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THE FOURTH ADDITION TO THE SEDGE FLORA (*CAREX, CYPERACEAE*) OF THE CZECH REPUBLIC

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Abstract

The article presents two *Carex* nothospecies new to the flora of the Czech Republic found in 2025 in the field and one rare nothospecies discovered in herbaria, previously mentioned in the Czech Republic. In a locality with exceptional microclimate and vegetation near the Břehyňský rybník pond (northern Bohemia), we found the hybrid *Carex aquatilis* × *C. elata*. It was previously reported from Finland and Sweden only as a combination of the parental species names. This is the first find of this hybrid in the heart of Central Europe, far from its nearest localities in northern Europe. In this article we formally described and named the hybrid as *C.* ×*aquosa*, nothosp. nov. We publish here the finding of *Carex* ×*beckmanniana* herbarium specimens (= *C. riparia* × *C. rostrata*) at two localities in Bohemia and one locality in Moravia, and of *C.* ×*biharica* (= *C. canescens* × *C. echinata*) at one locality in Šumava Mts.

Keywords: sedge hybrids, *Carex* ×*aquosa*, *Carex* ×*beckmanniana*, *Carex* ×*biharica*

INTRODUCTION

This contribution is the fourth addition to the knowledge of the genus *Carex* published in the 9th volume of the Flora of the Czech Republic (Grulich *et al.*, 2024) and follows the three previous ones (Řepka, 2024; Řepka *et al.*, 2024, Řepka and Řepka, 2025). So far, 54 accepted and morphologically proven sedge hybrids have been known in the Czech Republic, but some of them are still waiting for publication. Further intensive survey of selected wetland sites brings further results, with the help of the iNaturalist platform (https://www.inaturalist.org), but also from the results of re-revised *Carex* specimens from both larger and smaller Czech herbaria. These new findings are partly the result of non-specialists overlooking these plants at well-known and botanically frequented sites. The overlooking and misidentifying of these plants in nature is not only the fault of used determination keys (Dostál, 1958; Kubát *et al.*, 2002; Kaplan *et al.*, 2019), but it is a historical fact because only a small number of Czech botanists studied *Carex* hybrids. An exception that should be highlighted here is J. Podpěra (1878–1954), an outstanding Moravian botanist who described new *Carex* hybrids from the territory of Moravia, later summarized in his incomplete Flora of Moravia (Podpěra, 1930). Podpěra is the author of ten new binomial hybrids names, however, after typification nine of them are considered younger synonyms due to lack of priority (Řepka and Taraška, 2022, 2023). The last name, *Carex otrubae* Podp., was originally related to the hybrid combination *Carex muricata* × *C. vulpina* (Podpěra, 1922), but today it is considered a non-hybridogenous species (Ludwig, 1954; Holub, 1960, 1964). In Bohemia, K. Domin (in Polívka *et al.*, 1928), B. Jílek (1929), and L. Čelakovský (1867–1881) were also marginally responsible for discoveries of some *Carex* hybrids in the Czech Republic.

In May and June 2025, the authors of this paper made a surprising discovery at a locality in northern Bohemia, namely Břehyňský rybník National Nature Reserve. Rather small populations of the hybrid *C. aquatilis* × *C. elata* were found at several sites. This hybrid was previously known only from Scandinavia and Finland (Sylvén, 1963; Söyrinki and Toivonen, 1983; https://laji.fi/en/taxon/MX.40405), as summarized by Koopman (2022) and also the website GBIF (2025).

The rare hybrid *C.* ×*beckmanniana* Figert was found and determined in 2017 and 2026 during the visit of the HR and BRNM herbarium (at two localities in Bohemia and one locality in Moravia. This hybrid is already mentioned among *Carex* hybrids in Flora of the Czech Republic (Grulich *et al.,* 2024), however, apart from the protologue (Figert, 1889) few authors mention it in more detail (e.g. Kiffe *et al.,* 1999).

The last *Carex* taxon published in this paper is *C.* ×*biharica* Simonk., which was found during field research in the Šumava Mts. This hybrid used to be mentioned from the country even in the past, allegedly occurring near the town of Svitavy, but these plants have been recently revised and determined as *C. echinata* (see Grulich *et al*., 2024). Reliable records from the Czech Republic were thus missing. This taxon was originally described from Transylvania (Simonkai, 1887) and now is known from many European countries (Koopman, 2022).

The aim of the article is to publish the finds of three new *Carex* hybrids for the Czech Republic, which are presented in the following text, including plant descriptions, sites of the finds, taxonomic and ecological notes and their currently known distributions. For the first of them, *C. aquatilis* × *C. elata*, a new binomial name *C.* ×*aquosa* is published here and its formal description is provided.

MATERIALS AND METHODS

Additional plant material was collected at below listed localities and deposited in the BRNL herbarium. Morphological descriptions of *Carex* ×*aquosa* and *C.* ×*biharica* are based on authors' field observations and herbarium specimens collected by the authors. For *C.* ×*beckmanniana*, data were obtained only from specimens deposited in herbarium HR and BRNM; taxonomic notes are attached to all nothospecies as well.

The identity of *C.* ×*aquosa* was confirmed by morphology based on detailed comparison of Czech plants with herbarium specimens published on Finnish and Swedish websites (www.laji.fi; SLU Artdatabanken, 2025) and deposited in Herbarium of the Museum Botanicum Universitatis in Helsinki, Finland (H). The type specimen of the newly assigned name was deposited in the herbarium BRNM (Herbarium of the Moravian Museum in Brno, Czech Republic).

The abbreviation of herbaria follows NYGB (2025). Nomenclature of vascular plants follows Kaplan *et al.* (2019), nomenclature of vegetation Chytrý (2011) and bryophyte names Kučera *et al.* (2012).

Unless otherwise stated, all photographs were made by the authors of this article.

RESULTS

1. *Carex aquatilis* Wahlenb. × *C. elata* All.

The hybrid described below was found at the turn of May and June 2025 in wetland habitats in the littoral zone on the N, E and SW shores of the Břehyňský rybník pond in northern Bohemia. It grows here in rather small populations, often in the vicinity of *Carex elata* and its partially fertile introgressants. Except for the aforementioned localities we found the hybrid in a wetland on the S to SW edge of the Swamp National Monument near the city of Doksy (see Paratypes). A comparison of the hybrid's features with its parental species is given in Tab. I.

Carex ×*aquosa* Řepka & J. Řepka nothosp. nov. [= *Carex aquatilis Wahlenb.* × *C. elata* All.]

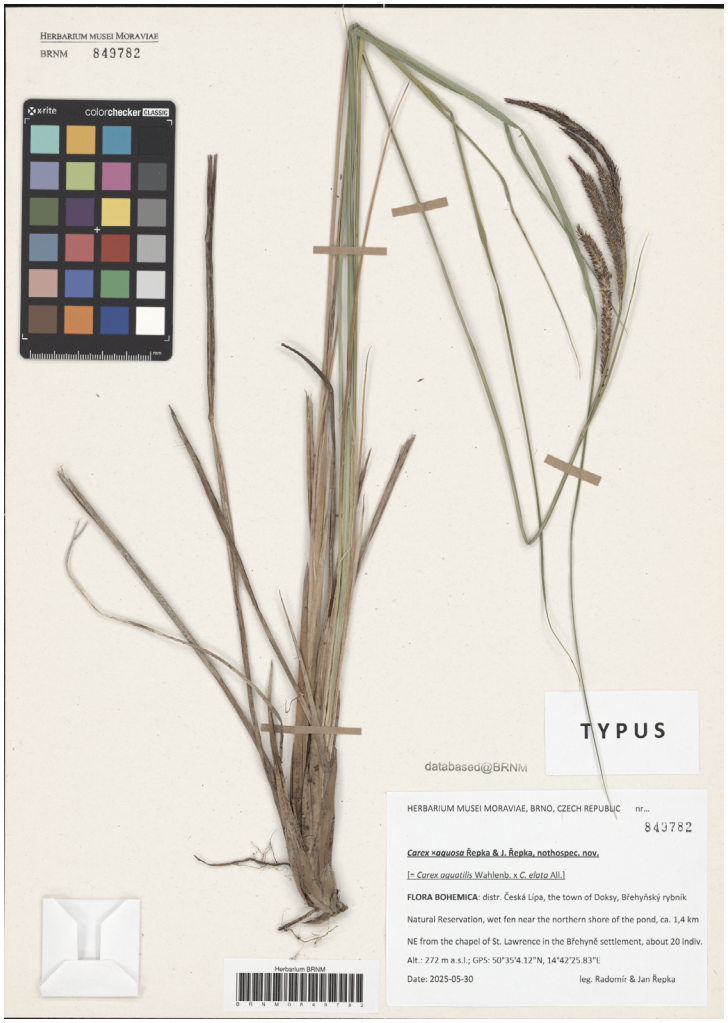
Type: Czech Republic, distr. Česká Lípa, the town of Doksy, Břehyňský rybník Natural Reservation, wet fen near the northern shore of the pond, ca. 1,4 km NE from the chapel of St. Lawrence in the Břehyně settlement, 272 m a.s.l., GPS: 50°35'4.12"N, 14°42'25.83"E (30 May 2025, coll. Radomír Řepka & Jan Řepka, BRNM 849782, holotype; Fig. 1).

Diagnosis: The hybrid differs from *C. aquatilis* by the tufted rhizome with short shoots, basal sheaths similar to *C. elata*, only sometimes reddish, by gray-green rough leaves, and the lowest bract of varying length, which rarely reaches or exceeds length of the inflorescence. From *C. elata* the hybrid differs by sometimes reddish basal sheaths, short shoots on otherwise tufted rhizomes, smooth stems, greater number of elongated narrow spikes while the lowest one is often stalked, longer lowest bract of the inflorescence which may reach its apex or rarely exceed it, whitish edge on the apex of female glumes. Utricles of some plants usually resemble *C. elata*, sometimes *C. aquatilis*, some utricles may contain mature achene while they are often empty (see Tab. I).

Description: The plant forms firm to loose crumbling tufts with shoots 2–5 cm long. Basal sheaths with light short solid shiny scales 2–5 cm long, above them other bladeless elongated sheaths 10–13 cm long, colour of straw to light brown or, in some cases, reddish, dull, keeled, rounded on the outside, rolling outside; on their edges with a whitish or dark net. Stems trigonous in cross section, mostly smooth throughout (not rough!), only in some plants slightly rough under the inflorescence, 40–95(–125) cm long. Leaves of sterile shoots 37–58 cm × 3.0–4.8 mm, grey-green, with a long elongated triangular rough apex, plicate in

I: *Comparison of diagnostic characters of the hybrid Carex ×aquosa and its both parental species*

Feature/taxon	*C. aquatilis*	*C. ×aquosa*	*C. elata*
rhizome	creeping with shorter or longer shoots	very short, forms dense or loose tussocks with 2–5 cm long shoots	very short, forms dense tussocks
basal sheats	brownish-red, spongy, lowermost scaly, upper elongated into leaves	light brown, scaly with a faint whitish net, upper sometimes reddish	straw-like coloured, scaly with a whitish net, persistent, shiny when dried up
stem	straight, obtusely trigonous, smooth, brittle	straight or curved, trigonous, entirely smooth or slightly rough below the inflorescence	straight, sharply trigonous, very rough
leaves	flat, smooth, vivid green	plicate or rarely channelled, rough, gray-green	plicate, rough, green-gray
inflorescence	erect, up to 30 cm long	erect or bent, approx. 20 cm long	erect, 7–16 cm long
lowest bract	leaf-like, significantly longer than inflorescence, ensheating at the base	variable in length, erect, ensheating at the base or not	erect, narrow, plicate, not exceeding half of the inflorescence
spikes	2–4 distant and up to 60 mm long female spikes, 2–3 overlapping male spikes	2–4 distant and up to 100 mm long female spikes, 1–2 male spikes	2–3 sessile and overlapping female spikes, up to 70 mm long, 1–2 male spikes
utricles	whitish green, elipsoid to oblong, veinless, 2.2–2.6 × 1.0–1.2 mm, usually fertile	light green or brown, oblong to ovoid, usually veinless, 2.7–4.5 × 1.3–1.7 mm, mostly sterile	greenish-grey, oblong-ovoid to ovoid, with 3–5 veins, 2.5–3.5 × 1.5–1.9 mm, fertile



1: *Holotype specimen of Carex ×aquosa from Břehyňský rybník pond (BRNM 849782)*

cross section, with prominent veins when dry and rolling down. Inflorescence 125–210(–250) mm long, similar to *C. elata*, with short cylindrical almost sessile spikes, or more often with conspicuously long, narrow spikes, stalked at the base; male spikes 1–2, terminal linear 30–88 mm long, lower 20–36 mm long, both 3–4 mm wide. Female spikes 2–3(–4), mostly narrow, cylindrical to club-shaped, (22–)46–78(–105) mm × 3.0–5.0(–6.5) mm, at the apex always with a proportion of male flowers (15–80%), lowest female spikes slightly interrupted at the base, pedunculated, peduncle 5–24(–35) mm long. Cladoprophyll very variable in shape, dark or whitish-brownish, cylindrical, embracing or divided, then with two dark ears or without them, straight or concave at the base, in some plants with a narrow whitish margin at the apex, up to 5 mm long. The bract below the inflorescence either short, bristle-like, not exceeding the lowest female spike, or leaf-like, erect, ensheating the lowest female spike, reaching half to ¾ of the length of the inflorescence, rarely significantly exceeding the inflorescence. Female glumes lanceolate, dark purple to black, with a narrow or wide central light stripe, with a sharp or blunt tip, often with a narrow white edge at the apex, in length 0.3 mm shorter than utricle up to exceeding utricle by ¼ of its length. Utricles oblong or ovoid in outline, without veins or rarely with several indistinct veins at the base (feature of fertile plants closer to *C. elata*), gray-green or brownish, biconvex or flat, 2.7–4.5 mm × 1.3–1.7(–2.0) mm, at the apex with a 0.2–0.3 mm long beak, at the base with a 0.2–0.5 mm long stalk. Utricles most often dry out and turn brown, do not contain achenes or contain drying achenes that do not mature. Within one inflorescence, some achenes may ripen while the others dry up or are absent. In some plants closer to *C. elata*, achenes mature in most utricles, differing only from *C. elata* in their size and shape. Even on a single plant, the achens may be highly variable. When ripe, the achenes resemble *C. elata*, oblong to ovate, 1.4–1.9 × 0.6–0.7 mm, light brown, dull (Figs. 2–4).

Etymology: The plant's name reflects its affinity for aquatic environments, which is similar to its both parental species *C. aquatilis* and *C. elata*.

Note: *Carex* ×*aquosa* is similar in some morphological characters to the very abundant

2: *A. The plant of Carex ×aquosa morphologicaly close to C. elata with elongated inflorescence, long bract and smooth stem in a bay on the northern shore of the Břehyňský rybník pond*

B. A plant with a tufted rhizome and narrow long female spikes in an elongated inflorescence with immature and dry utricles (female spikes resemble C. aquatilis)

3: *A. Carex ×aquosa with very long erect bract and long inflorescence in wet peat clearing near the NE shore of the Břehyňský rybník pond*
B. The strikingly coloured basal sheaths of the tufted plant C. ×aquosa

species *C. elata* at the site; this is the primary reason why it was overlooked there to date. This is also due to the long-term presence of this hybrid at the site and the continuous introgression from *C. elata*. The introgression is also evidenced by the complete or partial fertility of the hybrid plants and wider variability of characters on generative organs.

Another reason is the (alleged) absence of *C. aquatilis* in the flora of the Czech Republic. Botanists focus on hybrids of species that are known and related to the regional flora.

Distribution: see the Discussion chapter.

PARATYPES

(all specimens coll. Radomír Řepka and Jan Řepka in 2025, deposited in herb. BRNL)

Česká Lípa District, the town of Doksy, Břehyňský rybník National Nature Reserve:

- transitional mires with sparce reed near NE bank of the pond, north of the main tributary to the pond, 1,98 km NE of the chapel of St. Vavřinec in the settlement of Břehyně, 31 May, 275 m a.s.l. 50°35’2.9”N, 14°43’1.9”E;
- peat clearing with pools in coniferous forests above the NE bank of the pond in the direction of road no. 270, 1.6 km NE from the chapel of St. Vavřinec in the settlement of Břehyně, 31 May, 272 m a.s.l., 50°35’5.0”N, 14°42’36.8”E;
- reedbed with standing water in contact with alder carrs, above the N bank of the pond, 1.39 km NE of the chapel of St. Vavřinec in the settlement of Břehyně, 30 May, 272 m a.s.l., 50°35’11.9”N, 14°42’32.6”E;
- sparse low wet alder carr with reeds on a fen in the NW trunk of the northern shore of the pond, 360 m NE from the Mlýnský vrch hill (+390), NE of the settlement of Břehyně, 30 May, 272 m a.s.l., 50°35’2.0”N, 14°42’12.7”E;
- open *Caricetum elatae* (pool with standing water) in the NW trunk of the northern shore of the pond, 385 m NE of the Mlýnský vrch hill (+390), NE of the settlement of Břehyně, 30 May, 272 m a.s.l., 50°35’1.0”N, 14°42’14.5”E;
- water ditch on the edge of a peat bog (at the edge of the forest, S of the tributary to the pond), 1.52 km WNW of Dubová hora hill (+321), 31 May, 273 m a.s.l., 50°34’44.8”N, 14°43’11.4”E;

4: *A. The plant of Carex ×aquosa close to C. elata found in fen in SW bay of Břehyňský rybník pond with very long and stalked spikes whose utricles were empty and already falling*
B. The plant of Carex ×aquosa with very long female spikes from open transitional mires in Swamp Nature Monument

- extensive transitional mires with sparse reeds and pools, at the southern edge of the tributary to the pond, 1.63 km WNW of Dubová hora hill (+321), 31 May, 273 m a.s.l., 50°34'46.2"N, 14°43'5.0"E;
- extensive wet fen (transitional mires) with sparse reeds and low alders, in the SW corner of the pond, 225 m S of the chapel in the settlement of Břehyně, 31 May, 273 m a.s.l., 50°34'25.6"N, 14°41'33.0"E.

Česká Lípa District, the town of Doksy, Swamp National Nature Monument:

- Doksy-Klůček settlement, open transitional mires with water level 20 cm above the surface, at the SW edge of the reserve, 620 m NW of Bílý kámen hill (+309), 01 June, 267 m a.s.l., 50°34'31.5"N, 14°39'55.3"E;
- Doksy-Klůček settlement, alder carr by the path along the tributary part of Máchovo jezero pond, 540 m NW of the Bílý kámen hill (+309), 01 June, 267 m a.s.l., 50°34'30.6"N, 14°40'2.4"E.

Ecological Notes

Břehyňský rybník pond is a microclimatically very cold locality, with frequent ground frosts and radiation mists, caused mainly by the permanent waterlogging of a terrain depression between the Mesozoic sandstones. This is the main reason why relict peatlands are preserved here at such low altitudes (regarding the latitude), with relic vascular plants such as *Carex chordorrhiza*, *C. limosa* and *Rhododendron tomentosum* growing there.

All its tussocks grew in sites with water level above the substrate surface. The vegetation composition in which *C. ×aquosa* grows is mainly constituted by the species of transitional mires (*Caricion canescenti-nigrae*, *Sphagno warnstorfii-Tomentypnion nitentis* alliances), but species of tall-sedge vegetation in littoral zones of oligotrophic and mesotrophic water bodies (*Magno-Caricion elatae* alliance) and acidic moss-rich fens (*Sphagno-Caricion canescentis* alliance) are common as well. These communities are also accompanied by some other species such as *Galium palustre*, *Juncus effusus* and *Lycopus europaeus*. However, in some places there is an expansion of species as *Molinia caerulea*, *Phragmites communis*, as well as expanding trees *Alnus glutinosa* and *Pinus*

sylvestris (see the relevés below). These four species pose a danger to existing populations of the relict hybrid since they have significantly stronger competitive ability. A rise in abundance of these species has occurred in recent years due to higher supply of nutrients (especially nitrogen) and droughts, which weakened natural springs in the area.

Phytosociological relevé no. 1. Doksy–Břehyně, transitional mires with tall sedge and sparse reed in the NW bay of the Břehyňský rybník pond, water 20 cm above the substrate surface, area 5 × 5 m, total cover 45%: E_2 = 18%, E_1 = 40%, E_0 = 25%; 50°35'1.096"N, 14°42'14.502"E, 273 m a.s.l., 30 May 2025, not. R. Řepka and J. Řepka.

E_2 (%): *Alnus glutinosa* 8, *Pinus sylvestris* 10.

E_1 (%): *Carex elata* 30, *Phragmites australis* 15, *Carex ×aquosa* 7, *Carex lasiocarpa* 1, *Potentilla palustris* 1, *Lycopus europaeus* 0.5, *Lysimachia thyrsiflora* 0.5, *Pinus sylvestis* juv. 0.5, *Calamagrostis canescens* 0.25, *Agrostis canina* 0.1, *Betula pendula* 0.1, *Drosera rotundifolia* 0.1, *Galium palustre* 0.1, *Salix cinerea* 0.1, *Thelypteris palustris* 0.1, *Vaccinium oxycoccos* 0.1, *Viola palustris* 0.1, *Utricularia* sp. 0.1.

E_0 (%; det. Josef Plaček, Žárovice, Czech Republic): *Sphagnum subnitens* 20, for other species, cover not assessed: *Calliergonella cuspidata*, *Dicranum tauricum*, *Pellia epiphylla*, *Polytrichum formosum*, *Polytrichum strictum*, *Riccardia palmata*, *Sphagnum fallax*, *S. fimbriatum*, *S. flexuosum*, *S. girgensohnii*, *S. obtusum*, *S. palustre*, *Tetraphis pellucida*.

Phytosociological relevé no. 2. Doksy–Břehyně, transitional mires on a mowed wet area near the N shore of the Břehyňský rybník pond, area 5 × 5 m, total cover 98%, E_1 = 25%, E_0 = 90%; 50°35'4.375"N, 14°42'25.584"E, 273 m a.s.l., 30 May 2025, note R. Řepka and J. Řepka.

E_1 (%): *Carex panicea* 10, *Carex elata* 5, *Menyanthes trifoliata* 5, *Vaccinium oxycoccos* 5, *C. ×aquosa* 3, *Eriophorum angustifolium* 3, *Carex lasiocarpa* 2, *Phragmites australis* 2, *Drosera rotundifolia* 1, *Agrostis canina* 0.75, *Alnus glutinosa* 0.5, *Carex echinata* 0.5, *Molinia caerulea* 0.5, *Peucedanum palustre* 0.5, *Pinus sylvestris* juv. 0.5, *Rhynchospora alba* 0.5, *Hydrocotyle vulgaris* 0.25, *Juncus effusus* 0.1, *Luzula multiflora* 0.1, *Potentilla erecta* 0.1.

E_0 (%; det. Josef Plaček): *Sphagnum subnitens* 60, for other species, coverage not assessed: *Calliergon giganteum*, *Drepanocladus polygamus*, *Polytrichum commune*, *P. strictum*, *Sphagnum fallax*, *S. fimbriatum*, *S. palustre*, *Straminergon stramineum*.

Phytosociological relevé no. 3. Doksy–Břehyně, peatbog with sparse reed in the E–NE bay of Břehyňský rybník pond (in its tributary part), area 5 × 5 m, total cover 98 %, E_2 = 20%, E_1 = 60%, E_0 = 60%; 50°34'44.870"N, 14°43'11.440"E, 273 m a.s.l., 31 May 2025, note R. Řepka and J. Řepka.

E_2 (%): *Pinus sylvestris* 20.

E_1 (%): *Molinia caerulea* 40, *Eriophorum angustifolium* 8, *Phragmites australis* 8, *Carex* × *aquosa* 5, *Vaccinium oxycoccos* 0.5, *V. uliginosum* 0.1.

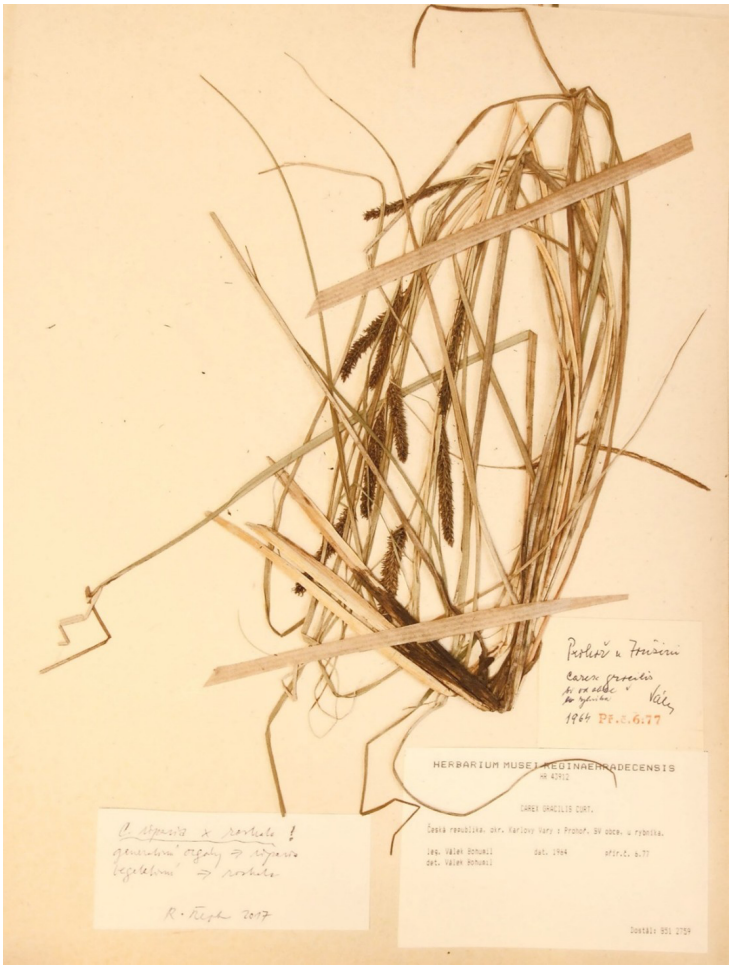
E_0 (%): *Sphagnum* spp. 60.

2. *Carex* ×*beckmanniana* Figert, Deutsche Bot. Monatsschr. 7: 185, 1889 [= *Carex riparia* Curt. × *C. rostrata* Stokes].

Location: Česká republika, okr. Karlovy Vary: Prohoř, SV obce, u rybníka [Czech Republic, Distr. Karlovy Vary, the village of Prohoř, in pond NE of the village] (1964, coll. & det. B. Válek, HR 43912), under *Carex gracilis* Curt., rev. R. Řepka 2017 as *C. riparia* × *rostrata* (Figs. 5 and 6). – Východní Čechy: Běleč n. Orlicí, SPR Častovec [Eastern Bohemia, the village of Běleč n. Orlicí, Nature Reserve Častovec] (16 July 1980, coll. & det. J. Belicová, HR 33768), under *Carex riparia* Curt., rev. R. Řepka 2026 as *C. riparia* × *rostrata.* – Olomouc: in fossis humidis ad pagum Hejčín [The city of Olomouc: wet ditch near the village of Hejčín] (18 May 1947, coll. et det. V. Skřivánek, BRNM 164833, 164848), under *C. vesicaria* var. *pendula* Blytt, rev. R. Řepka 2017 as *C. riparia* × *rostrata*.

It is a nothospecies which has already been published from the Czech Republic (Grulich *et al.*, 2024: 350), but its description and details of morphology are incomplete in this work, therefore a significantly more detailed text is devoted to it here. The description was based on the study of all 3 finds in the Czech Republic and supplemented with a photo of a herbarium specimen from the locality Prohoř (Figs. 5 and 6).

Description: Plant with thin creeping rhizome, basal sheaths spongy, greyish with light red colouring. Basal sheaths mostly with leaf blades, robust, spongy, greyish, with clearly visible sparse anastomoses, only on round new shoots pink coloured. Stem 60–80 cm long, sharply trigonous at the top, obtuse in the lower half and foliaceous in the lower 1/3. Leaves of sterile shoots gray to greenish-gray, flat to keeled, with anastomoses in the lower part, smooth on the upper side of leaf blade, 6–8 mm wide, about 30–48 cm long, with longer acicular leaf top. Inflorescence 22–27(–31) cm long, composed of 2–3 male and 3–4 female spikes. Male spikes 1.5–5.5 cm long, cylindrical; male glumes 5.5–7.5 × 1–1.5 mm long, dark brown with light stripe and central keel, elongated, sharp top. Female spikes 55–70 × 10–14 mm, sessile, lowest on stalk up to 23 mm long. The lowest female spike can be considerably remote from the others (up to the length of two spikes) and on a very long stalk. The glumes of female spikes intermediate: although they are more similar in shape to *C. rostrata*, and also typically narrow, but their overall size, length and reaching the top of utricle or slightly exceeding it and being drawn out into a longer point are features of *C. riparia*. Their colour is more similar to *C. riparia*, i.e. brownish purple with a wide central stripe, which is initially greenish, then light, and 4.7–5.5 mm long. The shape of utricle intermediate, i.e. the utricle body and the prominent ridges (ribs) on its surface are more similar to *C. riparia*, but beak is elongated and tubular, like in *C. rostrata*. The beak's teeth show characters of both parents. Utricles 4.5–5.3 mm long, brownish. Achenes missing, the plant is sterile. Stigmas 3 (see Figs. 5 and 6).



5: *Herbarium specimen of Carex ×beckmanniana collected near the village of Prohoř (HR 43912)*

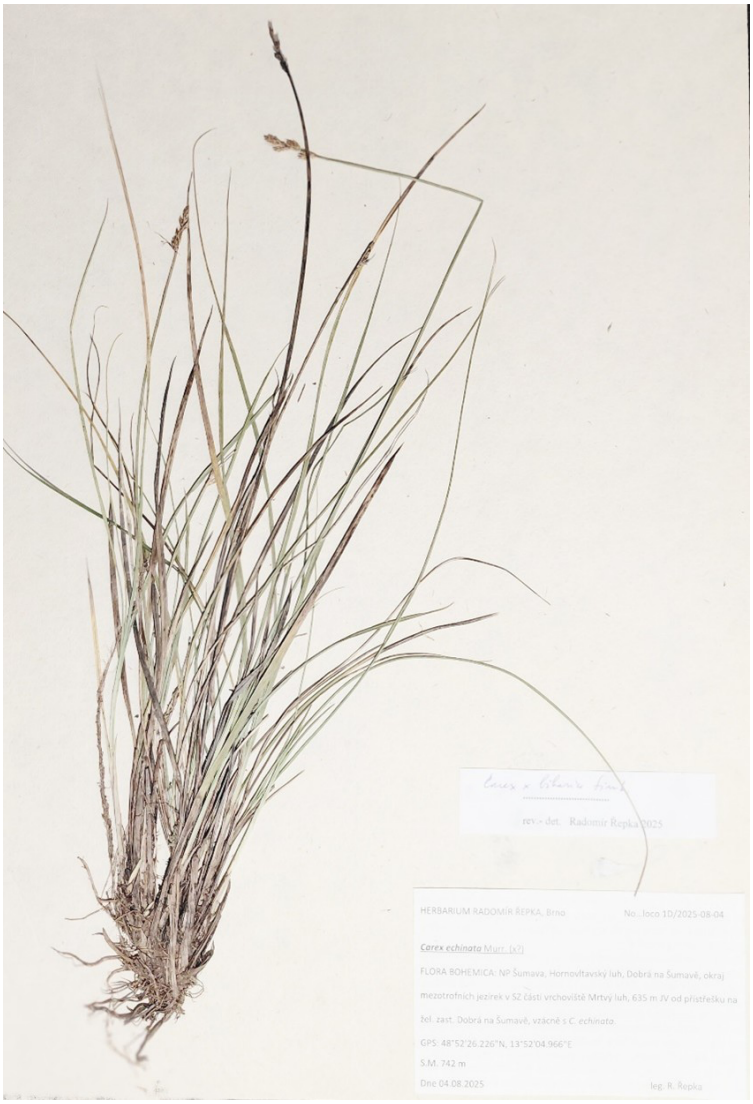
6: *Detail of female spike of Carex ×beckmanniana (HR 43912), photo J. Zámečník*

3. *Carex* ×*biharica* Simonk., Enum. Fl. Transsilv. 548, 1887 [= *Carex canescens* L. × *C. echinata* Murr.].

Location: Czech Republic, Distr. Prachatice, the village of Dobrá na Šumavě, overgrown water ditch with small pool in NW part of the Mrtvý luh peatbog, 48°52'26.226"N, 13°52'4.966"E, 741 m a.s.l. (4 August 2025, coll. Radomír Řepka, BRNL s.n.).

During sedge research in the Hornovltavská kotlina basin in Šumava Mts, a single *Carex* ×*biharica* plant was found among the parental species on the edge of a large peatbog "Mrtvý luh". Earlier information about the occurrence of this hybrid in the Czech Republic from the town of Svitavy (1900, F. Teuber, BRNM), was rejected after revision which assigned the specimen to *C. echinata* (see Grulich *et al.*, 2024: 359). Since it is a new (or newly confirmed) hybrid for the Czech Republic, we present its morphological description below.

Description: Plant densely tufted. Basal sheaths greyish to brownish, scale-like, not deintegrating, up to 40 mm long. Stems slightly curved, thick (up to 1.3 mm in diameter in the upper half), smooth thoroughly, noticeably grooved when dry, 38–42 cm long. Leaves of two types: on new shoots curved, with an extended thin tip, ca. 1 mm wide, greenish (feature of *C. echinata*), at the base of fertile shoots leaves 2.8–3.0 mm wide, flat, with an abrupt tip, gray-green to green-gray (feature of *C. canescens*). The inflorescence resembles an undeveloped inflorescence of *C. echinata*, shortened, 19–22 mm long, spikes 4–5, ellipsoid, clustered, gynandrous, the lowest spike supported by a narrow bristle-like bract up to 10 mm long. Glumes broadly ovate, light brown with a light central stripe and a prominent rib, membranous at the edges, with a blunt or sharp tip, shorter than the utricle. Utricles ovoid in outline with scabrid elongated beak, light brown, 2.5–3.0 mm long, dry up, not ripen. The achenes do not develop; the plants are sterile (Fig. 7).



7: *Herbarium specimen of Carex ×biharica from Mrtvý luh peatbog in Šumava Mts.*

DISCUSSION

Carex ×aquosa

The discovery of *C. ×aquosa* in northern Bohemia goes beyond Central Europe itself in its phytogeographical significance. It is the first finding of this hybrid in the heart of Central Europe. Along with the findings of other hybrids, one of whose parents is *C. aquatilis*, in other localities in the Czech Republic (see Krahulec *et al*., 2026), this finding advances our knowledge and hypotheses about the glacial and postglacial distribution of *C. aquatilis* in Central Europe. In combination with direct evidence (Bajzáth, 1996; Firbas and Grahmann, 1928; Rybníčková and Rybníček, 1972) is likely that this boreal-subarctic circumpolar species was very common in Central Europe, but gradually became restricted to microclimatically exceptional localities during the postglacial period and disappeared from this area with the onset of warmer periods of the Holocene. The Břehyňský rybník pond undoubtedly belongs to exceptional types of localities: with its relict peatland communities at an altitude of ca. 275 m, it is completely exceptional in Bohemia. It can be assumed that the site of today's pond was previously a post-glacial, drainless lake, which was gradually overgrown and in the 15th century it was converted into a pond, the drain was ensured by digging a natural sandstone dam. Since then, with the water regime preserved, many peatland communities have been abundantly restored and several boreal species, important glacial relics such as *Carex chordorrhiza*, *C. limosa*, *Rhododendron tomentosum*, *Rhynchospora fusca*, *Utricularia bremii*, *Vaccinium uliginosum* and others, among them also hybrids of *C. aquatilis*, have survived here to this day. Further evidence of the earlier existence of *C. aquatilis* at this site is the finding of *C. ×hibernica* (= *C. aquatilis* × *C. nigra*), which was found at three sites near the littoral of the northern and eastern banks of the pond (R. and J. Řepka, unpubl.).

Seven herbarium specimens assigned to the hybrid of *C. aquatilis* × *C. elata* collected in Finland shown in scans on www.laji.fi (2025) are mostly morphologically intermediate types with both longer and shorter inflorescences, always longer than in *C. elata*, with bracts longer than the inflorescence (rarely also shorter). The lowest female spikes are rather typical of *C. aquatilis*, they are the longest of all, stalked, often broken at the base and sometimes club-shaped. In some plants, it is visible that all the utricles turn brown and do not ripen. The plants have typical scaly basal sheaths of light colour like *C. elata*, but the higher sheaths above them pass freely into the leaf blades, have prominent anastomoses and are reddish in some cases (feature of *C. aquatilis*, Fig. 3B). The plants collected in the Czech Republic show very significant overall variability. Firstly, plants with narrow, long spikes in elongated inflorescences were found (Fig. 2A, 3A) and a whole range of nothoforms from those with inflorescences more typical of *C. aquatilis* to fertile plants very similar to *C. elata*, which however had long bracts and smooth stems (Fig. 2A). In nothoforms close to *C. elata*, utricles mature at the same time as in *C. elata* and usually contain a mature achene (Fig. 4A). However, most plants have utricles of a different shape that do not fall off (do not ripen) and remain in the spikes on the plant. A very important feature is the length of the bract relative to the inflorescence which is very variable: in plants closer to *C. elata* it is short, but more often reaches ½ to ¾ of the length of the inflorescence, in some cases it even exceeds it. It is smooth, groove-like or rounded-channelled in the lower part and embraces the lowest spike (feature of *C. aquatilis*, Fig. 2A). Söyrinki and Toivonen (1983) studied the position of stomata on the leaves of the hybrid and called it amphistomatous. We did not analyze the position of stomata for a simple reason: if the parental species have stomata on opposite sides of leaves, then the hybrid may not have only amphistomatous leaves (e.g. Jermy *et al.*, 2007) but also leaves with stomata on only one side like the parental species. The intermediarity of this trait depends on the level of intermediarity of the individual.

Söyrinki and Toivonen (1983) published the first four records of this hybrid from lake shores in central Finland, and these plants were later found in other places in the wider vicinity of the city of Oulu and elsewhere as shown by the maps published on www.laji.fi (2025). This hybrid was primarily identified as a combination of *C. aquatilis* and *C. elata* subsp. *omskiana*, and even mistakenly named as *C. ×hibernica* A. Benn. based on erroneous information from Bennett's protologue (Bennett, 1897). On the aforementioned Finnish websites this taxon was referred to as *Carex aquatilis* × *C. elata*, the same combination is also reported by Koopman (2022: 393) and GBIF (2025). It is evident that in Finland it was recorded in central part of the country (around the city of Kajaani) and also in two localities in the southern part of the country. In Sweden, the taxon was found in two localities (north of the city of Gävle and around the city of Karlstad, both in the southern half of the country (see www.artfakta.se 2025). According to the map data on the GBIF website (2025), this hybrid is also known from Denmark, from the area NW of the capital city of Copenhagen. Kiffe (1997) assumes the discovery of this hybrid in the area of occurrence of *C. aquatilis* in Lower Saxony (NW part of Germany), from where he published the finding of the hybrid *C. acuta* × *C. aquatilis.*

Carex ×beckmanniana

The features of the plants collected in the Czech Republic show an intermediate morphology: female spikes with their colour and structure (set of characters) more closely resemble *C. riparia*, but vegetative parts (width and colour of leaves, leaf type in cross-section, spongy base of shoots, rounded stems) show more features of *C. rostrata*.

Figert (1889) in protologue states the predominance of *C. riparia* features in the plants he found, with the male glumes distinctly white membranous in the upper half as in *C. rostrata*, and the female glumes shorter, less pointed than in *C. riparia*. Their leaves also resembled *C. rostrata* but were wider as in *C. riparia*. Figert further mentions the *C. rostrata* feature in the hybrid, i.e. the proportion of male flowers at the top of the female spikes. Jermy *et al.* (2007) report only one locality of a hybrid that resembles more *C. riparia*, but upon closer examination of the features it was rather morphologically intermediate. The basal sheaths were spongy, similar to *C. rostrata*. The leaves width, the position of the stomata on them are intermediate features, and the shape and venation of utricles, like in our plant, also show features of both parental species. Like Figert (1889), even Jermy *et al.* (2007) report intermediate male glumes similar to both parents. The plants described by them were sterile, similarly to our plant. Stace *et al.* (2015) confirm the single locality of this hybrid from Orkney Islands, intermediate features mentioned by them corresponding to our plants are: trigonous stem and aerenchyma near the ligule, spongy stem sheaths, and longer acicular leaf point. Utricles were empty, plant was sterile. The authors also point out the considerable similarity with the hybrid *C.* ×*bakkeriana* D. T. E. Ploeg (= *C. acutiformis* × *C. rostrata*) and the possibility of confusion.

Kiffe *et al.* (1999) reports this hybrid from several localities in Lower Saxony, Brandenburg and North Rhine-Westphalia in Germany, and only one of them had both parental species present, though *C. riparia* was mostly absent. It is noteworthy that this hybrid forms larger polycormons (up to 100 m^2) in most localities and the authors describe it as a competitively strong taxon, thus surpassing its parental species. In the attached table, the authors compare the features with *C.* × *involuta* (= *C. rostrata* × *C. vesicaria*), distinguishing features of *C.* ×*beckmanniana* are related to the width of leaves of living plants (5–14 mm), the number of male spikes (3–6), female spikes are usually interrupted at the base, the lower ones are separated on a longer stalk and often pedunculate. These spikes regularly have a proportion of male flowers at their tip, the colour of the female glumes is striking as they are blackish with a narrow green central stripe. Female glumes are as long as the utricles (which is the same in our plant, but the glumes can be even longer than utricles, see Fig. 6) and have a long, prominent top. Utricles are 4–5 mm long, slightly swollen, gradually turning into a 1.5 mm long beak (feature identical to our plant).

It is known that the two parent species have completely different ecological relationships and hardly ever meet in localities, yet this hybrid occurs in nature, though rarely. *Carex riparia* is a species rather typical of the alluvium of large rivers in warmer regions or grows on the banks of eutrophic reservoirs in the hills. *Carex rostrata* grows in more acidophilous to mesotrophic (often peaty) habitats, mostly in colder areas. *C. rostrata* is also occasionally found in the lowlands (and in the lower hills, see Pladias, 2025) on fens in the floodplains of larger rivers. In such types of localities, both species can meet and their (morphologically inconspicuous) hybrid can also grow there. Another complication for formation of this hybrid is the different phenology of the parent species, i.e. the shift in flowering time, which is partly determined by the average temperature of the location. We know that *C. riparia* often flowers in the lowlands very early-late April, while *C. rostrata* only blooms in early June in peaty habitats at higher elevations. If both species grow in the same lower locality, then flowering may partially overlap and the probability of pollination is much higher.

Carex ×*beckmanniana* is known so far from many European countries: Belgium, Denmark, Estonia, Finland, France, Germany, Great Britain, Helvetia, Italy, Latvia, Lithuania, Netherlands, Norway, Poland and Sweden (Koopman, 2022).

Carex ×*biharica*

The plant studied in this article was originally identified in the field as *C. echinata*. However, it is completely sterile, utricles are dried up, and no achenes are formed. The leaves are interesting, as they occur in two distinct types. Only a single tussock was found near both of the parental species.

The parent species *C. echinata* and *C. canescens* have significantly different phenology, if their flowering times are to coincide, they must occur together in climatically extreme sites. In such habitats, the growing season is shortened and the differences in phenology are reduced, then hybrid plants can arise (Kukkonen and Toivonen, 1988). The locality of the find clearly falls into this category, due to the specific microclimatic conditions of the Hornovltavská kotlina basin. These influences include frequent frosts even during the growing season, stronger frosts and soil freezing in winter, permanent water saturation of the substrate and a shortened growing season.

When compared with the literature data, it can be stated that the most important distinguishing features of *C.* ×*biharica* compared to the parent species are ± identical in our plant (Jermy *et al.*, 2007: 282). It is known from Great Britain from several localities in Scotland from acidic substrates at higher altitudes. Stace *et al.* (2015) remind that this hybrid is very similar to *C.* × *helvola* Blytt ex Fries [= *C. canescens* L. × *C. lachenalii* Schkuhr] and several British data of *C.* ×*biharica* have been confused with this plant. *Carex* ×*biharica* has been known so far from many European countries, mainly from Scandinavia, Great Britain, Denmark, Germany, Austria, Poland, Slovakia, Italy, Romania, Latvia and from the European part of Russia (Koopman, 2022). It was originally described from western Romania (Simonkai, 1887).

CONCLUSION

The article presents three new taxa of sedges (*Carex*, Cyperaceae) for the territory of the Czech Republic, found both in the field and by herbarium revisions. The hybrid *Carex aquatilis* × *C. elata*, which has already been known from Scandinavia, is formally described here, with the binomial name *Carex* ×*aquosa* Řepka & J. Řepka newly established for it. Another *Carex* hybrid found for the Czech Republic is *C.* ×*beckmanniana* Figert, recognized at three localities, at two in Bohemia and one in Moravia. The third *Carex* taxon concerned here is *C.* ×*biharica* Simonk. found in the Šumava Mts, which is the first reliable record of this nothospecies for the country. The previously mentioned occurrence near the town of Svitavy was based on a confusion with *C. echinata*.

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