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Rapid Communication

First record of non-native aquatic plant *Hydrocharis laevigata* (Humb. & Bonpl. ex Willd.) Byng & Christenh. in Czechia

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Abstract

Hydrocharis laevigata (syn. *Limnobium laevigatum*) is a floating aquatic plant native to Mexico and tropical America. The species has become invasive in Asia, Africa, Australia and North America, and is now spreading through European aquatic habitats. Naturalised populations have been found in Hungary and Spain, and the plant has been observed in Belgium, Germany, The Netherlands, Poland and Sweden. In June 2024, two separate populations were discovered in natural aquatic habitats in the Czech Republic for the first time. Occurrences of *Hydrocharis laevigata* were recorded in the Central Bohemian region. The first population was found in a small stream near Český Brod and the second population in a former oxbow lake of the Elbe River near Kolín. While the exact introduction path is unknown, it is likely to be the result of waste disposal by aquarists or gardeners.

Key words: alien plant, Central Europe, aquatic macrophytes, plant invasion

Introduction

Native, species-rich macrophyte communities perform key ecosystem roles, including providing of habitats that support biodiversity, nutrient and sediment retention, water purification and inhibiting algal blooms (Wang et al. 2015; Hussner et al. 2017; Grzybowski and Glińska-Lewczuk 2019).

Aquatic vegetation is experiencing a significant decline in temperate Europe, with the main threats to native flora being pollution, river regulations, climate change and invasive species (Stendera et al. 2012; Brundu 2015). Alien aquatic plants invading freshwater habitats mostly have strong negative impacts on native macrophyte richness, subsequent faunal diversity, and alter ecosystem functions (Brundu 2015; Hussner et al. 2017).

Given the global threat that invasive aquatic plants pose to wetland ecosystem integrity, documenting non-native water macrophyte occurrences is crucial (Hussner 2012; Schmitz et al. 2014).

Hydrocharis laevigata (Humb. & Bonpl. ex Willd.) Byng & Christenh. is a floating aquatic plant belonging to the *Hydrocharitaceae* family. It originates from tropical and subtropical regions of Central and South America (Cook and Urmi-König 1983; POWO 2025). *Hydrocharis*

laevigata thrives in various freshwater habitats, including rivers, lakes, pools, swamps, canals, ponds, dams and reservoirs (Cook and Urmi-König 1983; Garcia-Murillo 2023).

Based on recent taxonomic classification (Bernardini and Lucchese 2018; Li et al. 2022), the genus *Hydrocharis* L., which now comprises former *Limnobium* Rich. species, consists of five species. *Hydrocharis morsus-ranae* L., *H. chevalieri* (De Wild.) Dandy and *H. dubia* (Blume) Backer are native to Eurasia and Africa. *Hydrocharis laevigata* and *H. spongia* originate from the Americas (Efremov et al. 2020; Garcia-Murillo 2023; POWO 2025).

In Europe, the only native species of this genus is *H. morsus-ranae.* Its modern range extends across Eurasia and North America. The species has been established in North America since the 1930s or 1940s. New invaded localities are in regions of Western Asia, Middle and Eastern Siberia and the Indian subcontinent (Efremov et al. 2020). By contrast, *H. morsus-ranae* is currently listed as Least Concern (IUCN category) and is classified as endangered, rare and declining on a national level in the Red List of vascular plants of the Czech Republic (Grulich 2017).

A neophyte in Europe, *H. laevigata* is known for its rapid and efficient spread in aquatic habitats (Garcia-Murillo 2023) and has recently invaded all continents except Antarctica. The species has become naturalised in Africa (Howard et al. 2016), Asia (Kadono 2004), Australia (SERCUL 2020), Europe and North America (Van de Witte 2022). In Europe, the known occurrences are in natural aquatic habitats in Belgium (GBIF 2025), Hungary (Riezing 2019), Spain (Corro et al. 2019; Martínez-Sagarra et al. 2021; Garcia-Murillo et al. 2023) and Sweden (GBIF 2025). Observations in the artificial habitats were recorded in Germany (GBIF 2025), the Netherlands (GBIF 2025), Poland (Pliszko and Górecki 2021) and Sweden (GBIF 2025). This paper describes the first two records of this alien species in the Czech Republic.

Materials and methods

Study area

The study area is located in the Elbe River lowland in Central Bohemian region of the Czech Republic. Elevation range is 198–268 m a.s.l. The mean annual air temperature in Central Bohemian region was 8.8 °C in 1974–2024 (Czech Hydrometeorological Institute 2025a), the mean air temperature in July was 18.6 °C in 1974–2024 and the mean air temperature in February was 0.2 °C in 1974–2024. The total annual precipitation was 592 mm in 1974–2024 (Czech Hydrometeorological Institute 2025b). *Hydrocharis laevigata* populations were found in two separate locations in June 2024 (Figure 1). The first population was recorded in a small watercourse (GPS: 50°4′25.8″N, 14°52′38.1″E) near Český Brod. Unnamed stream (a tributary of the Šembera River) is heavily silted with muddy sediments. It is a slow-

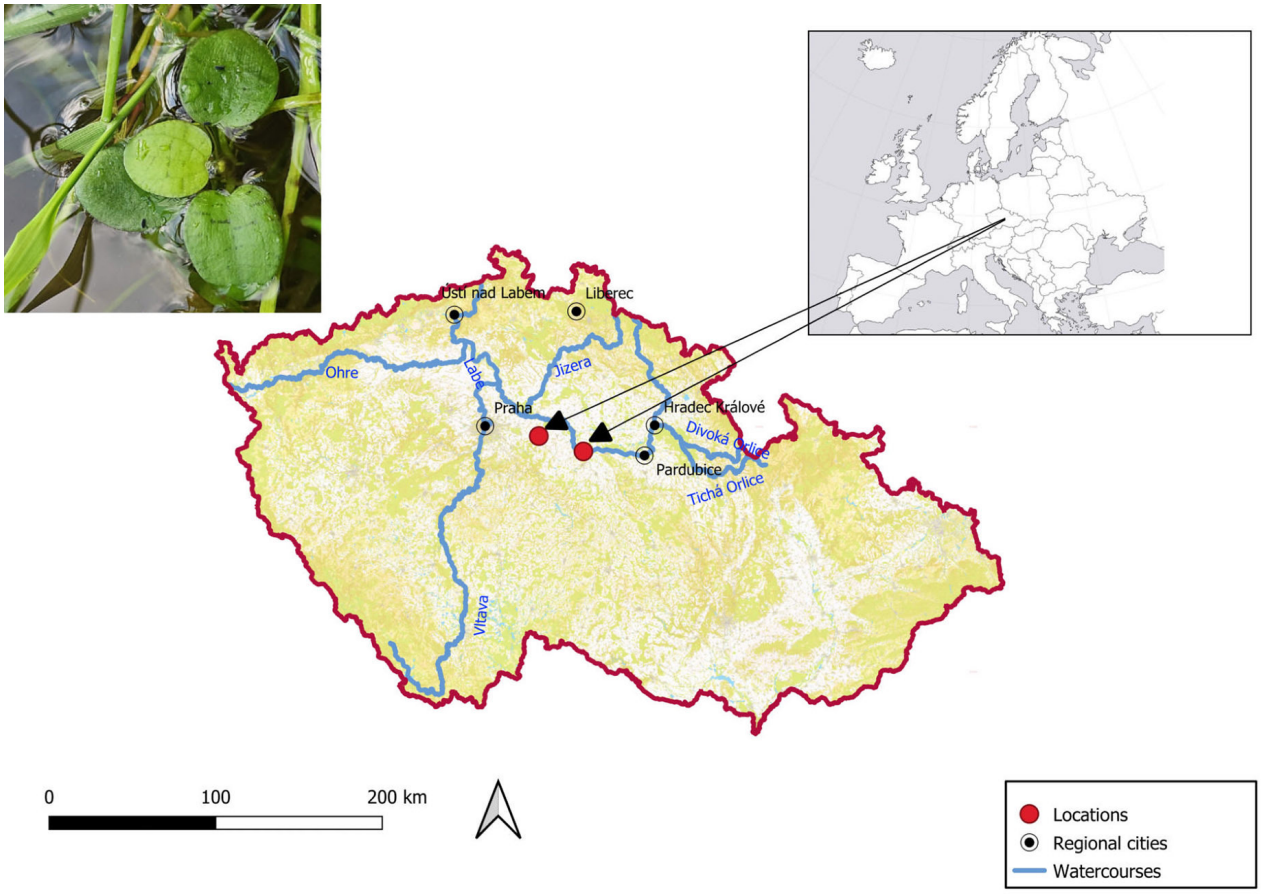


Figure 1. Location of first two records of *Hydrocharis laevigata* in the Czech Republic.

flowing water with these parameters: the mean water depth approximately 1.0–1.2 m; transparency values (determined using a Secchi disc) varied between 20 and 35 cm; pH 6.9; conductivity 672 µS. cm^{-1} and concentration of dissolved oxygen 5.8 mg/L.

The second population was observed in a former oxbow lake of the Elbe River (50°1′21.1″N, 15°15′52.9″E) near Kolín. The bottom is covered by sandy and silty deposits. This oxbow lake isolated from the main river channel is a reservoir of stagnant water with these parameters: the water depth is approximately 0.5–1.5 m; transparency values (determined using a Secchi disc) varied between 40 and 60 cm; pH 7.4; conductivity 496 µS. cm^{-1} and concentration of dissolved oxygen 10.2 mg/L.

Species identification

Identification of *H. laevigata* was based on morphological features (Cook and Urmi-König 1983; Lowden 1992; Garcia-Murillo 2023). *Hydrocharis laevigata* usually has a rounded leaf apex, the leaves bear stipules up to 22 mm long. Female flowers usually lack petals (if present usually less than 3), the ovary consists of 3–6 placental divisions (carpels), without dissepiments. Male flowers have frequently 6 fertile stamens in 2 (3) whorls. The fruits are elliptic. If the leaves are spathulate, then it is *H. laevigata*.

Hydrocharis spongia usually has a cordate leaf apex. Female flowers have well-developed petals, the ovary consists of 6–9 placental divisions (carpels), with well-developed dissepiments. Male flowers have frequently 12 fertile stamens in 5–6 whorls. The fruits are globose. If the leaves are cordate, then it is *H. spongia*.

Both species *H. laevigata* and *H. spongia* are anemophilous, though water and insect pollination have been also observed. Floating plants have thick, spongy aerenchyma on the abaxial leaf surface (Cook and Urmi-König 1983; Lowden 1992; Garcia-Murillo 2023).

Plant specimens were photographed and collected. Herbarium specimen is deposited at the Herbarium of the Museum of Eastern Bohemia in Hradec Králové (HR; herbarium code according to Index Herbariorum; NYBG 2022). The pictures of *H. laevigata* were taken with a Samsung S23 mobile phone. Photos from both sites were subsequently uploaded to iNaturalist (https://www.inaturalist.org/observations/220440700, https://www.inaturalist.org/observations/223543723).

Based on available identification keys, photographs of the specimens in situ and following botanical experts review (the identification of Czech populations was verified by Andrey Efremov), the specimens were confirmed to be *H. laevigata*. The map of the first two occurrences was prepared using QGIS.

Results and discussion

In June 2024, two populations of *H. laevigata* were discovered in natural aquatic habitats in the Central Bohemian region, which marks the first time this species has been recorded in the Czech Republic.

The first population was observed on 4th of June in an unnamed watercourse (GPS: 50°4′25.8″N, 14°52′38.1″E) in Liblice u Českého Brodu, which is a part of Český Brod city. This tributary of the Šembera River is an environment with a high degree of eutrophication, and its riverbed is heavily silted with organic matter (Figure 2a). *H. laevigata* formed a small population of 30 plants, all in vegetative state, with vegetative reproduction observed. The *Hydrocharis* population (Figure 2c) grew in stands of other macrophytes such as *Berula erecta* (Huds.) Coville, *Callitriche cophocarpa* Sendtn., *Lemna minor* L., *Lemna trisulca* L., *Lycopus europaeus* L., *Myosotis palustris* (L.) Hill, *Phragmites australis* (Cav.) Trin. ex Steud. and *Spirodela polyrhiza* (L.) Schleid. These stands of aquatic plants belonged to the following associations: *Lemno-Spirodeletum polyrhizae*, *Beruletum erectae*, *Lemnetum minoris* and *Lemnetum trisulcae*. Reeds consisted of *Phragmitetum australis*.

The second population of *H. laevigata* in the Elbe River basin was recorded on 18th June 2024 in the former oxbow lake (50°1′21.1″N, 15°15′52.9″E) of the Elbe River in a small village Tři Dvory near Kolín city. The former oxbow

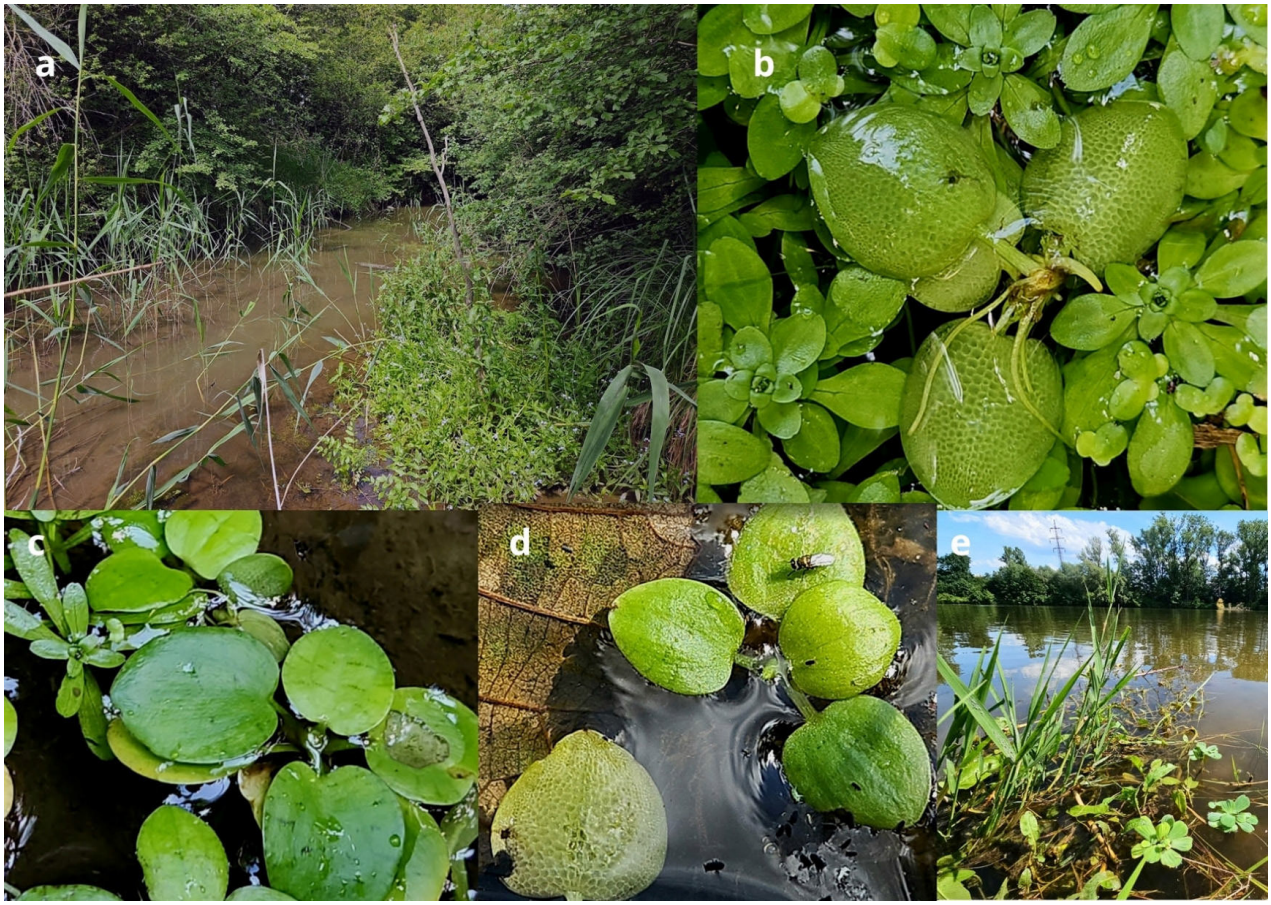


Figure 2. The figure shows: a – watercourse near Český Brod, b – aerenchyma on the abaxial leaf surface of *Hydrocharis laevigata*, c – *H. laevigata* and *Callitriche cophocarpa*, d – *H. laevigata* in the littoral zone of former oxbow lake, e – *Pistia stratiotes* in former oxbow lake near Kolín. *Photographs by M. Vávra.*

lake (Figure 2e), which is now used as a natural swimming pool, is located alongside a regulated channel of the Elbe River. The neophyte *H. laevigata* (Figure 2d) was found growing within stands of other macrophytes, such as *Acorus calamus* L., *Epilobium hirsutum* L., *Glyceria maxima* (Hartm.) Holmb., *Lemna minor*, *Lysimachia vulgaris* L., non-native *Pistia stratiotes* L., *Potamogeton crispus* L., *Rorippa amphibia* (L.) Besser, *Scutellaria galericulata* L., *Sparganium erectum* L. and *Spirodela polyrhiza*. *Pistia stratiotes* was in a vegetative stage (Figure 2e). Macrophytes formed associations *Lemnetum minoris*, *Oenantho aquaticae-Rorippetum amphibiae* and *Potametum crispi*. Reeds consisted of *Glycerietum maximae* and *Phragmitetum australis*.

In both populations, fragmentation of the stolons connecting the leaf rosettes was observed, and the plants reproduced vegetatively in their natural habitats. *Hydrocharis laevigata* can fix its roots in the substrate when the water depth is up to 30 cm (Cook and Urmi-König 1983). However, due to the deep water (1–1.2 m), the roots were unable to fix themselves in the substrate. Even plants growing in a thick layer of mud remained unrooted. Plant specimens ranged from small individuals with only two initial leaves and honeycomb-like aerenchyma on the abaxial leaf surface (Figure 2b) to

larger plants producing new ramets. To date, no flowers have been observed on any of the specimens seen in Czech freshwater habitats.

The following section describes known occurrences in other European countries. The first two records of *H. laevigata* in Hungary were from hot springs near Tata-Naszály and Dunaalmás, in the northwestern Komárom-Esztegrom region. The first population consisted mainly of vegetative plants, though some were flowering. These plants were observed in 2018 in the Fényes springs area. One month later, the plants had spread to Ferencmajor fishponds, approximately 1.3 kilometres away. The second population was found in the Szigeti sulphur springs, where the plants covered the water surface densely together with *Salvinia molesta* D.S. Mitch. Both populations were established near hot springs (with temperatures ranging from 20 to 24 °C), which do not freeze in winter (Riezing 2019). These populations persist due to the mild winter conditions and warm water of the hot springs; the plants grow at low density (Garcia-Murillo 2023).

The first observation of *H. laevigata* in Spain was made in the Manzanares River near Colmenar Viejo, north of Madrid, in 2019. The population was linked to the Grajal reservoir. The species rapidly spread in areas where the current was stagnant; the highest density was reached in a depression in the riverbed (Corro et al. 2019). In the province of Córdoba, *H. laevigata* was recorded as a new addition to the Andalusian flora, with only two specimens found in a stream near a dam (Martínez-Sagarra et al. 2021). The most recent record comes from the Guadaira River, a tributary of the Guadalquivir River. In the summer of 2021, the plants formed a dense mat that completely covered the surface of the Guidaira River on the outskirts of Seville (Garcia-Murillo 2023). *Hydrocharis laevigata* has become naturalised in Spain (Garcia-Murillo 2023).

Hydrocharis laevigata was first discovered in Poland in 2020, in an artificial pond in the eastern part of Kraków. It was deemed a casual occurrence, and the population disappeared due to cold winter temperatures (Pliszko and Górecki 2021; Garcia-Murillo 2023).

In Belgium, the species was found in a watercourse near Ganshoren in the Brussels Capital Region in 2013 (GBIF 2025). The latest specimen was recorded in 2024 in the Dommel watercourse near Pelt in the province of Limburg (GBIF 2025). In Germany the species was found in an artificial water body near Brüggen in North Rhine-Westphalia (GBIF 2025). In Sweden *H. laevigata* was found in the Dynnbäcken stream near Staffanstorp in the province of Skåne (GBIF 2025).

The occurence of alien macrophytes in Central European natural habitats is mainly due to the trading of tropical and subtropical aquarium plants, human-aided spread, increased eutrophication of water bodies and climate change (Champion et al. 2010; Hussner 2012; Ardenghi et al. 2017). The introduction and spread of invasive alien macrophytes are a major concern for integrity of European wetland ecosystems. Regulation

(EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014, on the prevention and management of the introduction and spread of invasive alien species is the key EU directive for invasive species. The list of invasive alien species of Union concern is an important instrument for implementing this regulation, however, *H. laevigata* has not yet been included on it. Considering the actual impacts and the risk of further spread, this species should be controlled and possibly taken into consideration for inclusion in the Union list to prevent its establishment in natural aquatic habitats. According to the criteria specified in Pyšek et al. (2004), *H. laevigata* should be treated as a casual alien species in the Czech Republic. This species has a high reproductive potential, as it can reproduce both vegetatively, through stolon fragmentation, and sexually, via seeds (Cook and Urmi-König 1983; Howard et al. 2016). Stolon fragments and seeds are usually dispersed by water or wind, but can be accidentally dispersed by waterfowl or large mammals (Cook and Urmi-König 1983; Martín et al. 2021). *Hydrocharis laevigata* can rapidly form dense mats across water bodies, dramatically altering habitat structure, restricting access for other species and reducing light penetration to submerse aquatic communities (Cook and Urmi-König 1983; Howard et al. 2016; Garcia-Murillo 2023). In addition to its ecological impact on native macrophytes and other aquatic organisms, this species interferes with human infrastructure by disrupting navigation, blocking irrigation systems and sewers, impeding water flow in waterways and damaging hydroelectric power station equipment (Riezing 2019; SERCUL 2020; Van de Witte 2022).

The possible pathways by which *H. laevigata* was introduced to Czech aquatic habitats remain uncertain, though it's likely a consequence of waste disposal by aquarists or gardeners. *Hydrocharis laevigata* has become a popular freshwater aquarium and garden pond plant, being more commonly cultivated for ponds and aquaria than *H. spongia* (Howard et al. 2016; Riezing 2019). In Australia, *H. laevigata* was discovered in urban wastewater drainage channels (SERCUL 2020). *Hydrocharis laevigata* has become one of the most harmful aquatic invasive plants in North America (Van de Witte 2022) and Australia (SERCUL 2020). Typical methods of controlling *H. laevigata* are mechanical harvesting and herbicide treatments e.g. imazamox (Willis et al. 2018). Although the Czech Republic is in the temperate zone, climate change could significantly impact the distribution of *Hydrocharis* worldwide in the future (Yang et al. 2023). Therefore, strengthening monitoring efforts, reporting this high-risk species and implementing effective control measures for *H. laevigata* are essential.

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Data availability

Species georeferenced records are available at the European Alien Species Information Network: https://easin.jrc.ec.europa.eu/easin/RJD/Download/47d92954-6518-4a36-a41a-40dd0a068.

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