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New records of an alderfly *Sialis nigripes* (Megaloptera: Sialidae) from the Czech Republic

Nové nálezy střechatky *Sialis nigripes* (Megaloptera: Sialidae) z České republiky

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Abstract. *Sialis nigripes* Pictet, 1865 (Megaloptera: Sialidae) was known until now from only nine localities in the Czech Republic, where it has been considered critically endangered. This study presents 49 new records from 35 streams and one fishpond distributed in all the major river basins. The species occurs mostly at low altitudes below 300 m a.s.l. (31 localities) in mid-sized and large streams (Strahler stream order 6–9; 36 localities). Based on the new records, it is proposed that *S. nigripes* should be listed as 'least concern' because it is frequent in running waters at mid and low altitudes throughout the Czech Republic, including localities with deteriorated water quality.

INTRODUCTION

The order Megaloptera is generally considered to be among the most primitive of the holometabolous insect orders and contains two families, the Sialidae (alderflies) and the Corydalidae (dobsonflies and fishflies). The family Sialidae is a small group of aquatic insects inhabiting both standing and running waters worldwide. In the Czech Republic, only four species have been recorded so far (Vaňhara 1970; Chládek 2003). *Sialis fuliginosa* Pictet, 1836 and *S. lutaria* (Linnaeus, 1758) are common and widespread species, whereas *S. morio* Klingstedt, 1932 and *S. nigripes* Pictet, 1865 are known only from a few localities and are considered critically endangered in the Czech Republic (Zelený 2005). The main threats to both species are habitat alteration, filling of pools, regulation of watercourses and water pollution from lowlands to mountains (Zelený 2005).

Sialis nigripes is a relatively rare species in its whole area of occurrence (Elliott 2009). Its distribution extends from the Iberian Peninsula (scattered in Spain except the Pyrenees, absent from Portugal (Monserrat 1984)), across the Mediterranean and Balkans (France, Italy,

Croatia, Slovenia, Greece, and Bulgaria) to Central and Western Europe (Austria, Belgium, Czech Republic, Denmark, Germany, Great Britain, Hungary, Ireland, Netherlands, Poland, Slovakia and Switzerland) (Aspöck et al. 2001; Kovács 2006; Elliott 2009). It is absent from Scandinavia (Popov 2002). The north-eastern limits of its range are in the Western Carpathians: the upper part of the San River basin, which has the only known localities in Poland (Pawlowski 2011), and several localities in Slovakia (Šíravský kanál near Michalovce and Topľa River near Bardejov are the easternmost; Mišíková Elexová et al. 2010).

The first record of *S. nigripes* from the present territory of the Czech Republic was a male imago collected in the environs of Hranice na Moravě (field code 6472) by Tjeder (1937). This record was mentioned by Obenberger (1958), but then overlooked in literature for a long time. Other records published in the second half of the 20th century are as follows: Libochovka River valley near Dolní Loučka (6664) and Loučka River valley near Tišnov (6664) in Moravia (Vaňhara & Rozkošný 1968; Vaňhara 1970), and Malše near Plav (7052–7053) in Bohemia (Vaňhara 1970). Recently, new records were published from Labe River in Obříství (5752), Děčín (5251) and Hřensko (5151) and Vltava River in Podolí (5952) and Zelčín (5652) by Kolaříková et al. (2014). The aims of this study are to summarize all available records of the species in the Czech Republic and to present new data on the distribution of the species.

MATERIAL AND METHODS

Material gathered for this study was collected during several surveys focused on the investigation of benthic macroinvertebrate assemblages in the Czech Republic. Samples were collected in various aquatic habitats, particularly in streams of different sizes and altitudes, ponds, lakes and pools. Adults of alderflies were collected by sweeping vegetation, Malaise traps and individual collecting of specimens sitting on the vegetation. Larvae were sampled by the kick sampling method (Frost et al. 1971) using a hand net or a metal strainer. Keys by Vaňhara (1970), Aspöck et al. (1980), Vshivkova (1985), Meinander (1996), and Hölzer (2002) were used for identification. The material is preserved in 70% ethanol or pinned, and is currently deposited in the following collections: the Jindřiška Bojková collection at the Department of Botany and Zoology, Faculty of Sciences, Masaryk University, Brno (MUB), Petr Komzák collection in Brno (PKC), collection of the Department of Entomology, National Museum, Prague (NMP), collection of the Municipal Museum, Mariánské Lázně (MML), and Jan Špaček collection in Hradec Králové (JSC).

Each locality where *Sialis nigripes* was recorded, was described as follows: municipality, field code (in parentheses) in the faunistic and floristic grid mapping system of central Europe (Ehrendorfer & Hamann 1965; Pruner & Míka 1996), name of the stream/pond, altitude, and stream order according to Strahler (1952).

RESULTS

Sialis nigripes was recorded from 48 localities on 35 rivers and one fishpond in 1993–2014 (Fig. 1). Localities are distributed below 550 m a.s.l. across the whole Czech Republic (Fig. 1), but the majority of localities (31) are at low altitudes below 300 m a.s.l. *Sialis nigripes* inhabits streams of different stream orders (4–9); records from small (stream orders 4 and 5) and large streams (stream orders 8 and 9) are less frequent (Fig. 2). Adults were found from the 1st May to 13th June.

Records are summarized as follows:

Bohemia bor.: Ves u Černous (4956), Smědá River, 215 m a.s.l., stream order 6, 16.iii.2004, 1 larva, J. Špaček leg. et det. (JSC). Postoloprty (5648), Ohře River, 183 m a.s.l., stream order 7, 1 larva, 30.vii.2008, 1 larva, T. Soldán, S. Zahrádková & J. Bojková leg., J. Bojková det. (MUB). Zadní Doubice (5052), Křinice River, 290 m a.s.l., stream order 5, 17.v.–10.vi.2010, 1 ♂, Malaise trap, M. Trýzna leg., J. Bojková det. (NMP). Žizníkov (5353), Ploučnice River,

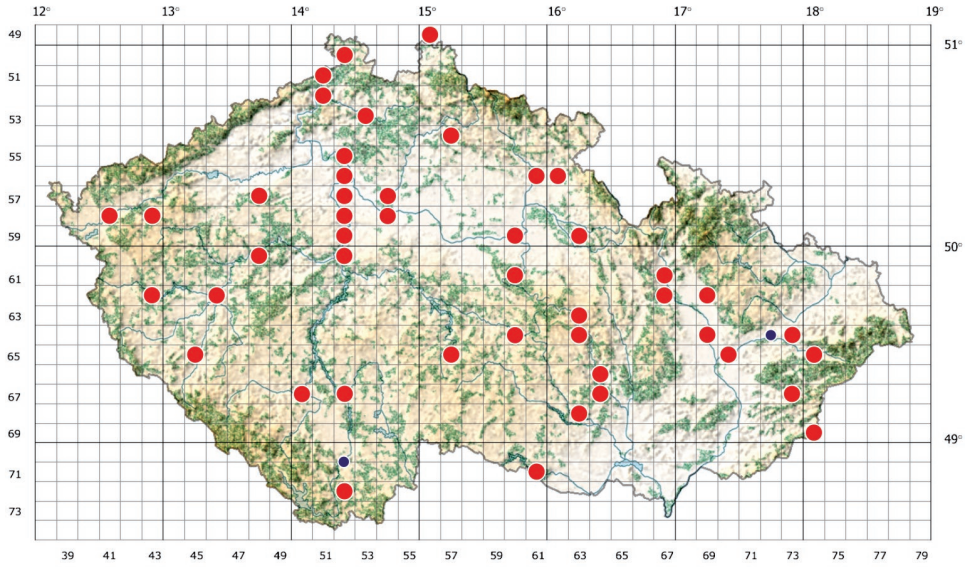


Fig. 1. Distribution of *Sialis nigripes* Pictet, 1865 in the Czech Republic. Small violet circles indicate occurrence based on data older than 1980, big red circles indicate new records.
Obr. 1. Rozšíření *Sialis nigripes* Pictet, 1865 v České republice. Malé fialové kroužky označují výskyt založený na datech starších než 1980, velké červené kroužky označují nové nálezy.

245 m a.s.l., stream order 7, 8.viii.2002, 2 larvae, 25.ii.2007, 1 larva, J. Špaček leg. et det. (JSC). Podlažany (5457), Žehrovka River, 255 m a.s.l., stream order 5, 9.ix.2009, 2 larvae, J. Špaček leg. et det. (JSC).

Bohemia occ.: Sokolov (5841), Ohře River, 400 m a.s.l., stream order 6, 26.iv.–18.v.2012, 1 ♂, Malaise trap, J. Kabelák leg., J. Bojková det. (NMP). Krásný Jez (5843), Teplá River, 460 m a.s.l., stream order 6, 29.iv.–26.v.2011, 1 ♂, Malaise trap, J. Kabelák leg., J. Bojková det. (NMP). Milíkov (6243), Mže River, 377 m a.s.l., stream order 6, 5.v.2007, 1 ♀, T. Soldán, S. Zahrádková & J. Bojková leg., J. Bojková det. (MUB). Plzeň-Slovany (6246), Radbuza River (bank with canebrake and sparse trees), 305 m a.s.l., stream order 6, 5.v.2014, 1 ♂, L. Dvořák leg. et det. (MML). Švihov (6545), Úhlava River (bank with grass), 375 m a.s.l., stream order 6, 10.v.2014, 2 ♂♂, A. Sieber leg., L. Dvořák det. (MML).

Bohemia centr.: Štětí (5552), Labe River, 153 m a.s.l., stream order 9, 8.xi.2012, 8 larvae, J. Špaček leg. et det. (JSC). Obříství (bridge Na Štěpáně) (5752), Labe River, 160 m a.s.l., stream order 8, 8.vi.2004, 1 larva, J. Špaček leg. et det. (JSC). Kačov (5754), Jizera River, 180 m a.s.l., stream order 7, 31.vii.2013, 1 larva, J. Hotový leg., J. Špaček det. (JSC). Káraný (5854), Jizera River, 170 m a.s.l., stream order 7, 16.v.1993, 1 ♂, 1 ♀, P. Chvojka leg., J. Špaček det. (NMP), 25.ii.2007, 1 larva, J. Špaček leg. et det. (JSC). Praha-Troja (5852), Vltava River (bank with sparse underbrush of plants), 180 m a.s.l., stream order 9, 1.v.2013, 2 ♂♂, 1 ♀, O. Kouklík leg. et det., L. Dvořák revid. (both ♂♂ MML); 10.v. 2013, 4 ♂♂, 2 ♀♀, O. Kouklík leg. et det., L. Dvořák revid. (2 ♂♂, 1 ♀ MML). Praha-Smíchov (5952), Vltava River (bank with sparse herb underbrush), 190 m a.s.l., stream order 9, 15.v.2013 1 ♂, 1 ♀,

O. Kouklík leg. et det., L. Dvořák revid. (MML). Zvíkovec (6048), Berounka River, 255 m a.s.l., stream order 8, 9.viii.2000, 3 larvae, J. Špaček leg. et det. (JSC). Skryje (6048) Berounka River (canyon with rich vegetation including trees, collected flying near the bridge), 250 m a.s.l., stream order 8, 29.v.2013, 1 ♀, O. Kouklík leg. et det., L. Dvořák revid. (MML). Praha-Radotín (6052), Berounka River, 190 m a.s.l., stream order 8, 12.viii.2006, 1 larva, J. Špaček leg. et det. (JSC).

Bohemia or.: Jaroměř-Josefov, Stará Metuje River (5661), 250 m a.s.l., stream order 7, 9.i.2014, 1 larva, J. Špaček leg. et det (JSC). Metuje River (5662), bridge near Slavětín, 260 m a.s.l., stream order 7, 2.iii.2014, 1 larva, J. Špaček leg. et det. (JSC). Nemošice (5960), Chrudimka River, 220 m a.s.l., stream order 7, 15.vii.2002, 1 larva, J. Špaček leg. et det. (JSC). Potštejn (5963), Divoká Orlice River, 300 m a.s.l., stream order 6, 9.v.2007, 3 ♂♂, 2 ♀♀, T. Soldán, S. Zahrádková & J. Bojková leg., J. Bojková det. (MUB). Záměl (5963), Divoká Orlice River, 292 m a.s.l., stream order 6, 25.viii.2003, 1 larva, J. Špaček leg. et det. (JSC). Klokočov (6160), Chrudimka River, 490 m a.s.l., stream order 5, 27.x.2008, 1 larva, M. Straka leg., J. Bojková det. (MUB). Ronov nad Sázavou (6460), Sázava River, 450 m a.s.l., stream order 6, 17.vi.2004, 1 larva, J. Špaček leg. et det. (JSC).

Bohemia mer.: Hodějovice (6557), Želivka River, 490 m a.s.l., stream order 4, 30.v.2007, 1 ♀, 1 larva, T. Soldán, S. Zahrádková & J. Bojková leg., J. Bojková det. et coll. (MUB). Zátaví (6750), Otava River, 360 m a.s.l., stream order 8, 7.x.2013, 8 larvae, J. Rucki leg. et det., J. Špaček rev. (JSC). Nuzice (6752), Židova strouha River, 373 m a.s.l., stream order 5, 21.vii.2008, 4 larvae, T. Soldán, S. Zahrádková & J. Bojková leg., J. Bojková det. (MUB). Kaplice (7252), Malše River, 530 m a.s.l., stream order 5, 21.v.2012, 2 ♂♂, T. Soldán & J. Bojková leg., J. Bojková det. (MUB).

Moravia bor.: Lupěné (6167), Moravská Sázava River, 292 m a.s.l., stream order 6, 14.v.2008, 1 ♂, T. Soldán, S. Zahrádková & J. Bojková leg., J. Bojková det. (MUB). Moravičany (6267), Třebůvka River, 250 m a.s.l., stream order 6, 10.v.2010, 1 ♂, P. Komzák leg. et det. (PKC). Dolní Žleb (6269), Sitka River, 320 m a.s.l., stream order 4, 15.v.2013, 1 ♀, P. Komzák leg. et det. (PKC). Jimramov (6363), Svratka River, 500 m a.s.l., stream order 4, 22.v.2014, 1 ♂, P. Komzák leg. et det. (PKC). Dalečín (6463), Svratka River, 465 m a.s.l., stream order 5, 22.v.2014, 1 ♀, P. Komzák leg. et det. (PKC). Blatec (6469), Morava River, 200 m a.s.l., stream order 7, 12.ix.2012, 1 larva, P. Komzák leg. et det. (PKC). Choryně (6473), Bečva River, 275 m a.s.l., stream order 7, 21.v.2014, 1 ♂, P. Komzák leg. et det. (PKC). Přerov (6570), Bečva River, 210 m a.s.l., stream order 7, 24.ix.2013, 4 larvae, P. Komzák leg. et det. (PKC). Valašské Meziříčí (6574), Rožnovská Bečva River, 305 m a.s.l., stream order 6, 24.iv.2014, 1 larva, P. Komzák leg. et det. (PKC).

Moravia mer.: Předklášteří (6664), Loučka River, 260 m a.s.l., stream order 4, 15.ix.2008, 3 larvae, 10.x.2011, 2 larvae, all P. Komzák leg. et det. (PKC). Borač (6664), Svratka River, 270 m a.s.l., stream order 5, 5.x.2012, 1 larva, P. Komzák leg. et det. (PKC). Veverská Bítýška (6764), Svratka River, 230 m a.s.l., stream order 6, 4.v.2010, 2 ♂♂, 2 ♀♀, P. Komzák leg., et det. (PKC). Leskovec (6773), Senice River, 380 m a.s.l., stream order 6, 15.viii.2007, 2 larvae, T. Soldán, S. Zahrádková a J. Bojková leg., J. Bojková det. (MUB). Senoradský mlýn (6863), confluence of Oslava and Chvojnice Rivers, 270 m a.s.l., stream order 6, 11.v.2008, 1 ♂, T. Soldán, S. Zahrádková & J. Bojková leg., J. Bojková det. (MUB). Čučice (6863), Oslava River, 240 m a.s.l., stream order 6, 7.x.2008, M. Straka leg., J. Bojková det. (MUB). Vlárský průsmyk (6974), Vlára River, 280 m a.s.l., stream order 6, 24.ix.2009, 8 larvae,

S. Větříček leg., P. Komzák det. (PKC); 13.ix.2012, 6 larvae, P. Komzák leg. et det. (PKC). Čížov (7161), Dolní Čížovský rybník, 380 m a.s.l., 19.v.2013, 1 ♂, P. Komzák leg. et det. (PKC). Havraníky (7161), Dyje River, 250 m a.s.l., stream order 6, 13.vi.2009, 1 ♀, P. Komzák leg. et det. (PKC).

DISCUSSION

Sialis nigripes is generally confined to running water (e.g. Meinander 1996; Hölzer 2002; Elliott 2009). According to Hölzer (2002), larvae predominantly inhabit mid-sized and larger streams in colline and submontane altitudinal zones in Central Europe and the altitudinal range of its occurrence is narrower than in *S. fuliginosa* and *S. lutaria*. This study documents the species predominantly from mid-sized streams in mid and low altitudes throughout the Czech Republic, although the distribution of localities is rather scattered (Figs 1, 2). One record from standing water (Dolní Čížovský rybník) is most likely exceptional, because this locality is only about 2.5 km from the Dyje (Thaya) River where a population of *S. nigripes* occurs. We know of other records from standing water, from lakes in Ireland (O'Connor & O'Grady 1990).

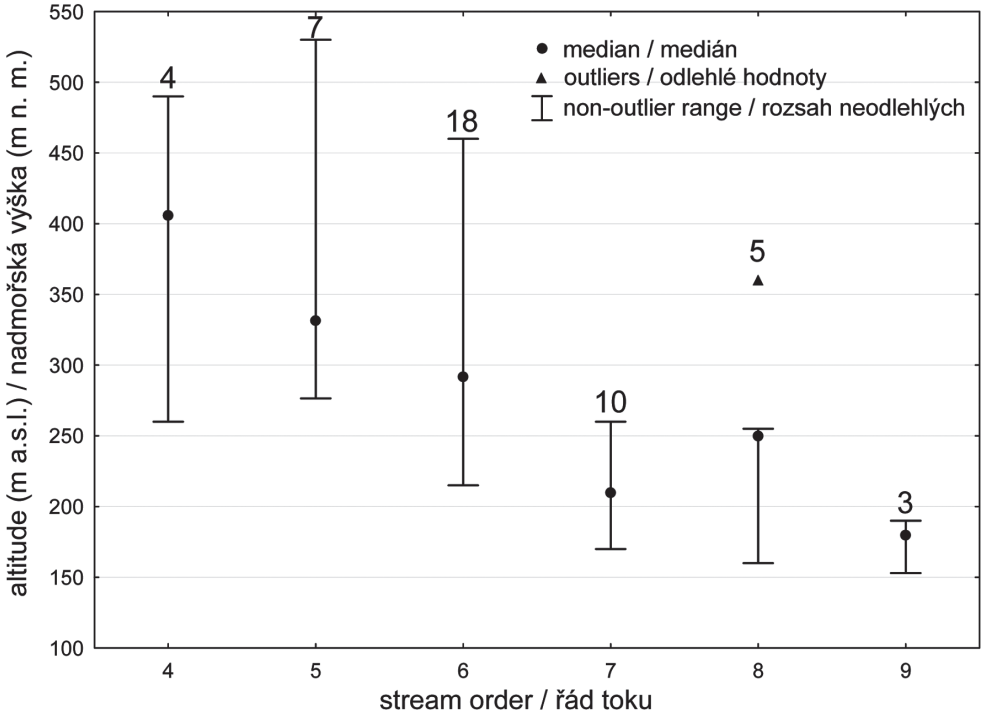


Fig. 2. Range plot showing the distribution of *Sialis nigripes* Pictet, 1865 in streams of different size expressed as stream order according to Strahler (1952), and altitude. Number of records in each stream order is shown.
Obr. 2. Graf rozsahu hodnot zobrazující výskyt druhu *Sialis nigripes* Pictet, 1865 v tocích různého řádu toku podle Strahlera (1952) a nadmořské výšky. Číslicí je zobrazen počet nálezů druhu v tocích jednotlivých řádů.

The sympatric occurrence of *S. nigripes* with either *S. lutaria* or *S. fuliginosa* was recorded at several localities. *S. nigripes* occurs with *S. lutaria* mainly in large, slowly-flowing rivers (such as the Ohře (Eger) River, Berounka River, Vltava River, Morava River, and Dyje River) and with *S. fuliginosa* in some mid-sized rivers (Žehrovka River, Metuje River, Vlára River, Svratka River, Loučka River, and Sitka River). The sympatric occurrence of all three species was recorded at five localities, Želivka River near Hodějovice, Berounka River in Praha-Radotín, Úhlava River in Švihov, and Svratka River above Jimramov and in Veverská Bitýška.

Sialis nigripes was considered critically endangered in the Czech Republic by Zelený (2005). However, the red list assessment was based on the four records known at that time, which included no recent records. It indicated that the species was very rare and its populations were most probably endangered. However, our data show that the species is relatively common in warmer streams below 300 m a.s.l. and it occurs in all the major river basins except the upper parts of some river basins, mainly Odra, Morava and Vltava Rivers basins, and the lower part of the Morava River basin (Fig. 1). This is probably the result of insufficient collecting in these regions. The low number of specimens collected at each locality indicates that populations are not large in the Czech Republic; nevertheless, according to Kaiser (1961) *S. nigripes* usually has low population densities. Based on new records of *S. nigripes*, its protection status in the Czech Republic should be re-evaluated. The species currently occurs at 49 localities throughout the Czech Republic and the finding of additional localities is highly probable. It was also found repeatedly in polluted streams, such as Labe, Vltava or Úhlava. *S. nigripes* seems to be more sensitive to alteration of stream banks than to water quality, because it was rarely recorded on channelized sections of streams. Nevertheless, we propose that *S. nigripes* is classified as least concern (LC) as it currently inhabits at least 35 streams in the Czech Republic. The lack of records in past decades was caused by little attention having been paid to collecting of adult alderflies and overlooking of larvae of *S. nigripes*, rather than any actual scarcity of its sites or endangerment by anthropogenic impacts. Larvae of *S. nigripes* were probably routinely mistaken for those of *S. fuliginosa* which are very similar in early instars and are distinguished mostly based on the head and thoracic ornamentation and the shape of the postoccipital sutures (e.g. Hölzer 2002; Elliott 2009).

Sialis nigripes was formerly regarded as very rare and endangered, because alderflies were insufficiently studied in past decades and it was overlooked for a long time. Our results show that it is frequent in running waters at mid and low altitudes in the Czech Republic.

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SOUHRN

Střechatka *Sialis nigripes* Pictet, 1865 (Megaloptera: Sialidae) byla dosud známá pouze z devíti lokalit, a proto byla v České republice považována za kriticky ohrožený druh. Tato studie prezentuje výskyt tohoto druhu na 49 nových lokalitách, které zahrnují 35 toků a jeden rybník. Lokality jsou rozmístěny přibližně rovnoměrně po celém území České republiky, s výjimkou vyšších poloh. *Sialis nigripes* se vyskytuje v nadmořské výšce 153 až 530 m n. m. v tocích čtvrtého až devátého řádu. Většina lokalit se ale nachází v nadmořské výšce nižší než 300 m n. m. (31 lokalit) a větších tocích řádu 6–9 (36 lokalit). Na základě těchto nových dat, které ukazují, že *Sialis nigripes* je poměrně běžným druhem tekoucích vod České republiky, navrhujeme reklasifikaci druhu z kriticky ohroženého (CR) na málo dotčený (LC).