A disjunctive site of *Sympecma paedisca* (Brau.) (Odonata: Lestidae) in Opole Silesia (south-western Poland)

Paweł Buczyński, Agnieszka Brożonowicz & Izabela Czerniawska-Kusza

A disjunctive site of *Sympecma paedisca* (Brau.) (Odonata: Lestidae) in Opole Silesia (south-western Poland). - Čas. Slez. Muz. Opava (A): 62: 45-50, 2013.

Abstract: The occurrence of *Sympecma paedisca* in a small water body in the Limestone Quarry "Góraždze" was recorded in 2010. This site is interesting because of the anthropogenic nature of ecosystem and its location 50 km west of the known range of the species.

Key words: Odonata, *Sympecma paedisca*, secondary habitat, SW Poland, distribution, site, disjunction

Introduction

Sympecma paedisca (Brau.) is a Siberian dragonfly for which the limit of compact distribution area runs through central and north-west Poland (Bernard et al. 2009). Although the species has been recorded as much as 800-900 km away to the west, its range is highly discontinuous over this point (Dijkstra 2006). The course of the border area and the changes in the distribution of the species are still not fully understood. Therefore all data on the presence of *S. paedisca* in this area is so valuable.

A new site of *Sympecma paedisca*, previously unknown in Opole Silesia (Zabłocki & Wolny 2012), has been described in this paper. The site is also interesting due to the anthropogenic origin of the water body and its specificity.

Study area

The Limestone Quarry "Góraždze" is located near Góraždze, 16 km south-east of Opole. The quarry is situated within the area of the Silesian Highlands on Chełm Hill, which is formed from dolomites and limestone of the Middle Triassic (Kondracki 2002). Limestone has been extracted in this place since the 19th century. Although the whole region is characterized by a varied landscape, the operating area is surrounded mainly by forest and meadows.

The opencast quarry area is of great interest due to its rich and diverse plant communities. They developed either on rocks exposed naturally or during quarry exploitation or those formed as a result of land reclamation works. The excavation reclamation policy has involved, first of all, silviculture with protective plantings of *Pinus sylvestris* L. and deciduous tree species in addition, but also the creation of aquatic ecosystems. Consequently various small water bodies have been created as suitable habitats for valuable biota (Każmierczak & Baszczyńska 2011).

Within the quarry area there are several anthropogenic water bodies, from four to 20 years old. Their water surface is from 0.1 to 0.5 ha and the maximum depth is 1.6 m. The old water bodies (over 10 years) are surrounded by trees with *Alnus glutinosa* Gaertn. on the shore. Their riparian vegetation is represented by the rushes mainly with *Phragmites australis* Trin. ex Steud. and the loamy bottom is overgrown with meadows of *Chara* sp. The younger ones are situated in an open area, which is significantly exposed to sunlight during summer and dust from exploitation work and transport.

Materials and methods

For the purpose of the study, five water bodies, which differ in their age and habitat characteristics, have been selected. Benthic samples, including larvae of dragonflies, were collected monthly from April until November 2010, by means of a standard hand net.

Each time, the following water parameters were measured directly in the field: temperature, pH, electrolytic conductivity, dissolved oxygen content, and oxygen saturation. The analysis was done using an Elmetron kit: pH-meter (CP-104), and conductivity and oxygen meters (CC-105 & CPO-401 respectively). Moreover, in May chemical analysis of water included total and carbonate hardness, as well as phosphorus and calcium contents. The analysis was performed in a laboratory according to Polish Standards.

Results

A total of 321 larvae were collected from all the studied water bodies. *Sympecma paedisca* was recorded only in one of them, the shallow seven-year-old water body of 0.18 ha, which was formed spontaneously on the limestone floor in the north-eastern part of the mine area (50°31'56" N, 18°02'19" E, UTM: BB90). This water body differs from the other investigated ones as it was characterized by a swamp with dominant *Typha laxmanii* L. Part of its water surface was covered with patches of *Potamogeton natans* L. Silt sediments, of approximately 30 cm depth and with filamentous green algae bloom during summer, corresponded with frequently occurring water turbidity (Fig. 1). *S. paedisca* (one larva) was found in the swamp zone on 29.vii.2010.

Apart from *Sympecma paedisca*, the larvae of four odonate species were collected in this water body. Those were: *Ischnura elegans* (Vander L.) (12 specimens), *Coenagrion puella* (L.) (6), *Anax imperator* (Leach) (1), and *Libellula depressa* L. (1).

The results of physical-chemical analysis of the water revealed a significant month-to-month variability of thermal and aerobic conditions (Tab.1). Water was medium hard revealing total and carbonate hardness of 221.7 and 170.3 mg CaCO₃·dm⁻³ respectively, and a calcium content of 77.6 mg Ca·dm⁻³. The concentrations of total phosphorus (0.129 mg·dm⁻³) and phosphates (0.394 mg·dm⁻³) were typical of mesotrophic waters.

Water parameter	Minimum value	Maximum value
Temperature [°C]	8.2 (Nov.)	25.1 (Jul.)
pH	7.6 (Apr.)	8.56 (Nov.)
Electrolytic conductivity [μScm ⁻¹]	273 (Jun.)	430 (Oct.)
Dissolved oxygen [mgO ₂ dm ⁻³]	1.00 (Oct.)	9.56 (Jul.)
Oxygen saturation [%]	10 (Oct.)	97 (Jul.)

Tab 1: Selected physico-chemical properties of water in the pond inhabited by *Sympecma paedisca*. (months in parentheses)

Discussion

The distribution area of *Sympecma paedisca* splits into two branches in Poland. One of them reaches the Netherlands and the second one, Switzerland and bordering regions in France and Italy. Both are discontinuous, formed by small distribution islands and single sites separated from each other by a few dozen or more than 100 km (Dijkstra 2006, Jödicke 1997, Schorr 1996). This specific pattern of the *S. paedisca* distribution may be connected with habitat preferences of the species and climate features, which are becoming warmer to the west due to the Atlantic current. According to Błażejczyk (2006), the eastern part of Poland is the farthest west area with a strong continental climate, which is inhabited by *S. paedisca*.

The site of *Sympecma paedisca* in the Limestone Quarry “Górażdże” is particularly intere-

Fig 1: Habitat of *Sympecma paedisca* in the Limestone Quarry “Górażdże” (May 2010).

Fig 2: Occurrence of *Sympecma paedisca* in Poland and in adjacent areas, after Dijkstra (2006), changed according to: Bernard et al. (2009); Bönsel et al. (2011); Łabędzki (1995); Dolný et al. (2007); Jarzembowski & Matraj (in press); Šacha (2011); Smolis et al. (2012); Waldhauser & Mikát (2010). A - maritime state borders, B - land state borders, C - state capitals, D - compact distribution area and larger distribution islands, E - single sites out of the area.

sting considering its location, which is outside the main distribution area and, at the same time, between the distinguished spotted branches (Fig. 2). In western Poland, *S. paedisca* has been recorded outside their range, determined by Bernard et al (2009), in two areas within the Lower Silesia region. Undoubtedly its disjunctive occurrence has been noted in the Lower Silesian Forest (Łabędzki in litt.). Jarzembowski & Matraj (in press) and Smolis et al. (2012) have also found *S. paedisca* in the complex of Milicz Ponds. However, these sites are only 6-12 km from the margin of *S. paedisca* range (Bernard et al. 2009). Thus, they are probably not isolated and indicate rather the need for boundary footprint correction on the map of species distribution. Whereas, it is likely that the site of *S. paedisca* situated near Góraždze is isolated, as the distance from the known sites in the region is several times longer and odonatological data from the area of the probable disjunction is much more complete (Bernard et al. 2009, Zabłocki & Wolny 2012). The nearest known site is located 50 km east.

Isolated sites of dragonflies, outside the main part of their ranges, are not rare (Bernard et al. 2009). In the case of Góraždze, it might be presumed that the site is all that remained of a previously wider distribution area of *Sympecma paedisca*. Due to climate changes, such as warming and the loss of continental features (Degirmendžić et al. 2004), the range has been progressively reduced. A decline in population and frequency of *S. paedisca* presence on the western margin of its distribution area is well documented (Hunger et al. 2006, Keleetaar 2007, Maiolini & Carolli 2009, Wildermuth et al. 2008). Similar symptoms have been observed also among other Siberian species (Bernard et al. 2009, Bernard & Wildermuth 2005, Dolný et al. 2007). On the other side, one of the most important life-history strategies of dragonflies is migration leading to the colonization of new habitats (Corbet 1999). Regular seasonal migrations have been recorded also for *S. paedisca* (Borisov 2005). Therefore, it is possible as well, that a new population might be formed in this way on the fringe of the distribution area. In Opole Silesia, including the investigated area, the creation of man-made water bodies may be favorable for migration activities. Anthropogenic water bodies become potential habitats for *S. paedisca* development. Considering the geographical range of the species in southern Poland as well as its disjunctive sites, the appearance of *S. paedisca* in the northeast Czech Republic, especially in Opava Silesia, seems also possible.

Sympecma paedisca inhabits a wide spectrum of stagnant and slow-flowing waters in eastern Poland, including anthropogenic and heavily disturbed ones (Buczyński 1998, Lis 2012). The same preferences have been observed in the center of its distribution in Central Asia (Jödicke 1997). According to Bernard et al. (2009) in the vicinity of the margin of its geographical range, *S. paedisca* prefers natural aquatic ecosystems, particularly mid-forest ones. Nevertheless, the whole spectrum of habitats is also quite wide and it encompasses anthropogenic waters (Cuber 2010, Gryboś 2013, Hájek & Mocek 2000, Jarzembowski & Matraj in press, Ruta & Wendzonka 2004, Waldhauser & Mikát 2010). It seems that the most important is not the type of the water body but the presence of fast-heating shallow areas overgrown with swamp vegetation and characterized by water level fluctuations. The surroundings providing suitable habitats for imaginal hibernation are important as well, especially bright pinewood or oak wood with herbaceous vegetation and grasses (Schmidt & Sternberg 1999). Wintering among shore vegetation of water bodies, where previously the species reproduction had taken place, has also been observed (Hiemeyer et al. 2001). In this context, anthropogenic water bodies in the Limestone Quarry “Góraždze” might be beneficial for *S. paedisca*. What is more, some features of the opencast quarry may create favorable conditions for its development. Exposed limestone bedrock contributes to high air temperature fluctuations and intensifies the effects of summer heats. Dustiness of the air is typical of continental climate. Only the instability typical of anthropogenic water bodies could be problematic for *S. paedisca* long-term development, which may require active protection involving the interference in the natural succession (Bernard et al. 2002).

References

- Bernard R., Buczyński P. & Tończyk G. (2002): Present state, threats and conservation of dragonflies (Odonata) in Poland. – Nat. Conserv. 59(2): 53-71.
- Bernard R., Buczyński P., Tończyk G. & Wendzonka J. (2009): A distribution atlas of dragonflies (Odonata) in Poland. Bogucki Wyd. Naukowe, Poznań, 256 pp.
- Bernard R. & Wildermuth H. (2005): *Nehalennia speciosa* (Charpentier, 1840) in Europe: a case of a vanishing relict (Zygoptera: Coenagrionidae). – Odonatologica 34(4): 335-378.
- Błazejczyk K. (2006): Climate and bioclimate of Poland. Pp. 31-48. In: Degórski M. [ed.]: Natural and human environment of Poland. A geographical overview. Institute of Geography and Spatial Organization PAS, Polish Geographical Society, 324 pp.
- Bönsel A., Mauersberger R. & Wachlin V. (2011): *Sympecma paedisca* (Brauer, 1877), Sibirische Winterlibelle, Anhang: IV, FFH-Code: 1039. Internet link: http://www.lung.mv-regierung.de/dateien/ffh_asb_sympecma_paedisca.pdf
- Borisov S.N. (2005): O letnikh migratsiyakh vidov roda *Sympecma* Burmeister, 1839 (Odonata, Lestidae) v Severnom Tjan'-Shane. – Euroas. entomol. J. 4(3): 256.
- Buczyński P. (1998): Ważki (Odonata) środkowo-wschodniej Polski: stan poznania, specyfika i zagrożenia. pp. 7-9. I. Krajowe Seminarium Odonatologiczne, Bromierzyk 17-19 IV 1998. Materiały zjazdowe, 21 pp.
- Corbet P.S. (1999): Dragonflies. Behaviour and ecology of Odonata. Harley, Colchester, 829 pp.
- Cuber P. (2010): Lestidae (Odonata: Zygoptera) rzadko stwierdzane w województwie śląskim. – Odonatrix 6(2): 37-41.
- Degirmendžić J., Kozuchowski K., Żmudzka E. (2004): Changes of air temperature and precipitation in Poland in the period 1951-2000 and their relationship to atmospheric circulation. – Int. J. Climatol. 24(3): 291-310.
- Dijkstra K.-D.B. [ed.] (2006): Field Guide to the Dragonflies of Britain and Europe. British Wildlife Publishing, Gillingham, 320 pp.
- Dolný A., Bárta D., Waldhauser M., Holuša O. & Hanel L. (2007): Vážky České republiky. Ekologie, ochrana a rozšíření. Český svaz ochránců přírody, Vlašim, 670 pp.
- Gryboś M. (2013): Mydlniki - stawy i okolice. Internet link: http://www.wazki.pl/krakow_mydlniki.html
- Hájek J. & Mocek B. (2000): Výskyt šidlatky kroužkované - *Sympecma annulata* (Sélys, 1887) (Odonata: Lestidae) v České republice. pp. 52-59. In: Hanel L. [ed.]: Vážky 2000. Sborník referátů III. celostátního semináře odonatologů v CHKO Třeboňsko 15.-18.6.2000. ZO ČSOP Vlašim, Vlašim, 192 pp.
- Hiemeyer F., Miller E. & Miller J. (2001): Winterbeobachtungen an *Sympecma paedisca* (Odonata: Lestidae). – Libellula 20: 103-113.
- Hunger H., Schiel F.-J. & Kunz B. (2006): Verbreitung und Phänologie der Libellen Baden-Württembergs (Odonata). – Libellula Suppl.7: 15-188.
- Jarzembowski P. & Matraj M. (in press): Pierwsze stwierdzenie chronionego gatunku ważki *Sympecma paedisca* (Brauer, 1877) na Dolnym Śląsku. Wiad. entomol.
- Jödicke R. (1997): Die Binsenjungfern und Winterlibellen Europas. Lestidae. Westarp Wissenschaften, Magdeburg, 277 pp.
- Kaźmierczak U. & Baszczyńska K. (2011): Propozycja rozszerzenia kierunków rekultywacji kopalni wapienia „Góraźdze”. – Kruszywa 3: 20-25.
- Ketelaar R., Manger R., Ruiter E.J., Uilhoorn H.M.G. & de Boer E.P. (2007): Analyse van de verspreiding van de Noordse winterjuffer (*Sympecma paedisca*) in Nederland. – Brachytron 11(1): 5-20.
- Kondracki J. (2002): Geografia regionalna Polski. PWN, Warszawa, 441 pp.
- Lis Ł. (2012): *Leucorrhinia albifrons* (Burmeister, 1839) (Odonata: Libellulidae) w siedlisku antropogenicznym na obszarze byłej kopalni siarki „Jeziórko” (Kotlina Sandomierska). – Odonatrix 8(2): 55-58.
- Łabędzki A. (in litt.). Fauna ważek (Odonata) wód bieżących województwa jeleniogórskiego jako wskaźnik stanu i zmian zachodzących w nich. Ekspertyza dla Wojewódzkiego Konserwatora Przyrody w Jeleniej Górze, 1995, 66 pp., Poznań.
- Maiolini B. & Carolli M. (2009): Odonata in Trentino (NE-Italy): historical and recent data. – Studi Trent. Sci. Nat. 84: 11-18.
- Ruta R. & Wendzonka J. (2004): 2. Owady. Pp. 72-106. In: Ziółkowski G. [ed.]: Przyroda Krainy Złotowskiej. Urbański Wydawnictwo, Toruń, 176 pp.
- Šacha D. (2011): *Sympecma paedisca* (Brauer, 1877). Internet link: http://www.vazky.sk/druhy/sympecma_paedisca.html
- Schmidt B. & Sternberg K. (1999): *Sympecma paedisca* (Brauer, 1877), Sibirische Winterlibelle. P. 440-451. In: Sternberg K. & Buchwald R. [eds]: Die Libellen Baden-Württembergs. Band 1: Allgemeiner Teil, Kleinlibellen. Eugen Ulmer, Stuttgart, 468 pp.
- Schorr M. (1996): *Sympecma braueri* Bianchi, 1904. Pp. 365-378. In: van Hedsingsen P.J., Willemse L. & Speight M.C.D. [eds]: Background information on invertebrates of the Habitats Directive and the Bern Convention. Nature and environment, 80. Council of Europe Publishing, Strasbourg Cedex, 398 pp.

- Smolis A., Kadej M., Bena W., Malkiewicz A., Zając K., Mańkowska-Jurek D. & Rapała R. (2012): Nowe dane o rozszedleniu ważek (Odonata) na Śląsku. – *Przyr. Sudetów* 15: 57-66.
- Waldhauser M. & Mikát M. (2010): Šidélko ozdobné - překvapení z výsypky. – *Ochr. přír.* 2: 16-17.
- Wildermuth H., Gonseth Y. & Maibach A. (2008): *Fauna Helvetica* 12. Odonata. Die Libellen der Schweiz. Centre Suisse de cartographie de la faune, Schweizerische Entomologische Gesellschaft, Terraux, 398 pp.
- Zabłocki P. & Wolny M. (2012): Materiały do poznania niektórych chronionych, rzadkich i interesujących gatunków ważek (Odonata) Śląska. – *Opolski Roczn. muz.* 19: 9-48.

Author's addresses: Paweł Buczyński, Maria Curie-Skłodowska University, Department of Zoology, Akademicka19, PL-20-033 Lublin, Poland
E-mail: pawbucz@gmail.com
Agnieszka Brożonowicz & Izabela Czerniawska-Kusza, University of Opole, Department of Land Protection, Oleska 22, PL-45-052 Opole, Poland
E-mail: abroz@uni.opole.pl, izabela.kusza@uni.opole.pl