

Third known locality of *Nehalennia speciosa* (Odonata) in the Czech Republic discovered at a revitalized peat bog in the Bohemian Forest

Matyáš Mátl

Agronomická fakulta, Mendelova univerzita v Brně, Zemědělská 1665/1, CZ-61300 Brno, Česká republika

matyasmatl@seznam.cz

Abstract

In 2024, the third known locality of the Critically Endangered (CR) damselfly *Nehalennia speciosa* (Charpentier, 1840) in the Czech Republic was discovered. The species was recorded at the revitalized post-excavation Soumarský Most peat bog, marking its first documented occurrence in the Bohemian Forest National Park. During two field visits, a total of 11 imagines were observed, indicating potential establishment. This finding significantly expands the known distribution of *N. speciosa* in the Czech Republic and highlights the importance of revitalized post-excavation peat bogs as habitats for biodiversity conservation. Conservation and further research on the population, such as mark–recapture studies, are recommended.

Key words: faunistics, insect, restoration, wetland, dispersal

INTRODUCTION

Peat bogs of Central Europe are relict wetland ecosystems that have been developing since the early Holocene. A variety of organisms are, to some extent, existentially dependent on these habitats, with insects being the most abundant group of animals (SPITZER & DANKS 2006). Among them, dragonflies and damselflies (Odonata) include several species closely associated with peat bogs and their unique microhabitats (DOLNÝ et al. 2007).

Nehalennia speciosa (Charpentier, 1840), the smallest dragonfly in Europe, is a Palearctic, tyrphophilous, highly stenotopic species, existentially dependent on emergent sedges (*Carex* spp.), where oviposition takes place (BERNARD & WILDERMUTH 2005, DOLNÝ et al. 2007). Due to its highly specific habitat requirements and ongoing loss and modification of its habitats, caused by drying out and eutrophication, the species' population is showing a declining trend (BERNARD & WILDERMUTH 2005, BERNARD & KALKMAN 2015). At the European level, the species is currently classified as Least Concern (LC) (DE KNIJF et al. 2024). However, in the Czech Republic, it is listed as Critically Endangered (CR) and classified as a relict species on the verge of extinction (DOLNÝ et al. 2007, DOLNÝ et al. 2017).

In the Czech Republic, *N. speciosa* was previously known from only two sites. The first population was discovered at the Kramárka fen (Nežárka Basin, Třeboňsko PLA; mapping

field 6854) (HLÁSEK 1999), while the second was discovered at the wetland near Břehyňský Pond (Břehyně-Pecopala NNR; mapping field 5454) (WALDHAUSER & ČERNÝ 2015). Recent fieldwork at the revitalized post-excavation Soumarský Most peat bog has led to the discovery of the species' first recorded occurrence in the Bohemian Forest National Park, marking its third known locality in the Czech Republic.

METHODS

Study site

Soumarský Most peat bog, a large valley peat bog covering 90 hectares and situated at an altitude of 743 meters a.s.l., is part of the wetland complex known as Vltavský Luh. Before human intervention, its character resembled that of other peat bogs within this complex. The original vegetation consisted of the association *Pino rotundatae-Sphagnetum* Kästner et Flössner 1933, surrounded at the edges by bog pine forests of the association *Vaccinio uliginosi-Pinetum* Kleist 1949 (HORN 2009). The original character was significantly altered due to peat extraction, which lasted until the year 2000. Shortly afterward, revitalization began, improving the hydrological regime and allowing wetland vegetation to start colonizing the site (HORN 2009, HORN & BASTL 2012).

Sampling was conducted at a water body situated in the southern part of the peat bog (48.8997092N, 13.8401533E). The lake currently covers a water surface area of 7850 m² and was either absent or significantly smaller before the revitalization interventions (Fig. 1). Open areas of transitional mire vegetation surround the lake (Fig. 2). Along the shores, submerged sphagnum mosses (*Sphagnum* sp.) can be found in some sections, accompanied by sparse stands of sedges (*Carex rostrata* Stokes, 1787). The shores adjacent to the lake are covered with sphagnum mosses (*Sphagnum* spp.), which dominate the moss layer, while the herbaceous layer is dominated by sedges (*Carex rostrata*), rushes (*Juncus effusus* L.), and cotton grasses (*Eriophorum* spp.). The northern side of the open mire area gradually transitions into sparse stands of low birches (*Betula pubescens* Ehrh., 1791) and low pines (*Pinus* sp.). On the southern side, the open mire vegetation gradually gives way to taller trees, predominantly spruce (*Picea abies* L.; Karsten, 1881), pines (*Pinus sylvestris* L.), and birches (*Betula* spp.).

Survey

The study site of the species' occurrence was visited twice during the summer of 2024 (July 15; August 28). The second field visit (August 28) took place outside the peak seasonal period of flight activity, which primarily occurs in June and July, but was conducted at the very end of the flight activity period under Bavarian conditions (KUHN & BURBACH 1998, BERNARD & KALKMAN 2015). During each visit, imagines of Odonata were observed and identified for 15 minutes along the northern shores of the lake, while exuviae were collected along the shoreline for 30 minutes and subsequently identified in the laboratory. During the survey, a pH value of 4.03 and a conductivity of 55 µS.cm⁻¹ were measured by a HANNA Combo pH/EC HI98129.

RESULTS AND DISCUSSION

A total of 11 imagines of *Nehalennia speciosa* were recorded during 2 field visits in 2024. No exuviae of the species were found. On July 15, 5 males and 4 females were observed, including 2 copulating pairs (Fig. 3). On August 28, 1 male and 1 female were recorded. Imagines were primarily observed in sedge stands (*Carex rostrata*), occasionally on rush stems (*Juncus effusus*), and they remained within the vegetation without leaving it. Exceptionally, after being disturbed, the imagines were able to fly over a part of the water body, approximately 2 meters. The observed copulations suggest potential oviposition and subsequent larval development. This assumption is supported by new records from 2025 (AOPK ČR 2025), indicating potential establishment.

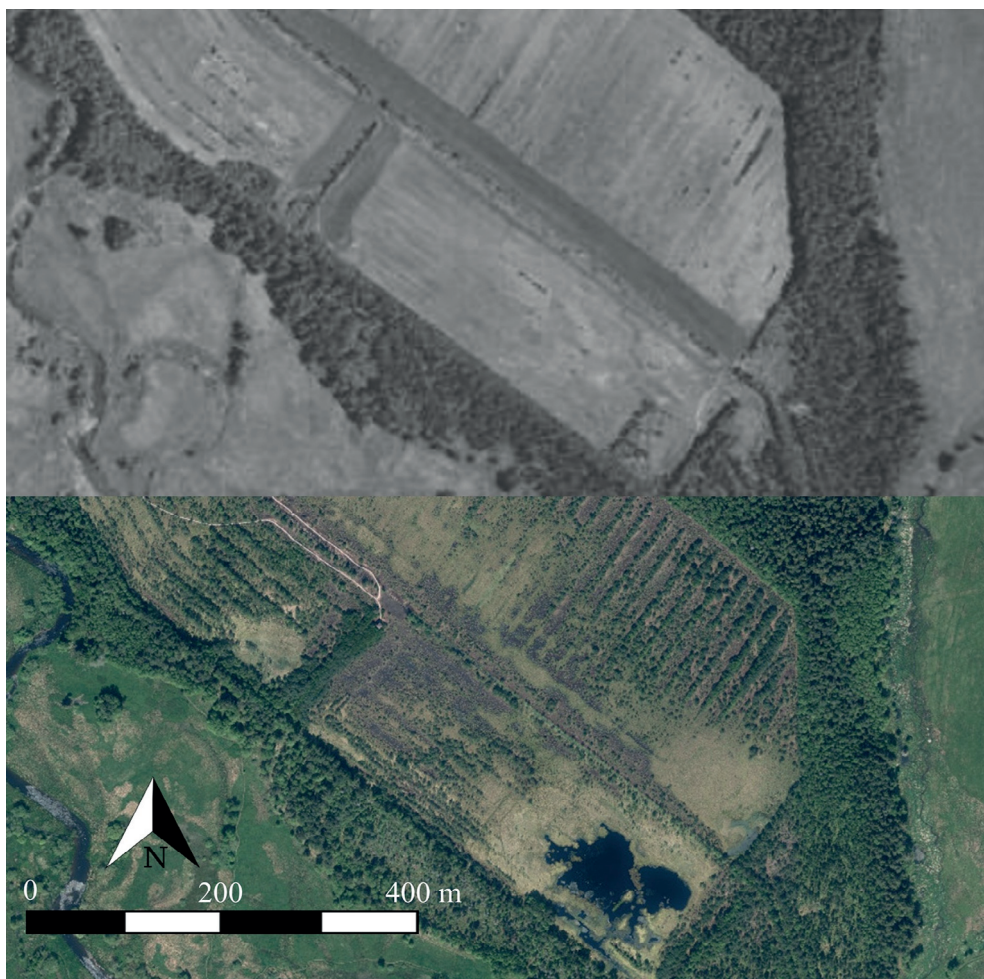


Fig. 1. Aerial survey of the southeastern part of the Soumarský Most peat bog showing stage before (1999, above) and after revitalization interventions (2024, bottom), source: ČÚZK (2025).

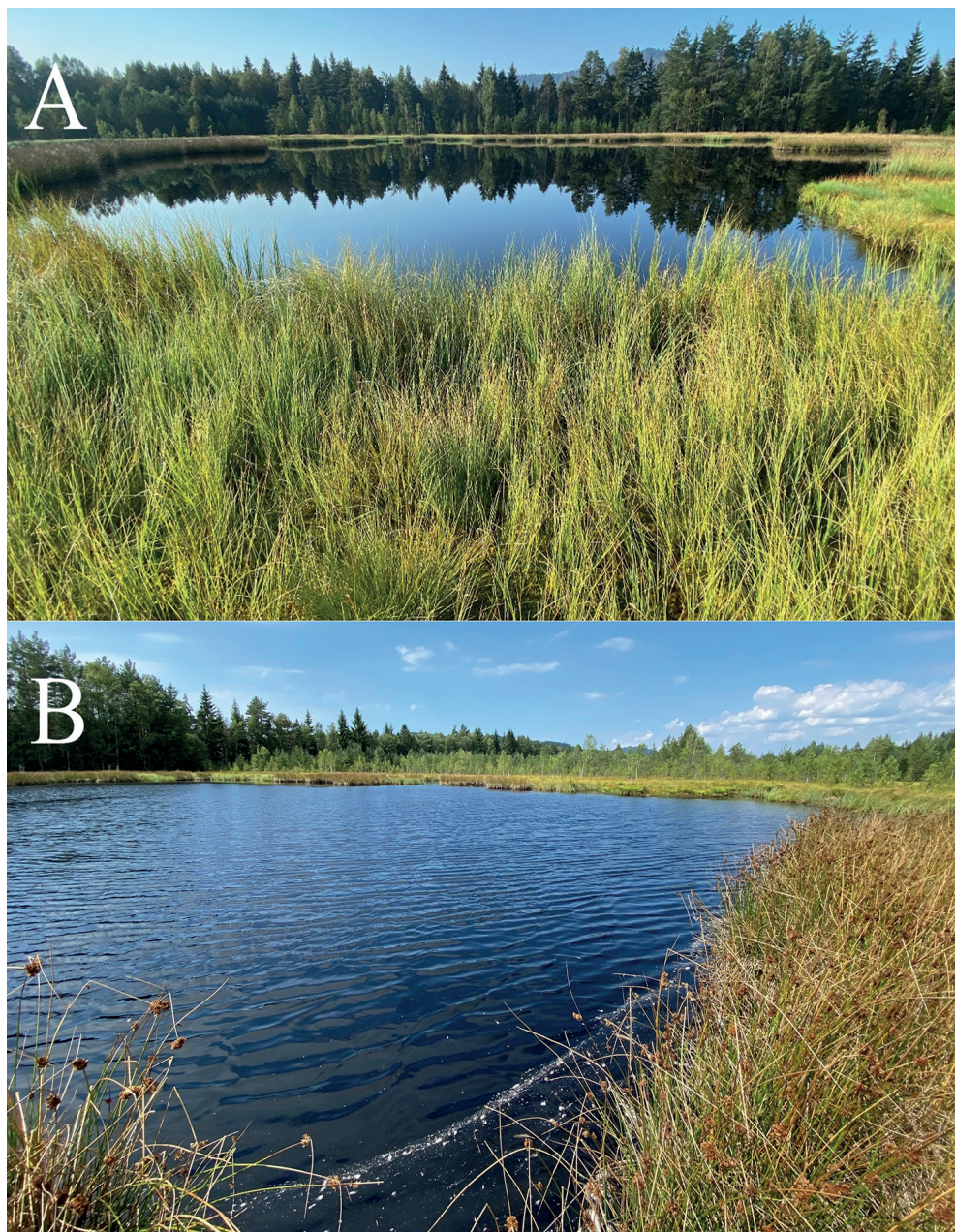


Fig. 2. A) A southeastern view of the lake with shores dominated by sedges (*Carex rostrata*), where imagines were observed, and with taller trees forming a distant backdrop.; B) A southwestern view of the lake, with a shoreline dominated by rushes (*Juncus effusus*) and an open mire area in the distance, characterized by sedges (*Carex rostrata*) and cotton grasses (*Eriophorum* spp.), gradually transitioning into sparse stands of low trees, photo: M. Mátl, 15. 7. 2024.

During the survey, imagines were observed within just 15 minutes during each visit, partly outside the peak seasonal period of flight activity and only in a small part of the site, suggesting that the overall population of the species might be more abundant. However, other Odonata species were also recorded at the site, which may interact in various ways, including potential predation or niche overlap. At the site, along with *N. speciosa*, the following species were recorded: *Aeshna cyanea* (Müller, 1764), *Aeshna grandis* (L.), *Aeshna juncea* (L.), *Aeshna subarctica* Walker, 1908, *Anax imperator* Leach, 1815, *Coenagrion hastulatum* (Charpentier, 1825), *Coenagrion puella* (L.), *Cordulia aenea* (L.), *Enallagma cyathigerum* (Charpentier, 1840), *Erythromma* sp., *Ischnura elegans* (Vander Linden, 1820), *Lestes sponsa* (Hansemann, 1823), *Leucorrhinia albifrons* (Burmeister, 1839), *Leucorrhinia dubia* (Vander Linden, 1825), *Leucorrhinia rubicunda* (L.), *Libellula quadrimaculata* (L.), *Somatochlora arctica* (Zetterstedt, 1840), *Sympetrum danae* (Sulzer, 1776), and *Pyrrhosoma nymphula* (Sulzer, 1776). Notably, the record of *L. albifrons* among the above is significant, as this Euro-Siberian species has previously been documented in the Bohemian Forest only twice, both times as larvae at the Rokytecká Slat' peat bog (PETR 1999). At the site, a copulating pair of this species was observed on July 15. In South Bohemia, where the species has so far been confirmed at only a few localities, some of which it has gone extinct from, it was



Fig. 3. Copulating pair of *Nehalennia speciosa*, photo: M. Mátl, 15. 7. 2024.

recently recorded at two man-made sites that were likely colonized in the recent past (ČERNÝ & HESOUN 2024).

The impact of peat excavation and subsequent revitalization efforts on the Odonata community remains unknown due to the lack of pre-revitalization research. Therefore, it remains unclear whether *N. speciosa* recolonized the site after peat excavation ended, or if it only recently appeared following the cessation of excavation and subsequent hydrological improvements.

The first hypothesis seems less likely, as the species is primarily associated with sedges (*Carex* spp.) (BERNARD & WILDERMUTH 2005, DOLNÝ et al. 2007), which were not recorded by botanical surveys before peat excavation and only began to appear toward its end (HORN 2009). The second hypothesis appears more plausible, as waterlogged depressions began to develop at sites abandoned in 1990, potentially providing suitable habitat conditions for the species. These were spontaneously colonized by the plant association *Caricion rostratae* Balátová-Tuláčková 1969 (ŠAMATA 2000 in HORN 2009), including *Carex rostrata*, which also forms part of the vegetation of the large water body where *N. speciosa* was recently recorded. If the second hypothesis is correct, the species must have arrived from another locality, likely not very distant due to its weak dispersal abilities, which primarily rely on wind drift (BERNARD & WILDERMUTH 2005). As observed in Germany, the species is capable of colonizing similar post-excavation peat bogs, even at distances of up to 11.5 kilometers from source populations (BURBACH & SCHIEL 2004). The nearest historically documented occurrence of the species is located near the Czech border in the Bavarian National Park, specifically in mapping field 6946 at an elevation of 1100–1199 meters a.s.l., approximately 33–43 kilometers away (KUHN & BURBACH 1998). However, there is currently no evidence of its presence (SEIFERT – pers. comm.), making dispersal from this site unlikely. A more plausible scenario is dispersal from another, closer, overlooked locality.

Post-excavation peat bogs, representing secondary habitats, seem to be valuable habitats for *N. speciosa* if stable water bodies with the required vegetation structure develop, as the species has been recorded at many such sites across Europe (BERNARD & WILDERMUTH 2005). In the context of post-excavation peat bogs, the species was historically recorded at a single site in the Czech Republic — Kramářka fen (HLÁSEK 1999). A similar occurrence was documented, for instance, in France (DEHONDT et al. 2010), Switzerland (WILDERMUTH 2004), Germany (BURBACH & SCHIEL 2004), Poland (BUCZYŃSKA & BUCZYŃSKI 2019), and Latvia (KALNINŠ et al. 2011).

SUMMARY AND CONSERVATION RECOMMENDATIONS

In 2024, the discovery of the third known locality in the Czech Republic with *N. speciosa* occurrence was made at the revitalized post-excavation Soumarský Most peat bog in the Bohemian Forest National Park. Overall, 11 imagines were recorded during 2 field visits. This finding not only marks the third recorded occurrence of the species in the Czech Republic and its first recorded occurrence in the Bohemian Forest National Park but also highlights the ecological value of revitalized post-excavation peat bogs as important habitats for biodiversity. The findings also emphasize the importance of incorporating biodiversity conservation goals into peat bog revitalization projects and monitoring their outcomes. This approach will contribute to inform conservation strategies for this and other endangered species dependent on fragile wetland ecosystems.

The presence of *N. speciosa* suggests that the revitalization efforts, particularly hydrological improvements and colonization of wetland vegetation, especially sedges (*Carex* spp.), may have supported the population of this stenotopic damselfly. However, uncertainties remain regarding the species' colonization history and its connectivity to other localities. Further research is needed to explore the potential genetic links to other populations and the species' dispersal mechanisms. Future studies at the site should also focus on monitoring the population dynamics of *N. speciosa* by mark–recapture methods, exploring interactions with other Odonata species, and evaluating the broader impacts of revitalization on the local ecosystem. Considering the importance of similar post-excavation peat bogs for the species' survival across Europe, efforts to enhance its regional status could focus on creating suitable conditions in other revitalized post-excavation sites, though generally recommended (BERNARD & WILDERMUTH 2005). For instance, the Vlčí Jámy peat bog, located only 4 kilometers away and recently revitalized, could be a candidate for the targeted introduction of vegetation required by the species, such as submerged sphagnum mosses (*Sphagnum* spp.) and thin, narrow-leaved sedge species (*Carex* spp.). However, *Carex rostrata* is already spreading in waterlogged areas and permanently flooded water bodies (BUFKOVÁ et al. 2024). A survey of the local Odonata would also be valuable, along with monitoring to see whether *N. speciosa* might naturally expand its range to this site on its own. The potential introduction of the species at the new sites is recommended if the species is not already present, with subsequent monitoring of population dynamics.

To ensure the long-term preservation of the *N. speciosa* population, according to BERNARD & WILDERMUTH (2005), it is essential to conserve the current habitat conditions and potentially limit factors leading to: a) changes in the hydrological regime that result in drying out the habitat; b) eutrophication; c) rapid changes in vegetation structure, including alterations in wetland vegetation, overgrowth, or total deforestation of the surrounding forest.

Acknowledgements. First and foremost, I would like to thank the Šumava National Park for providing permits for the research. I would also like to express my gratitude to A. Balázs for assistance in the field and to L. Seifert for providing valuable information from the Bavarian Forest National Park's records database. I thank M. Palík for reviewing the article. I also thank the reviewers for their comments.

REFERENCES

- AOPK ČR, 2025: Nálezová databáze ochrany přírody [Species Occurrence Database]. Online <https://portal.nature.cz> (accessed on 8 July 2025) (in Czech).
- BERNARD R. & KALKMAN V.J., 2015: *Nehalennia speciosa* (Charpentier, 1840). In: *Atlas of the European dragonflies and damselflies*, BOUDOT J.-P. & KALKMAN V.J. (eds). KNNV Uitgeverij, p.: 139–141.
- BERNARD R. & WILDERMUTH H., 2005: *Nehalennia speciosa* (Charpentier, 1840) in Europe: a case of a vanishing relict (Zygoptera: Coenagrionidae). *Odonatologica*, 34: 335–378.
- BUCZYŃSKA E. & BUCZYŃSKI P., 2019: Aquatic Insects of Man-Made Habitats: Environmental Factors Determining the Distribution of Caddisflies (Trichoptera), Dragonflies (Odonata), and Beetles (Coleoptera) in Acidic Peat Pools. *Journal of Insect Science*, 19: 1–15.
- BUFKOVÁ I., URBANOVÁ Z., HAIS M., VÁCLAVÍKOVÁ E., DOLEŽAL T., NÁVRÁTILOVÁ S., ZELENKA J., LINHART L. & ZELENKOVÁ E., 2024: *Hydrological restoration in mountainous and hilly areas*. Šumava National Park Administration, Vimperk, 204 pp.
- BURBACH K. & SCHIEL F.-J., 2004: Beobachtungen zur Ausbreitungsfähigkeit von *Nehalennia speciosa* (Odonata: Coenagrionidae) [Observations on the Dispersal Ability of *Nehalennia speciosa* (Odonata: Coenagrionidae)]. *Libellula*, 23: 115–126 (in German, English summary).

- ČERNÝ L. & HESOUN P., 2024: Nové nálezy vážky bělousté v jižních Čechách [New records of the Dark whiteface dragonfly in South Bohemia]. *Sborník Jihočeského muzea v Českých Budějovicích, Přírodní vědy*, 64: 126–130 (in Czech, English summary).
- ČÚZK, 2025: Český úřad zeměměřický a katastrální [Czech Office for Surveying, Mapping and Cadastre]. Online <https://cuzk.gov.cz/> (accessed on 25 June 2025).
- DEHONDT F., MORA F. & FERREZ Y., 2010: Redécouverte en France de *Nehalennia speciosa* (Charpentier, 1840) (Odonata, Zygoptera: Coenagrionidae) [Rediscovery in France of *Nehalennia speciosa* (Charpentier, 1840) (Odonata, Zygoptera: Coenagrionidae)]. *Martinia*, 26: 3–8 (in French, English summary).
- DE KNIJF G., BILLQVIST M., VAN GRUNSVEN R.H.A., PRUNIER F., VINKO D., TROTTET A., BELLOTTO V., CLAY J. & ALLEN D.J., 2024: *Measuring the pulse of European biodiversity. European Red List of Dragonflies & Damselflies (Odonata)*. IUCN Brussels, Belgium: European Commission, 46 pp.
- DOLNÝ A., BÁRTA D., WALDHAUSER M., HOLUŠA O. & HANEL L., 2007: *Vážky České republiky: Ekologie, ochrana a rozšíření [The dragonflies of the Czech Republic: Ecology, conservation and distribution]*. Český svaz ochránců přírody, Vlašim, 672 pp. (in Czech, English summary).
- DOLNÝ A., HARABIŠ F., HOLUŠA O., HANEL L. & WALDHAUSER M., 2017: Odonata (vážky) [Odonata (dragonflies)]. In: Červený seznam ohrožených druhů České republiky. Bezobratlí [Red List of threatened species of the Czech Republic. Invertebrates], HEJDA R., FARKAČ J. & CHOBOT K. (eds). *Příroda*, 36: 118–122 (in Czech).
- HLÁSEK J., 1999: Šidélko lesklé (*Nehalennia speciosa*) – nový druh v České republice [The dragonfly *Nehalennia speciosa* – a new species in the Czech Republic]. In: *Sborník referátů z mezinárodního semináře „Vážky 1999“*. ČSOP Vlašim, p.: 75–76 (in Czech, English summary).
- HORN P., 2009: Ekologie rašeliníšť na Šumavě [Mire ecology in the Šumava Mountains]. Ms., Ph.D. thesis, University of South Bohemia, České Budějovice, 98 pp. (Library of the Faculty of Science, University of South Bohemia, České Budějovice) (in Czech).
- HORN P. & BASTL M., 2012: Restoration of the mined peatbog Soumarský Most. In: *Ecological Restoration in the Czech Republic*, JONGEPIEROVÁ I., PEŠOUT P., JONGEPIER J.W. & PRACH K. (eds) Nature Conservation Agency of the Czech Republic, Prague, p.: 82–84.
- KALNIŅŠ M., BERNARD R. & MIKELSONE I., 2011: Protected Aquatic Insects of Latvia – *Nehalennia speciosa* (Charpentier, 1840) (Odonata: Coenagrionidae). *Latvijas entomologs*, 50: 41–54.
- KUHN K. & BURBACH K., 1998: *Libellen in Bayern [Dragonflies in Bavaria]*. Verlag Eugen Ulmer, 336 pp. (in German).
- PETR J., 1999: Vodní entomofauna vybraných rašeliníšť NP Šumava a hodnota těchto lokalit z hlediska ochrany genofondu [Aquatic entomofauna of selected peat bogs in Šumava NP and the conservation value of these sites in terms of genetic resource preservation]. Ms., Ph.D. thesis, University of South Bohemia, České Budějovice, 67 pp. (Available from the author) (in Czech).
- SPITZER K. & DANKS H.V., 2006: Insect biodiversity of boreal peat bogs. *Annual Review of Entomology*, 51: 137–161.
- WALDHAUSER M. & ČERNÝ M., 2015: *Vážky České republiky: příručka pro určování našich druhů a jejich larev [The dragonflies of the Czech Republic: field guide for identification our species and their larvae]*. Český svaz ochránců přírody, Vlašim, 188 pp. (in Czech).
- WILDERMUTH H., 2004: *Nehalennia speciosa* in der Schweiz: ein Nachruf (Odonata: Coenagrionidae) [*Nehalennia speciosa* in Switzerland: an obituary (Odonata: Coenagrionidae)]. *Libellula*, 23: 99–113 (in German, English summary).

Received: 30 April 2025

Accepted: 29 July 2025