.41" E46°16'36.08"; 216 m a.s.l.). The river Mazimchay (Mazımçay), with sandy shores, the bottom is pebbly in places (Fig. 15). Along the banks there are open meadows with herbaceous vegetation, as well as gardens and a forest area. There is a small water spill in the forest not far from the river.

Figure. 14. Balaken district, a small reservoir near Peshtatala (Peştatala) village.

Zagatala district:

Loc. 11. Geratap (N41°34'32.25" E46°32'36.99"; 274 m a.s.l.). Small pond among agricultural fields (*Medicago, Zea mays*) bordering the forest (Figs. 16-17). The pond is overgrown with reeds, the banks are clayey and overgrown with herbaceous vegetation.

Khizi district:

Loc. 12. On the road to Khyzy city (N40°51'3.67" E49°18'5.57"; 4 m a.s.l.). A small river flowing through arid places, clay banks, overgrown with reeds and sometimes cattails (Fig. 18).

Gazakh district:

Loc. 13. Neighbourhoods of Demirchilar village, Jogazchay (Cohazçay) river (N41°5'35.98" E45°15'29.22"; 426 m a.s.l.) (Fig. 19), the banks of the river are low, clayey, with herbaceous vegetation, as well as thickets of cattail, reed and blackberry. In some places there are spills, also with reeds and cattails).

Figure 15. Balaken district, Gabagchol (Gabağçöl) settlement, plot of rivers Mazymchay.

Figure 16. Zagatala district, agricultural fields bordering the forest on the site of Geratap.

Figure 17. Zagatala district, Geratap, small pond overgrown with reeds.

Figure 18. Khizi district, a small river flowing through arid places, overgrown with reeds and sometimes cattails.

Figure 19. Gazakh district, near Demirchilar village, Jogazchay (Cohazçay) river.

Figure 20. Gazakh district, Agstafachay Water reservoir.

Figure 21. Gazakh district, Abbasbeyli Water Reservoir.

Loc. 14. Agstafachay Water reservoir (N41°3'9.79" E45°15'23.52"; 444 m a.s.l.) (Fig. 20). The reservoir has clayey banks, with almost only grassy vegetation.

Loc. 15. Abbasbeyli Water Reservoir (N41°4'36.88" E45°11'20"; 533 m a.s.l.) (Fig. 21). The reservoir is the same in appearance as the previous one - clayey banks, practically no vegetation along the banks, only grass and in some places tall dried grasses.

Loc. 16. Shikhly 1 settlement, along the Kura River (N41°17'59.26" E45°8'37.41"; 4 m a.s.l.). Small numerous spills along the section of the Kura River (Fig. 22), densely overgrown with reeds, rushes and cattails. In addition, along the Kura, there are groves of tamarisks and in some places silverberries (Fig. 23).

Figure 22. Gazakh district, numerous small spills along the section of the Kura River, densely overgrown with reeds, rushes and cattails.

Fig. 23. Gazakh district, Shikhly 1, along the Kura River.

Agstafa district:

Loc. 17. Yanarbulag vicinity (N41°15'7.72" E45°24'55.65"; 189 m a.s.l.). An irrigation canal along the road, densely overgrown with reeds and cattails. On the other side of the road, there is a small stream with thickets of silverberries and tamarisks (Figs. 24-25).

Loc. 18. The Kura River and water spills near the Poylu village (N41°14'26.56" E45°25'55.33"; 201 m a.s.l.). Along the banks of the Kura there are riparian forests consisting of silverberries and tamarisks. Not far from the coast, there are large freshwater floods with clayey shores and grassy vegetation, and pondweed (*Potamogeton* sp.) pads in the water (Fig. 26).

Fig. 24. Agstafa district, Yanarbulag vicinity.

Fig. 25. Agstafa district, a small stream with thickets of silverberries and tamarisks.

Fig. 26. Agstafa district, water spills near the Poylu village.

Fig. 27. Shemakha district, a small pond near Galeybugurd village.

Fig. 28. Nakhichevan MR, Ordubad district, freshwater flood and a small river on the way to the lake Goygol.

Shemakha district:

Loc. 19. Galeybugurd village (N40°45'35.93" E48°32'18.57"; 840 m a.s.l.), a small pond (Fig. 27). The banks are clayey, along the border of the pond there are trees with thickets of blackberries.

Nakhichevan MR:

Ordubad district:

Loc. 20. Freshwater flood and a small river on the way to the lake Goygol (N39°14'24.54" E45°55'11.76"; 2253 m a.s.l.) (Fig. 28).

Loc. 21. Pazmari village (N39°2'53.88" E46°1'48.8"; 2162 m a.s.l.). A small river with grassy shores, with a cascading waterfall (Fig. 29).

Fig. 29. Nakhichevan MR, Ordubad district, a small river with grassy shores.

Fig. 30. Nakhichevan MR, Julfa district, a small stream near Goynuk village.

Fig. 31. Nakhichevan MR, Julfa district, small ponds densely overgrown with various grasses and reeds at the exit from the Goynuk village.

Fig. 32. Guba district, Krim lake.

Julfa district:

Loc. 22. Goynuk (Göynük) village (N39°17'44.91" E45°40'3.9"; 1569 m a.s.l.), a small stream flowing near the village, along the banks of which various herbs grow (Fig. 30).

Loc. 23. Goynuk (Göynük) village (N39°17'20.23" E45°39'24.31"; 1499 m a.s.l.), freshwater spill with meadow vegetation and small ponds densely overgrown with various grasses and reeds at the exit from the village (Fig. 31). .

Guba district:

Loc. 24. Krim lake (N41°18'35.89" E48°34'55.55"; 481 m a.s.l.). The lake is covered with forest on one side of the bank, on the other side there is an open clay bank with herbaceous vegetation and in places with reed thickets (Fig. 32).

Results

A total of 34 odonate species was recorded; records are documented specieswise.

Recorded species

Calopterygidae

Calopteryx splendens intermedia (Selys, 1887)

Loc. 10. 2♂♂, 3.06.2021; Loc. 11. 3♂♂, 2.06.2021; Loc. 13. 2♂♂, 18.06.2021; Loc. 16. 1♂, 21.06.2021; Loc. 17. 1♂, 20.06.2021.

Calopteryx splendens orientalis (Selys, 1887)

Loc. 3. 1♂, 17.05.2021; Loc. 4. 1♂, 1♀, 19.05.2021.

Euphaeidae

Epallage fatime Charpentier, 1840

Loc. 5. 1♂, 22.05.2021; Loc. 13. 2♂♂, 18.06.2021.

Lestidae

Lestes barbarus (Fabricius, 1798)

Loc. 9. 3♂♂, 2♀♀, 1.06.2021; Loc. 11. 1♂, 1♀, 2.06.2021.

Lestes dryas Kirby, 1890

Loc. 20. 4♂♂, 1♀, 10.07.2021.

Lestes virens Rambur, 1842

Loc. 20. 2♀♀, 10.07.2021.

Chalcolestes parvidens (Artobolevsky, 1929)

Loc. 4. 1♀, 14.10.2021.

Coenagrionidae

Ischnura pumilio (Charpentier, 1825)

Loc. 9. 2♂♂, 1.06.2021; Loc. 10. 1♂, 3.06.2021; Loc. 23. 3♂♂, 2♀♀, 8.07.2021.

Ischnura elegans (Vander Linden, 1820)

Loc. 1. 1 ♀, 25.07.2021; Loc. 2. 1♀, 15.06.2021; 1♂, 19.05.2021; Loc. 3. 1♂, 17.05.2021; Loc. 5. 1♂, 1♀, 22.05.2021; Loc. 6. 1♀, 23.05.2021; Loc. 9. 1 ♂, 1.06.2021; Loc. 10. 3♂♂, 1♀, 3.06.2021; Loc. 13. 3♂♂, 18.06.2021; Loc. 16. 3♂♂, 1♀, 21.06.2021; Loc. 18. 2♂♂, 2♀♀, 20.06.2021; Loc. 23. 3♂♂, 1♀, 8.07.2021; Loc. 24. 3♂♂, 1♀, 27.07.2021.

Coenagrion puella (Linnaeus, 1758) (Fig. 33)

Loc. 4. 2♂♂, 1♀, 19.05.2021; Loc. 9. 1♂, 1♀, 1.06.2021; Loc. 10. 5♂♂, 3.06.2021; Loc. 11. 3♂♂, 1♀, 2.06.2021; Loc. 13. 2♂♂, 18.06.2021; Loc. 16. 1♂, 21.06.2021.

Coenagrion scitulum (Rambur, 1842) (Figs. 34-36)

Loc. 6. 6♂♂, 6♀♀, 23.05.2021.

Coenagrion ornatum (Selys, 1850)

Loc. 5. 4♂♂, 22.05.2021.

Erythromma viridulum orientale Schmidt, 1960

Loc. 16. 2♂♂, 21.06.2021; Loc. 24. 1♂, 27.07.2021.

Fig. 33. *Coenagrion puella* (Linnaeus, 1758), male (Loc. 10).

Fig. 34. *Coenagrion scitulum* (Rambur, 1842), copula (Loc. 6).

Fig. 35. *Coenagrion scitulum* (Rambur, 1842), copulae (Loc. 6).

Fig. 36. *Coenagrion scitulum* (Rambur, 1842), copulae (Loc. 6).

Platycnemididae

Platycnemis dealbata Selys in Selys and Hagen, 1850

Loc. 3. 1♂, 2♀♀, 17.05.2021; Loc. 4. 1♂, 19.05.2021; Loc. 7. 1♀, 1.06.2021; Loc. 8. 3♀♀, 1.06.2021; Loc. 10. 2♂♂, 1♀, 3.06.2021; Loc. 11. 1♂, 2.06.2021; Loc. 12. 3♂♂, 1♀, 9.06.2021; Loc. 13. 5♂♂, 2♀♀, 18.06.2021; Loc. 17. 2♂♂, 3♀♀, 20.06.2021; Loc. 18. 1♂, 20.06.2021; Loc. 24. 2♂♂, 27.07.2021.

Aeshnidae

Anax imperator Leach, 1815 (Fig. 37)

Loc. 6. observation, 23.05.2021; Loc. 18. 1♂, 20.06.2021; Loc. 19. Observation, 28.06.2021.

Aeshna affinis Vander Linden, 1820

Loc. 10. 1♀, 03.06.2021.

Aeshna isoceles (Müller, 1764) (Fig. 38)

Loc. 4. 1♂, 19.05.2021; Loc. 8. 1♂, 1.06.2021; Loc. 11. 1♂, 2.06.2021; Loc. 18. 1♂, 20.06.2021.

Gomphidae

Gomphus schneiderii Selys, 1850 (Fig. 39)

Loc. 4. 2♂♂, 19.05.2021.

Onychogomphus forcipatus albotibialis Schmidt, 1954

Loc. 7. 1♀, 1.06.2021; Loc. 11. 3♂♂, 2.06.2021; Loc. 16. 3♂♂, 21.06.2021; Loc. 17. 2♂♂, 20.06.2021; Loc. 18. 1♂, 1♀, 20.06.2021; Loc. 22. 3♂♂, 8.07.2021.

Cordulegastridae

Cordulegaster charpentieri (Kolenati, 1846)

Loc. 21. 1♀, 12.07.2021.

Libellulidae

Libellula depressa Linnaeus, 1758 (Fig. 40)

Loc. 5. 2♀♀, 22.05.2021; Loc. 6. observation, 23.05.2021; Loc. 7. 1♂, 1.06.2021; Loc. 8. 1♀, 3.06.2021; Loc. 10. 1♂, 03.06.2021.

Libellula pontica Selys, 1887 (Fig. 41)

Loc. 7. 1♀, 1.06.2021; Loc. 8. 1♂, 5♀♀, 1.06.2021.

Orthetrum brunneum (Fonscolombe, 1837)

Loc. 1. 1♂, 2♀♀, 25.07.2021; Loc. 10. 1♂, 1♀, 03.06.2021; Loc. 12. 1♂, 9.06.2021; Loc. 13. 2♂♂, 1♀, 18.06.2021; Loc. 16. 1♂, 21.06.2021; Loc. 17. 2♂♂, 20.06.2021; Loc. 22. 1♂, 8.07.2021; Loc. 23. Observation, 8.07.2021; Loc. 24. 1♂, 27.07.2021.

Orthetrum cancellatum (Linnaeus, 1758) (Fig. 43)

Loc. 2. 2♂♂, 1♀, 15.06.2021; Loc. 17. 1♀, 20.06.2021.

Fig. 37. ***Anax imperator*** **Leach, 1815, male (Loc. 18).**

Fig. 38. ***Aeshna isoceles*** **(Müller, 1764), female (Loc. 8).**

Fig. 39. ***Gomphus schneiderii*** **Selys, 1850, male (Loc. 4).**

Orthetrum coerulescens (Fabricius, 1798)

Loc. 1. 1♂, 2♀♀, 25.07.2021; Loc. 5. 1♂, 22.05.2021; Loc. 7. 1♀, 1.06.2021; Loc. 8. 1♂, 2♀♀, 1.06.2021; Loc. 10. 1♀, 3.06.2021; Loc. 12. 1♂, 1♀, 9.06.2021; Loc. 13. 1♂, 18.06.2021; Loc. 16. 1♂, 21.06.2021; Loc. 17. 1♂, 1♀, 20.06.2021; Loc. 22. 3♂♂, 8.07.2021; Loc. 23. Observation, 8.07.2021; Loc. 24. 1♂, 27.07.2021.

Orthetrum albistylum (Selys, 1848) (Fig. 42)

Loc. 16. 1♂, 2♀♀, 21.06.2021; Loc. 18. 2♂♂, 20.06.2021.

Orthetrum sabina (Drury, 1773)

Loc. 18. 1♀, 20.06.2021.

Sympetrum fonscolombii (Selys, 1840) (Fig. 44)

Loc. 1. 1♂, 14.04.2021; 1♀, 21.07.2021; Loc. 13. 1♀, 18.06.2021; Loc. 14. 3♂♂, 1♀, 18.06.2021; Loc. 15. 2♂♂, 1♀, 19.06.2021.

Sympetrum sanguineum (Müller, 1764) (Fig. 45)

Loc. 23. 4♂♂, 4♀♀, 8.07.2021; Loc. 24. 2♀♀, 27.07.2021.

Sympetrum striolatum (Charpentier, 1840)

Loc. 2. 1♂, 15.06.2021; Loc. 4. 4♀♀, 14.10.2021; Loc. 10. 1♀, 3.06.2021; Loc. 12. 1♂, 9.06.2021; Loc. 13. 1♂, 18.06.2021; Loc. 22. 2♀♀, 22.07.2021.

Sympetrum meridionale (Selys, 1841)

Loc. 12. 2♀♀, 9.06.2021; Loc. 19. 1♀, 28.06.2021.

Sympetrum flaveolum (Linnaeus, 1758)

Loc. 20. 2♂♂, 10.07.2021.

Fig. 40. *Libellula depressa* Linnaeus, 1758, female (Loc. 5).

Fig. 41. *Libellula pontica* Selys, 1887, male (Loc. 8).

Fig. 42. *Orthetrum albistylum* (Selys 1848), male (Loc. 18).

Fig. 43. *Orthetrum cancellatum* (Linnaeus, 1758), female (Loc. 2).

Fig. 44. *Sympetrum fonscolombii* (Selys, 1840), male (Loc. 15).

Crocothemis erythraea (Brullé, 1832)

Loc. 16. 2♂♂ 21.06.2021; Loc. 22. 1♂, 8.07.2021.

Selysiothemis nigra (Vander Linden, 1825)

Loc. 14. 1♀, 18.06.2021.

Fig. 45: *Sympetrum sanguineum* (Müller, 1764), female, Loc. 23.

Discussion

Gomphus vulgatissimus / *G. schneiderii*: Snegovaya (2020) had identified specimens collected in July 2019 at Loc. 5. Khachmaz, Nabran vill., (N 41°45'23.78", E 48°40'53.51"; 6m a.s.l.) as *G. vulgatissimus*. The re-examination of these specimens – using Dijkstra & Lewington 2006 for identification – resulted in *G. schneiderii*. Therefore, this misidentification is corrected here: *G. schneiderii* is occuring at Nabran, not *G. vulgatissimus*.

Previously unpublished records of *G. schneiderii* are published in Dumont et al. (2021). They are based on collections of N. Snegovaya from the Lenkoran region in southern Azerbaijan.

Libellula pontica Selys, 1887 was previously documented by us near Loc. 8 in this study (Skvortsov & Snegovaya 2014: Dzhidzhikhana (Cicixana) (41°40’33.9”N, 46°29’34.8”E), where we had caught only one specimen. This year we caught a specimen from another location - Loc. 7. In addition to these locations, we have previously noted it from the Agstafa region in the vicinity of the village Poylu (41°09’27.15”N, 45°26’53.81”E, 1 male, Snegovaya, unpublished data). *Libellula pontica* is included in the IUCN Red List of Threatened Species with status NT (near threatened). In the Balaken region this species was recorded in glades near the forest, whereas in the Agstafa region it was recorded in the arid zone among reed beds and silverberry thickets.

Cordulegaster nakhitschevanica Skvortsov & Snegovaya 2015 was synonymized by Schneider et al. (2021) with *Cordulegaster charpentieri* (Kolenati, 1846). For this taxon, a

new location was noted – in the vicinity of the village of Pazmari, Ordubad district. Earlier, it had also been recorded in Ordubad region, Agdera, and it had been observed but not caught in the Shahbuz region near the Kolany (41°04'24.16"N, 49°09'06.37"E) and Kyukyu (39°31′24″N 45°37′21″E) villages (Snegovaya, 2018, unpublished data).

Coenagrion ornatum (Selys, 1850) is rare in Azerbaijan. It had previously been recorded for Azerbaijan from Absheron, Gusar (Dumont 2004), Shemakha (Skvortsov & Snegovaya 2015), and Nakhichevan (Skvortsov & Snegovaya 2014, Snegovaya 2019). Here, we add Shefekli village (Şefekli) as yet another locality for this species.

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On the occurrence of *Gomphus vulgatissimus* (Linnaeus, 1758) and *G. schneiderii* Selys, 1850 in Azerbaijan – a brief discussion of the known status quo

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Abstract

Boudot et al. (2021) extirpated, without any discussion, *G. vulgatissimus* from the list of Azerbaijan Odonata, subsuming all records of this taxon under *G. schneiderii*. This is contradictory to the fact that *G. vulgatissimus* was documented for Azerbaijan by Bartenef (1912). We discuss the current knowledge of the two taxa *G. vulgatissimus* and *G. schneiderii*, document a new record of *G. vulgatissimus* for Azerbaijan, and map all known findings of the two taxa that have been reported to date as well as the potential distribution (search area) of *G. vulgatissimus* in northern Azerbaijan.

Keywords: *Gomphus schneiderii*, *Gomphus vulgatissimus*, distribution map, Azerbaijan.

Introduction

Currently, the species complex comprising *Gomphus vulgatissimus* and *Gomphus schneiderii* seems to be taxonomically and systematically unsettled as obvious problems with field identification are existing (De Knijf at al. 2013). From the regional point of awareness in Russian literature, e.g. Ketencheniev & Haritonov (1998) did not consider the occurrence of *G. schneiderii* in the Caucasus region, however, Skvortsov (2010) and Onishko & Kosterin (2021) did.

Dumont et al. (2021) sequenced in total as few as eight specimens of both taxa for the mitochondrial COI gene and nine specimens for the nuclear nucleotide sequence ITS1 – 5.8 S rRNA – ITS2 - 18S rRNA. In this limited analysis, they ignored large parts of the ranges of these taxa. On page 28, these authors made a misleading statement: “COI and ITS, however, single it [*G. schneiderii*] at full species level (Fig. 1)”. In fact, fig. 1 shows the COI phylogenetic tree while the ITS tree is shown in fig. 2. *G. schneiderii* and *G. vulgatissimus* indeed form two sister clusters with maximum support in the COI tree, while in the ITS tree only *G. vulgatissimus* forms a cluster of its own which is nested inside (!) the cluster of *G. schneiderii*. So, contrary to what they claimed, the molecular analysis by Dumont et al. (2021) failed to resolve the phylogenetic relations and systematic positions of these two species but caused more confusion. Obviously, more sequences need to be involved to resolve them.

Seidenbusch (1997) tried to separate the taxa based on six specimens from Turkey, Romania and Germany. He hesitated to consider his conclusions as final and requested the study of broader material. The deepest study was made by De Knijf et al. (2013) based on material from Montenegro and giving insight into the variability of morphological characters of *G. schneiderii*.

Based on our current knowledge, there seems to be no study that treats the status of the two taxa on an empirical basis which would allow us to rule out one of the two taxa in Azerbaijan. Despite this unsatisfactory situation, the occurrence of *G. vulgatissimus* was extirpated from Azerbaijan without any discussion by Boudot et al. (2021), even though one of the co-authors had stated the following: „…it appears to be possible that at least the contact zone of both species might run through the eastern part of the Transcaucasian depression." (Schröter et al. 2015).

The situation caused by Boudot et al. (2021), and the problem of insufficiently determined larvae

Boudot et al. (2021) show only *G. schneiderii* as occurring in Azerbaijan, although *G. vulgatissimus* is given in the map by Boudot & Kalkman (2015) for Azerbaijan. Without any discussion, this dot is now attributed to *G. schneiderii*. It is not fully clear which finding it was, but it is likely to be the one reported by Bartenef (1912). Bartenef (1912) explicitly identified the specimen from Areš, Elisavetpol as *G. vulgatissimus vulgatissimus*. Bartenef (1912a: 154) illustrated the appendages of *G. vulgatissimus* and *G. schneiderii* comparatively. Therefore, it can be assumed that Bartenef knew the difference between *vulgatissimus* and *schneiderii*, especially since his illustration corresponds very well with that in Dijkstra et al. (2020) or Skvortsov (2010). The geographical coordinates given by De Knijf (in litt.) and said to be used in Boudot et al. (2021) mark Areš (Agdash district) south of the Mingechevir Reservoir in the Kura Valley. In the distribution map presented by Boudot et al. (2021), there are further localities for *G. schneiderii* in Azerbaijan. This is peculiar since, to our knowledge, no occurrences of *G. schneiderii* for this country were published prior to the Atlas by Boudot et al. (2021). It could be concluded from the distribution of *G. vulgatissimus* and *G. schneiderii* as shown therein that only *G. schneiderii* occurs in Azerbaijan. However, this is not true given the finding by Bartenef (1912) and reconsidered literature data (Tab. 1).

Kasymov (1975) provides evidence of larvae of *G. vulgatissimus* for Poylu, Dashbulak, Yenikend, Muganly and Almaly. However, the author did not indicate how these larvae were determined. It can be assumed that Popova (1953) was used for this purpose. Regardless of whether the marking of *G. vulgatissimus* given there is suitable for a determination, *G. schneiderii* is not mentioned in this publication, which is why all users are inevitably led to *G. vulgatissimus*.

There are references to *G. vulgatissimus* in Kasymov (1965), although it is unclear where the information comes from. Some of the localities are mentioned in Kasymov (1975) and he probably had the later published findings at his disposal, since he stated in 1975 that he studied the aquatic fauna of the Middle Kura, Alazani, Iori (Georgia) and Ganjachay Rivers during the summer months of 1964-1966.

Gomphus vulgatissimus at Balakan/Balaken (Itital village) in northern Azerbaijan from 01-VI-2012

Fig. 1 documents a current record of *Gomphus vulgatissimus* from Itital village, a locality in Azerbaijan near the border to Georgia. The specimen likely developed in the boundary river Katehchay (tributary of Alasani River), a river where Kasymov (1972), too, collected larvae he identified as *G. vulgatissimus*.

The morphology of secondary genitalia from the specimen (Fig. 1a-c) corresponds very well with drawings in Dijkstra et al. (2020), Skvortsov (2010: 333) or Onishko (2019). The primary genitalia (Fig. 1d,e) are very close to the drawings provided in Dijkstra et al. (2020) and Skvortsov (2010). Therefore, the specimen is definitely *Gomphus vulgatissimus*.

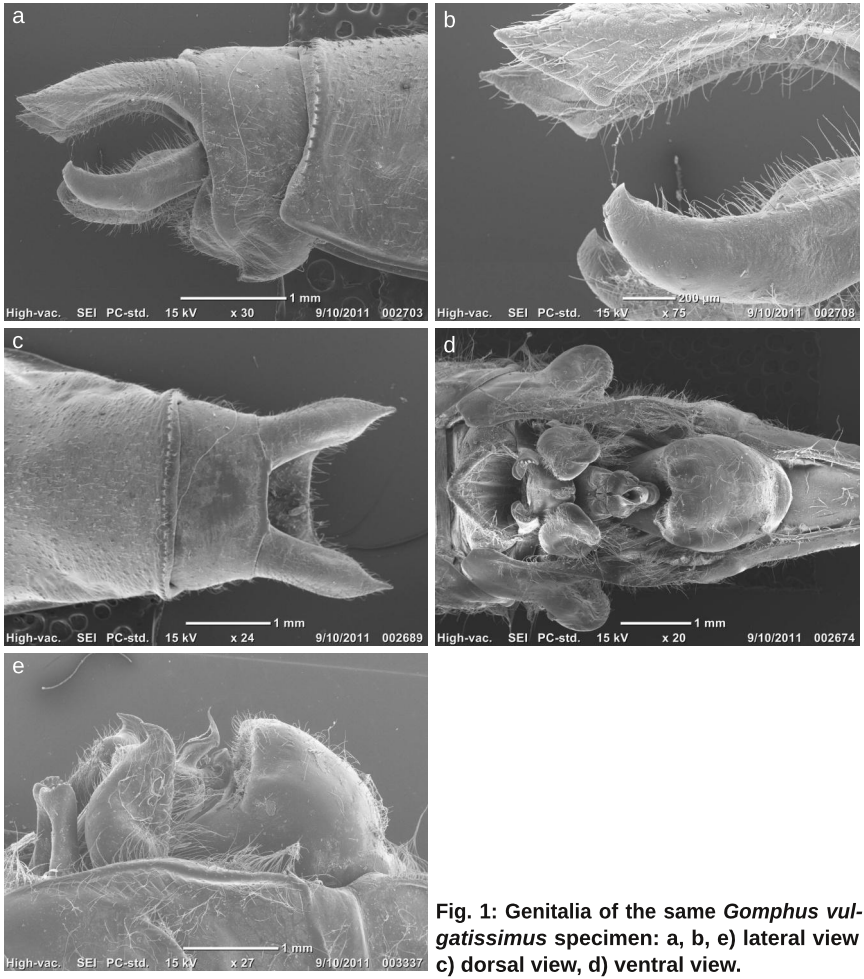

Fig. 1: Genitalia of the same *Gomphus vulgatissimus* specimen: a, b, e) lateral view c) dorsal view, d) ventral view.

The current knowledge of the distribution of *Gomphus vulgatissimus* and *G. schneiderii* in Azerbaijan

To demonstrate the current knowledge of the distribution of *Gomphus vulgatissimus* and *G. schneiderii* in Azerbaijan, we compile the records of these species and „*G. vulgatissimus*"-larvae in Table 1 and Fig. 2, of all published records that we know. Records of gom-

Tab. 1: Azerbaijan records of *Gomphus vulgatissimus, G. schneiderii* and the „*G. vulgatissimus*"-larvae with unsettled identification. Coordinates - decimal degrees of latitude and longitude – are derived from Google Earth.

Locality	Source	Latitude	Longitude
„*Gomphus vulgatissimus*" – larvae without definite identification			
Village Bala Bagman near Kirovabad / = Ganja	Kasymov 1975	40.74511	46.38285
Kapuchay river near Zakatala	Kasymov 1975	41.64888	46.63831
Mouth of Katehchay in Alasani (at the border between Georgia and Azerbaijan	Kasymov 1972	41.57674	46.30222
Poylu	Kasymov 1972	41.16762	45.44699
Dashbulak	Kasymov 1972	40.90294	46.04441
Yenikend (Hauptkanal)	Kasymov 1972	40.91133	46.30883
Muganly (Alasani, Fluß)	Kasymov 1972	41.47928	46.49045
Almaly (Alasani, Fluß)	Kasymov 1972	41.34297	46.76196
River branches of Alazani ca. 2km north of the Mingecha-Ure River Reservoir	Kasymov 1965	40.89131	46.70274
Iori (Georgia)	Elanidze (1956)		
Orphan Kur (Yetim Kur Akhmaz)	Guliyeva (2020)	40.59765	47.19963
Nakhchivan	Guliyeva (2021) (from the geographic position of record: probably *G. schneiderii*)	39.13997	45.41702
Garkhun	Guliyeva (2021) (from the altitude of record: probably *G. vulgatissimus*)	41.12451	48.33378
Yalama	Dengina (1947) (This record is due to general distribution of *G. schneiderii* in Azerbaijan quite surely not *vulgatissimus* but *schneiderii*)	41.75209	48.58403
Gomphus vulgatissimus			
Ərəş (Areš)	Bartenef (1912)	40.73123	47.22943
Balakan/Balaken (Ititala village)	Skvortsov & Snegovaya, 01-VI-2012, this publication	41.58552	46.36080
Gomphus schneiderii			
Lenkoran	Dumont et al. (2021)	38.75286	48.84750
Masalli	Dumont et al. (2021)	39.03403	48.65884
Lenkoran, Azfilial	This study	38.67637	48.79885
Samson river near Acharkut, Armenia	Durand (2019)	41.0331	45.0746
Khachmaz, Nabran village	Snegovaya (2020) (reexaminated and corrected record) (see Snegovaya 2022)	41.75894	48.69300

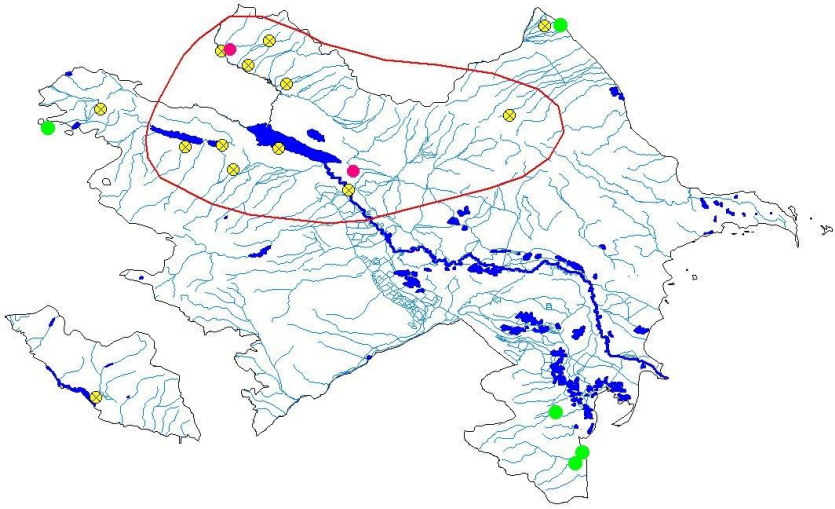

Fig. 2: All findings of *Gomphus schneiderii* (green dots), *G. vulgatissimus* (red dots) and *G.* c.f. *vulgatissimus*-larvae (yellow dots) that have been reported to date. Flowing waters are shown in light blue, standing waters in dark blue. The potential distribution (search area) of *G. vulgatissimus* is outlined in red and is probably restricted to the northwestern part of Azerbaijan. To draw the map, several shapefiles from open sources on the internet (DIVA-GIS etc.) were used.

phids that are impossible to occur in Azerbaijan (e.g. *G. pulchellus* or *Ophiogomphus cecilia*) published by several authors are ignored, although they could also be based on larval stages of *G. vulgatissimus*/*G. schneiderii*.

Considering the situation documented in Fig. 2 and the above-mentioned statement by Schröter et al. (2015) that the contact zone of *Gomphus schneiderii* and *G. vulgatissimus* might run through the eastern part of the Transcaucasian depression, it would be wise to carry out more fieldwork in the area of potential distribution of *G. vulgatissimus* to obtain further evidence of the occurrence of this taxon in Azerbaijan. Two of the specimens identified as true *G. vulgatissimus* originated from this area, as well as several specimens identified as cf. *vulgatissimus*-larvae.

Discussion

Against this background, it should be noted that

(1) There is a published record of *G. vulgatissimus* for Azerbaijan by Bartenef (1912), which was omitted in the atlas by Boudot et al. (2021).

(2) All records of *G. vulgatissimus*/*schneiderii* available prior to the publication of the above-cited atlas referred to "*G. vulgatissimus*". Since Kasymov (1965, 1975) made these finds in the same area of the Kura or the Mingechevir reservoir as Bartenef (1912), and as the here published record of *G. vulgatissimus* (see Tab. 1), it cannot be assumed a priori that Kasimov's larvae were not "*vulgatissimus*". On the contrary, based

on the currently known facts, it is more likely to be *vulgatissimus* than *schneiderii*. Only a targeted search can clarify which species occurs in this area.

(3) This uncertainty should have been communicated in the accompanying text to *G. schneiderii* published by Boudot et al. (2021), and the distribution map of *G. vulgatissimus* had better been included. Boudot & Kalkman (2015) presented a very patchy map of the distribution of *G. vulgatissimus* north of the Black Sea, and it is not clear whether these are natural distribution gaps or coverage gaps.

(4) A revision of the taxonomic status of *Gomphus vulgatissimus* and *G. schneiderii*, based on a broad base of material collected from the entire range and on an extended number of target sequences, is urgently needed. Until such a study is available, the species status of the two taxa should be treated conservatively.

(5) In order to be clear which taxon is involved, reports of field studies should indicate which identification characters were used to identify the imagines, and which book was consulted to identify the specimens.

- Because of the broadest availability among odonatologists and some very good figures, we consider the book of Dijkstra et al. (2020) to be the most suitable to achieve maximum transparency in the identification of imagines. Skvorstov (2010), too, provides a detailed key with instructive and detailed figures to separate the two taxa.
- In the case of larval identification, the advice of Brochard & van der Ploeg (2013) should be followed. Again, Skvorstov (2010) provides a key to separate the larva of the two taxa. In any case, this book of Skvortsov is the gold standard to separate the two taxa.

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On the occurrence of *Gomphus vulgatissimus* (Linnaeus, 1758) and *G. schneiderii* Selys, 1850 in Azerbaijan – a brief discussion of the known status – a reply

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The unfair, disloyal and discourteous paper published by Schorr & Snegovaya (2022) in IDF report 168, proves, upon reading, to have no sound basis and to rely on a superficial look only.

The minimum to criticize a paper is to read it instead to just looking at the images, and I will list hereafter the wrong statements it contains.

(1) Contrarily to your statements, the reasons of the omission of *Gomphus vulgatissimus* and other doubtful taxa in the area covered are perfectly explicated in the atlas. Just read the taxonomy section page 10. It is not the place in such Atlas to discuss more and to resolve systematic and taxonomic uncertainties.

(2) Your statement that Bartenev was able to differentiate *G. vulgatissimus* from *G. schneiderii* is far from being convincing as Bartenev is known to have described many species and subspecies which don't actually exist in terms of distinct taxa (*Aeshna juncea atshischgho, A. undulata, Leucorrhinia circassica, L. ussuriensis, Lindenia inkiti, Sympetrum matrix, S. verum*...etc.), confounding intraspecific variability and interspecies differences. Prior to Morton's paper on the Odonata of Constantinople (1915) these two *Gomphus* were mostly separated by colour characters of strong variability as the structural characters we can use now, which originate from Selys (1850, 1857, 1887) had never been published with drawings, making likely that Bartenev could not use them reliably. Three years after Bartenev's papers, Morton (1915) published drawings of the male abdominal appendages of one *G. vulgatissimus* and two *G. schneiderii* to allow a reliable identification of these two taxa. However the two *G. schneiderii* specimens were so different that one is equally different of the other than it is different from the drawing of *G. vulgatissimus*. Natural variability of each taxon was not accounted for by this paper, raising the issue of how representative actually they are and making their use unreliable.

(3) Claiming that larval determination of *Gomphus vulgatissimus* by Kasymov (1965) is correct is particularly naive as anybody know that a large part of purely larval papers

published by general limnologists include basic aberrations (can we accept because that has been published that *Macromia splendens* and *Boyeria irene* reproduce in Oman, that *Somatochlora arctica* and *Coenagrion armatum* reproduce in temporary wadi in Algeria, that *Ophiogomphus cecilia* and *Coenagrion lunulatum* are plentiful in the rivers of Central Anatolia, and that New World Odonata species are common in Iran ?). Any identification of a species out of its known range basing on only larvae or exuviae should be carefully evaluated and often rejected. Prior to Seidenbusch (1995), Suhling & Müller (1996) and Brochard & Van Ploeg (2013) there was no way to separate the exuviae/larvae of *G. vulgatissimus* and *G. schneiderii* and the proposed criteria remain still to be validated at the continental scale throughout the range of both taxa (the same criteria of the occurrence or the absence of lateral spines on the 6th segment of the larvae or the exuviae has been proved to fail to separate reliably the larvae/exuviae of *Onychogomphus f. forcipatus* and *O. f. unguiculatus*, due to a number of exceptions (Julian & Julian; 1994)). Kasymov's work could not therefore separate reliably these *Gomphus* species at the larval stage.

(4) Claiming that Skvortsov's book (2010) is the gold standard to study Odonata and their larvae in the Caucasus is a dream, being the number of basic errors it contains besides useful information (*Cordulegaster princeps* doesn't live in the Caucasus but in Morocco; etc).

(5) The apparent absence or rarity of *Gomphus vulgatissimus* from the North Caucasus countries can hardly be due to a gap of field investigation, as Ciscaucasia had been enough covered in the past to take the absence or rarity of this species in Ciscaucasia for true, and consequently, Azerbaijan, as geographically the easternmost part of Anatolia, is clearly out of the range of *G. vulgatissimus* sensu stricto. This is the reason for which Skvortsov (2010) mapped *G. schneiderii* (p. 583) and not *G. vulgatissimus* (p. 557) in Azerbaijan, adopting with care the most reasonable point of view as possible in this respect. This is now confirmed by the emendation of a former record of *Gomphus vulgatissimus* by Snegovaya (2020) from Northeast Azerbaijan, which is now turned into *G. schneiderii* (Snegovaya, 2022). Being the obvious difficulty of the local odonatologists to separate both taxa (and the same is true for anybody in Northern Greece), a previous record of *G. vulgatissimus* by Skvortsov & Snegovaya (2014) in the Northwest of the country cannot be accepted as reliable any more.

(6) Ketenchiev's (e.g. Ketenchiev 2021) papers are no help as their taxonomic nomenclature is largely obsolete and ignore nearly all recent updates

(7) Any paper can be criticized, but critics published with the aim to destroy by people which described previously (Skvortsov & Snegovaya 2015) two so-called new species which were actually known since a long time as *C. charpentieri* don't agree with the usual standard of scientific behaviour, courtesy and politeness.

(8) Rather than publishing such an unpleasant paper full of false claims, missing of substantiated statements and attacking slyly authors' Atlas It would have been more correct to e-mail to the first author at the valid e-mail address indicated in the work incriminated.

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Editor's response to Boudot (2022)

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Ad 1 and 2: See Schorr (2022): this volume.

Ad 3: We did not consider the identification of the larvae to be correct, as can easily be seen from our table 1 and figure 2.

Ad. 4: We used the phrasing “gold standard” exclusively in the context of the two taxa involved in our text. In addition: Boudot does not know the difficulties to produce such a book with the very limited financial sources IDF could made available to V. Skvortsov. Boudot is free to produce a better field guide.

Ad 5: As currently no one knows the true taxonomic status of *G. schneiderii*, caution is advised. To my knowledge the number of faunistic studies in the Russian part of the area of *G. vulgatissimus* and *schneiderii* is quite limited. The situation will be improved as IDF has funded studies in the region. The results are not published yet.

Ad. 6: We have only quoted a study of Ketenchiev & Haritonov. Boudot takes this quotation out of any logical context.

Ad. 7: No one is destroying Boudot. *Cordulegaster* sp. is a genus debated for long times. As each odonatologist is allowed to describe taxa, Skvortsov & Snegovaya considered specimens they had collected as two new taxa. And the editor regarded it as opportune to publish this paper for further discussion. Obviously Boudot refers to a paper from Schneider et al. (2021) on the genus *Cordulegaster* (Diversity 2021, 13, 667). One of the reviewers was so frustrated about this publication that he circulated his review and letter to the publisher to a few people: “More specifically I urge them to … (3) discuss the genetic data, but attach no taxonomic conclusions to a distance threshold; (4) discuss the morphological variation, but hold off from describing taxa that currently have weak genetic support and no morphological confirmation …]. Again: We should be cautious with jugdements and disparaging someone personally as done with V. Skvortsov and N. Snegovaya, and wait for further fair discussion of the *Cordulegaster* problem.

Ad. 8: It is fateful that the e-mail address I used was not valid anymore. No automatic reply was given so that we assumed that our e-mail had reached its recipient. But: Since I forwarded this e-mail addressed to Boudot to a co-author of the atlas, there would also have been a chance that Boudot had received notice of our very friendly and collegially formulated e-mail.

The phrasing of my e-mail should make it very clear that I had definitely no bad intentions:

Betreff: Gomphus schneiderii
Datum: Mon, 22 Nov 2021 08:55:14 +0100
Von: Martin Schorr <bierschorr1@online.de>

An: Boudot Jean-Pierre <jean.pierre.boudot@numericable.fr>

Dear Jean-Pierre,

In a current manuscript regarding new records of Odonata in Azerbaijan, Nataly Snegovaya reports a record of *G. schneiderii* she is considering a true and proven record for Azerbaijan. Browsing your fine new atlas of West and Central Asia Odonata, we found records dating prior 1990 in the map provided by you. I couldn't find any record of this species in my library, but obviously I missed some sources.

As Nataly considers her record as the first one in Azerbaijan, we would be very glad if you would provide us with an excerpt of your database with the records of *G. schneiderii* in Azerbaijan to give us the chance to assess the correct status of this species in Azerbaijan.

Thanks very much for your cooperation.

Best wishes

Martin

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Following Boudot's rebuttal, we tried to defuse the conflict and put it on a more technical basis. The result is documented on the following pages.

The all-important question of how Boudot distinguishes *Gomphus schneiderii* from *G. vulgatissimus* has still not been answered. From this point of view - and this becomes more and more important with the increasing length of the conflict and the discussion of the taxonomic problem - this is all a discussion about a phantom, because obviously there is currently no one who is able to distinguish the two taxa with certainty. The only exception may be Boudot, but he does not reveal how he does it.

Le 14/02/2022 à 21:22, Dr. Holger Hunger (INULA) a écrit :

Dear M. Boudot,

my name is Holger Hunger and I support the IDF primarily by linguistically editing and proofreading manuscripts. I also maintain the homepage of the IDF. I have not yet uploaded the edited version of IDF Report 168 with your response, because I absolutely agree with what Geert wrote on February 1. Our common goal - to advance odonatology and to work together to do so - should not be thwarted by emotions. Therefore, I think it would be really wise if you revised your reply, limiting it to the factual arguments given in points 1 and 2. In turn, Martin Schorr has agreed to add on the part of the authors Schorr & Snegovaya that unfortunately, due to your outdated e-mail address, a discussion of the facts before the article appeared failed.

What do you think about this? Please let me know! Of course, it is all up to you and if you are not interested, I can upload the pdf with your original reply just as well. In my humble opinion, that would be a pity, however,

Best regards

Holger Hunger

Response of Boudot (unedited original writing):

"The unfair, disloyal and discourteous paper published by Schorr & Snegovaya (2022) in IDF report 168, proves, upon reading, to have no sound basis and to rely on a superficial look only.

The minimum to criticize a paper is to read it instead to just looking at the images, and I will list hereafter the wrong statements it contains.

1- Contrarily to what is said, the reasons of the omission of Gomphus vulgatissimus and other doubtful taxa in the area covered are perfectly explicated in the atlas. Just read the taxonomy section page 10. It is not the place in such Atlas to discuss more and to resolve systematic and taxonomic uncertainties.

2- The statement that Bartenev was able to differentiate G. vulgatissimus from G. schneiderii is far from being convincing. Despite the huge contribution of Bartenev to Odonatology it is factual that he ascribed a too strong importance to colour details and individual aberrations, which are at the level of intraspecies variability and not at the species or subspecies level, leading it to describe many species and subspecies which don't actually exist in terms of distinct taxa (e.g. Aeshna juncea atshischgho, A. undulata, Leucorrhinia circassica, L. ussuriensis, Lindenia inkiti, Sympetrum matrix, S. verum...etc.), confounding intraspecific variability and interspecies differences (see e.g. Belevich & Yurchenko 2010) like many authors in old times. Prior to Morton's paper on the Odonata of Constantinople

(1915), Gomphus schneiderii and G. vulgatissimus were mostly separated by colour characters of strong variability as the structural characters we can use now, which originate from Selys (1850, 1857, 1887) had never been illustrated, making likely that Bartenev could not use them reliably. Three years after Bartenev's papers, Morton (1915) published drawings of the male abdominal appendages of one G. vulgatissimus and two G. schneiderii to allow a reliable identification of these two taxa. However the two G. schneiderii specimens were so different that one is equally different of the other than it is different from the drawing of G. vulgatissimus. Natural variability of each taxon was not accounted for by this paper, raising the issue of how representative actually they are and making their use difficult. It is factual that in 1912 Bartenev could not know and could not use Morton's paper published three years later. It is therefore uncertain whether Bartenev's record of G. vulgatissimus vulgatissimus in Areš (Azerbaijan) is correct.

3- Claiming that larval determination of Gomphus vulgatissimus by Kasymov (1965) is correct is particularly naive as anybody know that a large part of purely larval papers published by general limnologists include basic aberrations (can we accept because that has been published that Macromia splendens and Boyeria irene reproduce in Oman, that Somatochlora arctica and Coenagrion armatum reproduce in temporary wadi in Algeria, that Ophiogomphus cecilia and Coenagrion lunulatum are plentiful in the rivers of Central Anatolia, and that New World Odonata species are common in Iran ?). Any identification of a species out of its known range basing on only larvae or exuviae should be carefully evaluated and often rejected. Prior to Seidenbusch (1995), Suhling & Müller (1996) and Brochard & Van Ploeg (2013) there was no way to separate the exuviae/larvae of G. vulgatissimus and G. schneiderii and the proposed criteria remain still to be validated at the continental scale throughout the range of both taxa (the same criteria of the occurrence or the absence of lateral spines on the 6th segment of the larvae or the exuviae has been proved to fail to separate reliably the larvae/exuviae of Onychogomphus f. forcipatus and O. f. unguiculatus, due to a number of exceptions (Julian & Julian; 1994)). Kasymov's work could not therefore separate reliably these Gomphus species at the larval stage.

4- The apparent rarity of Gomphus vulgatissimus from the North Caucasus countries (Onishko & Kosterin 2021, 2022) can hardly be due to a gap of field investigation, as Ciscaucasia had been enough covered in the past and the present to take the absence or rarity of this species in Ciscaucasia for true, and consequently, Azerbaijan, as geographically the easternmost part of Anatolia, is clearly out of the range of G. vulgatissimus sensu stricto and falls within the range of G. schneiderii. Both taxa seems to overlap and mixes only in the West Caucasus, Krasnodar kray (Onishko & Kosterin, 2022), where the Caucasus barrier lower considerably and can hardly act as a climate fence. Further East, G. schneiderii extends even on the northern side of the Caucasus in the Krasnodar, Adygea, Karachay-Cherkessia, Stavropol, Karbadino-Balkaria, North Ossetia and Daghestan republics and districts (Onishko & Kosterin, 2021; 2022), making the occurrence of G. vulgatissimus further South unlikely. Accordingly, Skvortsov (2010) mapped G. schneiderii (p. 583) and not G. vulgatissimus (p. 557) in Azerbaijan, adopting with

care the most reasonable point of view as possible in this respect. This is now confirmed by the emendation of a former record of Gomphus vulgatissimus by Snegovaya (2020) from Northeast Azerbaijan, which is now turned into G. schneiderii (Snegovaya, 2022). Being the obvious difficulty to separate both taxa at mid-latitudes (e.g. Northern Greece and some Caucasus countries), a previous record of G. vulgatissimus by Skvortsov & Snegovaya (2014) in the Northwest of the country cannot be accepted as reliable any more. The SEM photographies published in Schorr and Snegovaya (2022) don't demonstrate a precise identification. The apex of the superior appendages in lateral view looks more like one of those of G. schneiderii published in Morton's paper than to that of G. vulgatissimus in the same paper. Moreover it should be kept in mind that turning the angle of the SEM a little bit, this give another perspective and may suggest another identification. At least the comparison of the accessory genitalia in lateral view with those of G. vulgatissimus in the two editions of the Field Guide to the Dragonflies of Britain and Europe by Dijkstra et al. (2006, 2020) does'nt allow any conclusion as the correspondent drawing has not been included for G. schneiderii. In fact, the lateral view of the accessory genitalia for both taxa are mostly found in Buchholz (1954), pp.61-62. It turns that they are very similar and cannot be used for their taxonomic separation.

5- Rather than publishing such an unpleasant paper full of false claims and missing of substantiated statements, it would have been more correct to e-mail to the first author at the valid e-mail address indicated in the work incriminated.

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Suhling F. & Müller O., 1996. Die Flußjungfern Europas. Gomphidae. Die Neue Brehm-Bücherei, 628, Westarp-Wissenschaften."

Published 16.02.2022

Call it *schneiderii*, but document which identification key you used

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Preface

Boudot (2022) criticised in unusually harsh language with reference to 'Resolution 74 (26) on the Right of Reply of the Committee of Ministers of the Council of Europe (https://-rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=09000016805048e1)' in an e-mail with attached word document dated 31st January 2022, local time Zerf: 15.45h a small and rather insignificant publication written by Nataly Snegovaya and myself, and demanded that his counter statement be published. In my function as the responsible editor of IDF Report I granted this wish. It has to be noted that all we had done was insisting on retaining the record of Bartenef (1912a) which we are considering a proven record of *Gomphus vulgatissimus*.

Motive for the publication of Schorr & Snegovaya (2022)

In a pluralistic, knowledge-based society, the discussion of scientific publications is normality. In this context, we exercised our right, covered by tradition and good practice, to objectively criticise an issue and, importantly, to make constructive suggestions on how to deal in the near future with a taxonomic problem that even Selys-Longchamps could not solve.

- We were of the opinion that, according to our knowledge, *Gomphus vulgatissimus* should still be considered part of the dragonfly fauna of Azerbaijan and consequently should also be included in a distribution map.
- We consider the currently used methods for the identification of the taxa *vulgatissimus* and *schneiderii* as not fully developed, and document on the basis of SEM images that, according to the current state of knowledge, G. *vulgatissimus* occurs in Azerbaijan.
- It will not be further explained in detail here that a critical comparison of existing illustrations does not substantiate the alleged differences between *vulgatissimus* and *schneiderii*, just as the molecular genetic study by Dumont et al. (2021) does not provide a solution to the taxonomic problem. However, IDF has in the meantime made funds available to facilitate an evidence-based discussion - at least with regard to a sub-area of the two taxa.

A conflict is apparently **triggered** by the following paragraph, the meaning of which is assessed differently by Boudot (2022) than by Schorr & Snegovaya (2022), namely as a "discussion", whereas I consider it to be an opinion that has been solidified into a statement (my phrasing: "without any discussion"): "Similarly, two records of *Gomphus* vulgatissimus made by Skvortsov & Snegovaya (2014) and Snegovaya (2020) have been rejected as, due to strong variation in both taxa, this species is difficult to separate from *G. schneiderii* on the basis of colour pattern (De Knijf et al. 2013) and intermediate individuals are known where the two taxa meet. The authors themselves have expressed some doubts ("most probably belong to true *G. vulgatissimus*"), and as these records fall within

the range of *G. schneiderii* we regard the records as doubtful and have thus omitted *G. vulgatissimus* from this atlas. Whether the records represent *G. schneiderii* or intermediate individuals is unknown." (Boudot et al. 2021: 10)

When publishing our paper, we didn't write about *G. schneiderii* in general, but two special issues: The record of Bartenef and the record published in Schorr & Snegogaya (2022). This may have caused confusion.

One can disagree about the semantic meaning of some of the above formulations. However, despite all doubts and taxonomic problems, in the case of the situation in Azerbaijan Bartenef (1912b) has provided illustrations and Nataly Snegovaya has published verifiable SEM images of an individual that is also considered by other odonatologists to be *G. vulgatissimus*. Also, this decision to consider *G. vulgatissimus* as a faunal component of Azerbaijan is based solely on structural features, and explicitly leaves "colour pattern" out of consideration. However, this at least clearly and verifiably documents something that can be falsified by other odonatologists. And one does not have to choose a spatially indeterminate formulation - "these records fall within the range of *G. schneiderii* we regard the records as doubtful and have thus omitted *G. vulgatissimus* from this atlas". However, the following is only my opinion (see below): I find no evidence-based analysis of the range of *Gomphus schneiderii* anywhere, and dare to ask whether anyone can really determine beyond doubt what is behind the taxon "*Gomphus schneiderii*".

The pitfalls of semantics - what is 'discussion', what is 'opinion', what is 'statement'?

A **discussion** in the scientific sense also allows for other opinions. It places one's own results at the centre of the considerations, explains why one's own view - according to current knowledge - is correct despite the opinion of other published views. However, many authors explicitly allow other conclusions to be reached, taking into account broader or deeper studies to be done in future.

This is contrasted with an **opinion**. An opinion or position on an issue can be a contribution so that others also communicate their opinion. However, it can also be a position of authors that is not intended to trigger an exchange of opinions, but is published without further or more in-depth discussion. It thus becomes a **statement** or can even become a dogma that excludes any discussion.

I consider the paragraph on page 10 by Boudot et al. (2021) quoted above - regardless of its psychological intention - not to be a discussion, but an opinion, since the state of knowledge, especially the increase in new knowledge, has not changed significantly. The authors do not include any new facts for their decision not to include *G. vulgatissimus* in the West Asia Atlas, but have only changed their assessment of an almost unchanged data situation - only Snegovaya has contributed new material -, and consequently held a different opinion in 2021 than in 2015 (Boudot & Kalkman 2015). The interpretation of Snegovaya's published material was accepted by us, and we even added new material of "*G. schneiderii*" following the current insight of Boudot et al. (2021) in the general distribution of this taxon (see our published map).

In 2015, *G. vulgatissimus* was still considered for Azerbaijan, but no longer in 2021 (Boudot & Kalkmann 2015, Boudot et al. 2021). The crucial question for me was: Why was *G. vulgatissimus* published in 2015, but now no longer considered to be *G. vulgatissimus*?

Furthermore, it is crucial that the assumption of Schröter et al. (2015: 327) that *G. vulgatissimus* could also occur as far as Azerbaijan has not yet been modified: „Given correct determination, also single migrants of *Gomphus vulgatissimus* may have been involved here and it appears to be possible that at least the contact zone of both species might run through the eastern part of the Transcaucasian depression.“

Thus, Boudot et al. (2021) interpreted old data as being "*schneiderii*" without any real increase in knowledge. This was done on the basis of pure assumption and without any new evidence, solely on the basis of their self-confessed competence.

I do not question this competence - let this be explicitly and unequivocally stated here. Together with Snegovaya, however, I was of the opinion, which we put up for discussion, that it is still too early to conclusively remove a species or taxon '*vulgatissimus*' from consideration, because there is something final or conclusive about an atlas written by such competent and leading odonatologists.

Given the totally unsatisfactory taxonomic state of knowledge of the species complex '*vulgatissimus/schneiderii*' (cf. Boudot & Kalkman 2015, Schneider & Ikemeyer 2019, and especially Dumont et al. 2021), all we have done was to suggest to be a bit more cautious with the two taxa, to collect new material ('search area', our Fig. 2) and to always document precisely how an author arrived at an identification result, if it is to be published. This will make it easier for future researchers to assess why a specimen was called '*vulgatissimus*' or '*schneiderii*'.

Can a taxonomic classification based on its range alone be convincing?

Boudot & Kalkman (2015: 192) write the following about *G. schneiderii*: "This species is very similar to *Gomphus vulgatissimus* and is sometimes considered as a subspecies of the latter. In the Balkan Peninsula, where the ranges of the species meet, **there is a broad zone where intermediates are found and populations cannot be ascribed to either of the species with certainty**. The status of *G. schneiderii* as species or subspecies is still under debate and the matter can only be solved by a thorough investigation of material from a wide range of localities from south-west Europe and south-west Asia, preferably using both morphological and molecular methods."

Given such considerable difficulties in correctly identifying the two taxa, it is surprising that it was possible to produce distribution maps that give the impression that a correct assignment to a taxon was possible even in the 'overlap zones'. In the case of Boudot, who (co)authored the *schneiderii* and *vulgatissimus* chapters, there is no doubt that this unambiguous assignment can be achieved within the framework of field studies. However, since the atlas mainly uses external data, it cannot be assumed that correct identifications were made in all cases.

I see this map of world distribution in Boudot & Kalkman (2015: 194) but I didn't find a source on what taxonomic basis the map was drawn. How was *G. vulgatissimus* distinguished from *schneiderii*? Blue eyes, appendices, other structures? I see the detailed discussion in De Knijf et al. (2013) of the problems in distinguishing the two taxa with certainty, but I do not find a solution to the problems there either. I hope I didn't miss the relevant paragraph in the publications I here consider.

If you look at the illustration of *G. schneiderii* in Schneider & Ikemeyer (2019:139), for example, you will inevitably ask yourself what the difference is between *G. schneiderii* and *G. vulgatissimus* if you exclude possible differences in colouration and focus exclusively on structural characters. And even if one considers these minor differences as valid to separate two taxa, who has done this in the field?

Why is it correct to assign the species described by Bartenef (1912a) to *Gomphus vulgatissimus*?

Every species identification depends on which identification keys and knowledge were available at a given time. This problem is easy to solve for the current conflict, because only two time periods have to be considered: (a) that of Bartenef around 1912 and (b) that of Snegovaya around 2012.

Regarding a): The basis on which Bartenef (1912a) determined the individual he identified as *Gomphus vulgatissimus vulgatissimus* can easily be checked in this case using the drawing in Bartenef (1912b) (Fig. 1).

These drawings of Bartenef may not be of the very best quality and for *G. vulgatissimus schneiderii* one can assume that on the way from Montenegro to Bartenef the specimens were compressed or that a lateral illumination on the drawing table changed the proportions. Unfortunately, this must remain pure speculation. However, the fundamental difference between the two individuals is recognisable (cf. lock-and-key concept, see below). And, crucially, these differences will not be depicted differently in 2020 (Fig. 2).

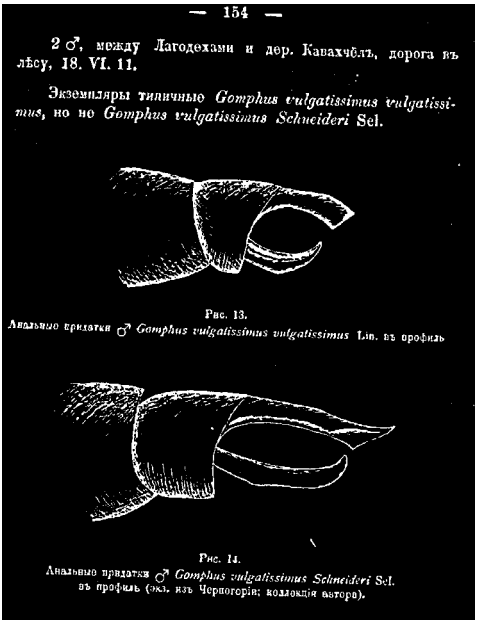
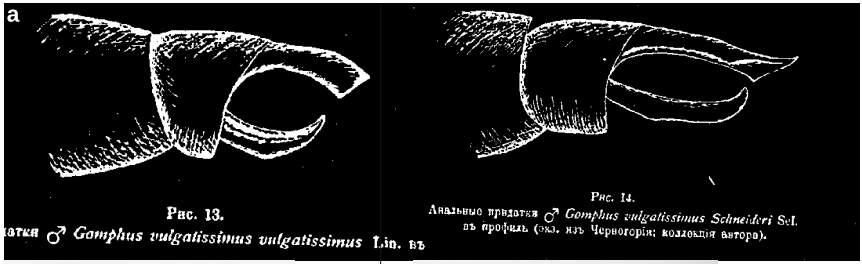


Abb. 1: „Figures 13 and 14 show the difference in the shape of the upper anal appendages of both subspecies of *G. vulgatissimus*. As can be seen in the figures, the upper anal appendages also differ in relative length. So in *G. v. vulgatissimus* their length is equal to the length of the 10th segment, and in *G. v. schneiderii* they are almost 1/3 longer than the 10th segment.“ (Translation Vladimir Onishko).



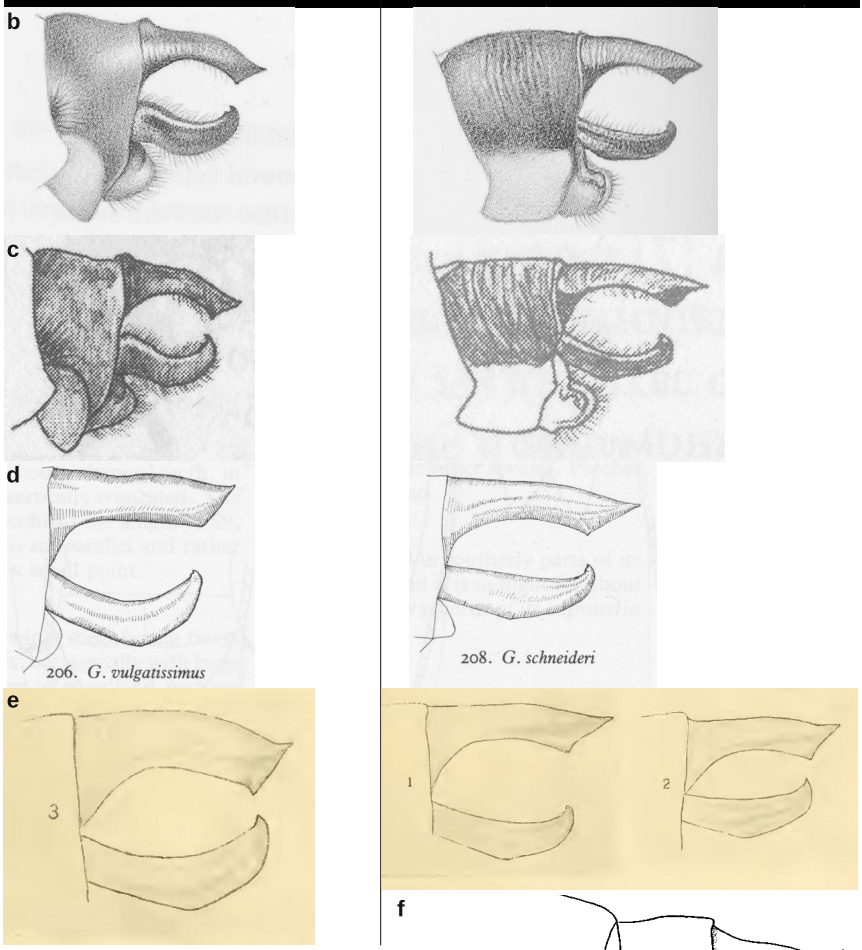


Fig. 2: Comparison of anal appendices. Left column: *Gomphus vulgatissimus*. Right column: *G. schneiderii*. a): Bartenef (1912b); b) Dijkstra et al 2020; c) Skvortsov (2010); e) Askew (1988); e) Morton (1915); f) Dumont (1991): *G. vulgatissimus schneiderii*

In the case of *G. vulgatissimus*, the upper appendages are more downward curved (Exception: Askew 1988), while the lower appendages are more upward directed. In the case of *G. (vulgatissimus) schneiderii*, both appendages appear less curved with more straight-stretched parts (see also Seidenbusch 1997a).

Considering only these two alternatives, it is clear that the specimen indicated by Ares is *G. vulgatissimus* or 'forma', 'race' or 'subspecies' *vulgatissimus*. The colourings referred to by Boudot (2022), to which Bartenef is said to refer, are not found in the two relevant publications of 1912a and 1912b, but are in the one by Bartenef (1912c) on the dragonflies of Montenegro, which had been given to him for identification.

Boudot (2022) writes: "Prior to Morton's paper on the Odonata of Constantinople (1915) these two *Gomphus* were mostly separated by colour characters of strong variability as the structural characters we can use now, which originate from Selys (1850, 1857, 1887) had never been published with drawings, making likely that Bartenev could not use them reliably. Three years after Bartenev's papers, Morton (1915) published drawings of the male abdominal appendages of one *G. vulgatissimus* and two *G. schneiderii* to allow a reliable identification of these two taxa. However the two *G. schneiderii* specimens were so different that one is equally different of the other than it is different from the drawing of *G. vulgatissimus*. Natural variability of each taxon was not accounted for by this paper, raising the issue of how representative actually they are and making their use unreliable."

Now it is not correct that it was Morton (1915) who first illustrated the two taxa in a comparative manner that allowed a reliable differentiation or determination. It was Bartenef (1912b) (Fig. 1).

Considering the high variability of the species or of the structural and/or colouration characters - especially of *G. schneiderii* - even three individuals sketched by Morton should not be sufficient to bring about a decision on the taxonomic status of the taxon.

It may be that Bartenef first identified his Montenegro specimens on the basis of colouration differences and found that both species or subspecies were present in virtually the same locality. On the basis of colouration (Selys) and structure (Bartenef), however, he succeeded in first identifying and then separating the two taxa. Since he did not find any significant differences in colouration ("The colouration of the head and legs is almost the same as that of the latter. The underside of the chest behind the legs is yellow."), he drew the appendices in Bartenef (1912b). With this he was exactly as far along as we still are 100 years later. If he had had the identification key by Dijkstra et al. (2020), he would also have ended up with *G. vulgatissimus*, because the colouration characteristics described in the latest available field guide do not help either: in the table on page 189, no distinguishing characteristics are given apart from the different geographical area of the occurrences. And also the textual descriptions given in the main text remain vague and advise caution, but do not really help to separate the two taxa. (for more see below)

Against this background, one cannot come to any other conclusion than that Bartenef had a taxon of Ares in front of him that is also *Gomphus vulgatissimus* according to today's knowledge. He compared this taxon with the two taxa from Montenegro available to him, as all relevant publications by him in this context date from the same year.

Why is it correct to assign the individual collected by Svorstov & Snegovaya 2012 to *Gomphus vulgatissimus*?

The unpleasant conflict that led to this publication is also due to the fact that especially in a difficult taxonomic situation it would be appropriate to justify on which species concept and on which basis a determination is made.

Schorr & Snegovaya (2022) have reduced the species concept to one aspect, namely morphological structures, which are of great importance in separating species and preventing interspecific mating (e.g. Gorb 1998). This results logically from the problem to be dealt with, whether a taxon occurs or not. This is primarily only a question of the unambiguous determination of a given individual.

Arnqvist (1997) discusses the importance and change of morphological structures in the course of evolutionary processes for speciation processes: "Rapid evolution of genitalia is one of the most general patterns of morphological diversification in animals. Despite its generality, the causes of this evolutionary trend remain obscure. Several alternative hypotheses have been suggested to account for the evolution of genitalia (notably the lock-and-key, pleiotropism, and sexual selection hypotheses)." Further factors that play a role in speciation can be read compactly and didactically in Wildermuth (2008: Chapter 1.2).

Even though I am aware of the problematic nature of the "lock-and-key" explanatory approach, it must be stated that this approach is still of central, if not crucial, importance in all identification books for dragonflies. For ultimately, every identification result must be checked against the genital structure, i.e. as a rule the secondary copulatory apparatus, of individuals at least in Anisoptera; only then is a reliable identification result available.

This 'lock-and-key' concept gives field odonatologists the chance to make a correct identification, if the authors of field guides have succeeded in defining criteria for lock and key and figuring them in such a way that they can be applied.

It should hardly be disputed that for the determination of the European dragonfly fauna the work of Dijkstra & Lewington (2006) and in a second edition Dijkstra, Schröter & Lewington (2020) is the gold standard, and complementary to this Skvortsov (2010) can be used going more to southwestern Asia. The book of Skvortsov (2010) is of some interest as he illustrates the secondary genitalia of both taxa involved in this paper.

Comparing the appendices shown by Dijkstra et al. (2020) with the illustration by Bartenef (see Fig. 1), there can be no doubt that Bartenef correctly identified the specimens available to him according to today's valid and best available standard work.

As Suhling & Müller state in Dijkstra et al. (2020: 188): "The separation of three species (*G. schneiderii*, [...]) from their more widespread counterparts (*G. vulgatissimus*, [...]) is still somewhat questionable, although the species in each pair are geographically (largely) segregated. A simple table, based on markings of both sexes and ranges, is provided, but for positive identification careful comparison is required, preferably in the hand. The male's appendages and female's vulvar scales may then be useful, but are fairly uniform.] The shape of the male's posterior hamules is underappreciated as a character, but the hamules are almost as easily examined with a hand lens as the appendages, and may be more informative."

The German translation says: "Ein wichtiges und immer eindeutiges Bestimmungsmerkmal ist dagegen die Form der posterioren Hamuli des Männchens.", which is explicitly referred to in a drawing on page 191 in the English edition of the book. What is peculiar, however, is that the secondary sexual apparatus with the hamuli is not illustrated for *G. schneiderii*. This leaves the user perplexed. And this leaves only the appendages of the two species for the normal user to distinguish, as it is not only in the context of the discussion that led to this article that the value of colouration differences, even of the blue eyes in *G. schneiderii*, is considered diagnostically insufficient. These anal appendages are illustrated clearly positioned, and this is what a user of an identification book expects: he does not read long texts, but looks at the illustrations: "A picture says more than a thousand words", is a German proverb).

The specimen of Nataly Snegovaya

In Dijkstra et al. (2020), the appendices superiores are not illustrated dorsally, in contrast to other current identification works. In Schneider & Ilkemeyer (2019: 139) they are figured to determine different gomphids. And it is interesting what Suhling & Müller (1996: 173) provide in their book in terms of identification. However, it must be noted here that these may have been taken from d'Augilar & Dommanget (1998). Whether the differences shown are actually valid in the entire range of the taxon "*schneiderii*" is beyond my knowledge. However, it is clear that the dorsally depicted shape of the appendices superiores is completely consistent with Fig. 1c in Schorr & Snegovaya (2022), and that is true for Asahina's (1986) figure, too, and there is no correspondence with the shape given by these authors for *G. schneiderii* (Fig. 3a, c). But it is not true, compared with Dumont (1991). However, in Dumont (1991) (Fig. 3d) the "superior appendices" seem to be longer than in *G. vulgatissimus*. Probably the shape of the appendices superiores - seen dorsally - is not a good character to distinguish the taxa.

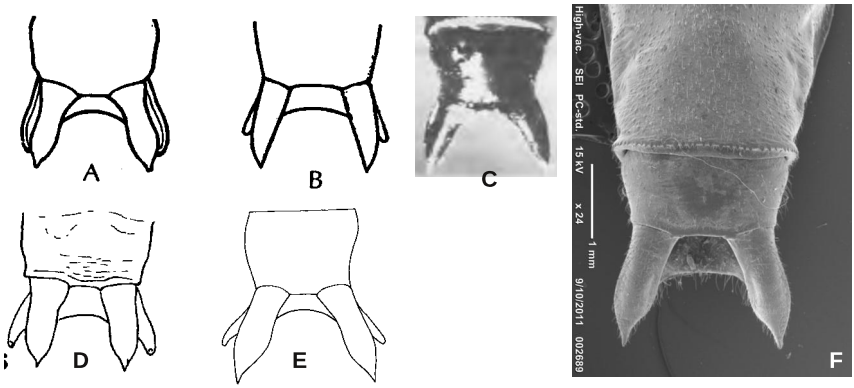


Fig. 3: Figures taken from identification key in Müller & Suhling (1996): Dorsal view of appendices superiores. A: *Gomphus vulgatissimus*, B: *Gomphus schneiderii* (above), C: Seidenbusch (1997b): *G. schneiderii*; D: *G. vulgatissimus* (Germany) (Asahina 1985) E: *G. vulgatissimus schneiderii* (Dumont 1991) and F: compared with the specimen published by Schorr & Snegovaya (2022) (right, SEM).

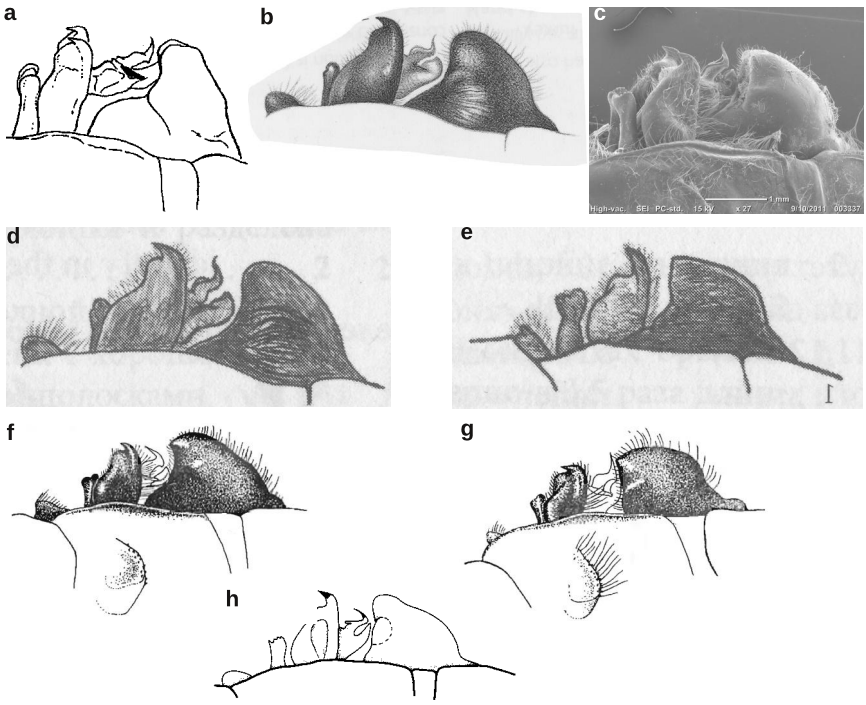


Fig. 4: Secondary genital apparatus of *Gomphus vulgatissimus*. A: Asahina (1986); B: Dijkstra et al. (2020); C: Schorr & Snegovaya (2022); D: Skvorstov (2010): E: *Gomphus schneiderii* from Skvortsov (2010), where hamulus and anterior lamina are different from *G. vulgatissimus*. The form of the genital lobe is quite interesting and should be studied more in detail when reconsidering the taxa in future (e.g. Seidenbusch 1997, pl. 2). F: *G. vulgatissimus* and G: *G. schneideri hellacidus* (Buchholz 1954); H: Dumont (1991): *Gomphus vulgatissimus schneiderii.*

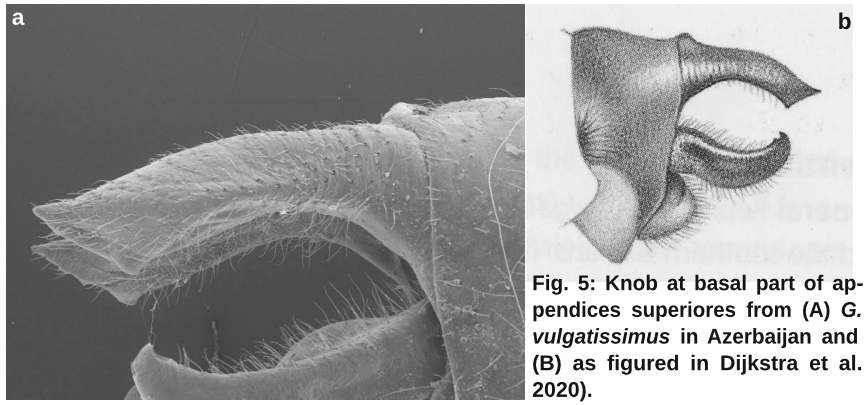


Fig. 5: Knob at basal part of appendices superiores from (A) *G. vulgatissimus* in Azerbaijan and (B) as figured in Dijkstra et al. 2020).

If one additionally takes the hamulus (see Fig. 4), which Suhling & Müller in Dijkstra et al. (2020) cite as a central identifying character (for *G. vulgatissimus*), but unfortunately do not illustrate *G. schneiderii*, only a perfect match can be found here as well. Fig. 1 e in Schorr & Snegovaya (2022) shows the pointed ends, which are explicitly referred to on page 191 in Dijkstra et al. (2020).

There is no alternative to this identification character. However, in the case of the taxon *vulgatissimus/schneiderii*, one day one will have to ask the question - e.g. considering Dumont (1991) or Schneider (1986) -, is the hamulus sufficient to separate the two taxa, if they are really two different taxa?

Studying the illustrations in Fig. 2, there are differences in the form and extension of the paraproct (nomenclatur following Walker 1953). Again, the form of the paraproct of the specimen illustrated in the SEM photograph in Schorr & Snegovaya (2022: fig. 1) resembles more the figure in Dijkstra et al. (2020) for *G. vulgatissimus* than *G. schneiderii*.

Since the basal knob at the superior appendage in Fig. 1a in Schorr & Snegovaya (2022) is also not an artefact and can be clearly seen when the SEM image is enlarged (Fig. 5), there is also 100% agreement with Dijkstra et al. (2020) here, since no knob is indicated for *G. schneiderii*. It remains unclear, whether this is true, as one can see such a knob in Fig. 6, a specimen that was identified as *G. schneiderii.* Whether and which functional role the knob plays is not to be considered here. It is given as a morphological structure in the most important identification book for European dragonflies (and in Skvortsov 2010 too).

Consequently, there can be no doubt that ***G. vulgatissimus* is found in Azerbaijan if these books by Dijkstra et al. (2020) and Skvorstov (2010) are taken into account alone**.

This alone is decisive for our criticism of the missing distribution map in Boudot et al. (2022). Regardless of the taxonomic assessment of the taxa *vulgatissimus* / *schneiderii*, a discussion of the current state of knowledge cannot simply be dispensed with just 'by opinion'. Since this is not done elsewhere and since it is also pointed out that it is difficult to make an identification "on the basis of colour pattern" the reaction of Boudot (2022) is hard to understand. Bartenef (1912a, b) did not discuss colouration variations, but focused exclusively on characters of the appendices. And Snegovaya has published black and white SEM illustrations that do not show colour variations, but only structural features.

In conclusion, with the **identification possibilities currently available** *Gomphus vulgatissimus* is figured in Schorr & Snegovaya (2022).

And now? What next?

How this picture changes when area-geographical factors are included in the consideration can only be revealed by later and detailed studies of the taxonomic complex *Gomphus vulgatissimus*/*schneiderii*. This is because the characters of *G. schneiderii* illustrated e.g. by Schneider & Ikemeyer (2019: 139) show considerable similarities to those I have discussed here in the context of *Gomphus vulgatissimus*.

And if one considers the specimen identified as *G. schneiderii* by Kosterin & Ahmadi (2018) from Iran (Fig. 6), one involuntarily realises that there are no, at least no signi-

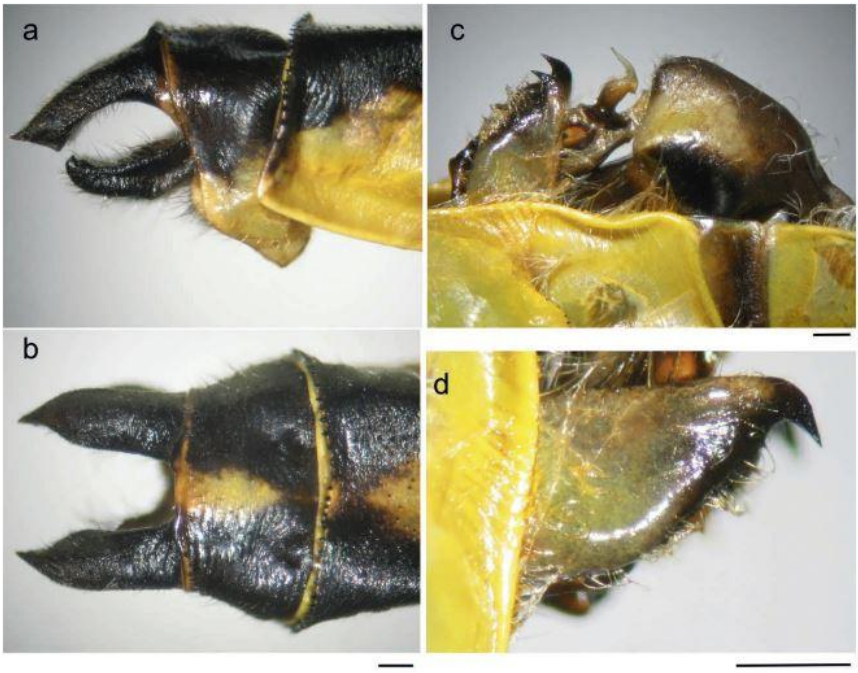


Fig 45. Abdominal details of the male of *Gomphus schneideri* collected on the Ghomrood (Anaarbar) River left bank: a – anal appendages, dorsal view; b – ditto lateral view; c – accessory genitalia, lateral view; d – hamulus posterioris, lateral view. Scale bar 0.5 mm.

Fig. 6: Taken from Kosterin & Ahmadi (2018).

ficantly different structural characters to *G. vulgatissimus*. May be that one day the form of the anterior lamina and the gential lobe will help to differentiate the taxa. Same to form of appendices and paraproct. Correlating molecular studies with such morphological structures may help to get more insight into the taxa.

Comparing the secondary genitalia figured in Skvortsov (2010) one will find some consistency with *G. kinzelbachi* (see Schneider & Ikemeyer 2019) if you set a focus on the hamulus. And upon comparing the morphological structures with further figures in some other publications more (e.g. Beschovski 1994, Puschnig 1926, Schneider 1986, Seidenbusch 1997b, St. Quentin 1968) confusing will grow even more.

In conclusion, there can be no doubt that the complex *G. vulgatussimus*/*schneiderii* and probably also other species must be fundamentally rethought and reworked.

Final remark

I have merely tried to add a few pieces to the mosaic, but do not intend to criticise or disparage anyone with my comments. If I have misunderstood something or overlooked important sources, please accept my apologies.

Science is a process that is in constant flux, the direction of which new perspectives and insights can influence.

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