

## *Carex scoparia* – a new alien sedge in Europe

*Carex scoparia* – další zavlečený druh ostřice v Evropě

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In 1992, *Carex scoparia* Schkuhr was found in the floodplain of the Latorica river (East-Slovakian Lowlands, Slovakia). This North American sedge is a new alien species in Slovakia and also, in Europe. The sites in which the species was found are described, and their phytosociological characteristics and results of soil analyses are presented. A detailed description of the species is provided and its characters important from the taxonomical point of view are compared with those of other related sedges known from the former Czechoslovakia, i.e. *C. ovalis* and *C. muskingumensis*. The features distinguishing *C. scoparia* from the closely related *C. crawfordii* are also mentioned. A key for determination of Central European representatives of sect. *Ovales* is provided. Possible ways of the species introduction to Central Europe are discussed.

**Key words:** *Carex scoparia*, alien plant, Central Europe, Slovakia

### Introduction

In August 1992, we found an unknown sedge of subgen. *Vignea*, sect. *Ovales* in the riparian vegetation of oxbows of the Latorica river in East-Slovakian Lowlands. Morphological features, both vegetative and generative, of this taxon were partly different from both introduced and related native sedge species known so far from the territory of the former Czechoslovakia, i.e. *C. ovalis* Good. and *C. muskingumensis* Schweinf. Comparative study of our own material and literature revealed that the material belonged to the North American species *C. scoparia* Schkuhr. This species has not been recorded from the European continent so far, representing thus a new alien species not only for Slovakia but also for Europe.

The species was found at the following localities: (1) Lelés, upper flood line bordering a stand of high sedges on the banks of oxbows, 250 m E of the bridge across the Latorica river, 95 m a.s.l.; (2) Lelés, margin of a *Carex gracilis* Curt. stand, at the bank of the Latorica river oxbow in a floodplain forest, about 500 m N of the bridge across the river, 96 m a.s.l.

Herbarium material is deposited in the private herbaria of the authors and in the Herbarium of the Department of Botany at the Faculty of Natural Science, Palacký University, Olomouc (OL).

Nomenclature follows Smejkal (1980) except for the species of the genus *Carex*, section *Ovales*.



Fig. 1. – A herbarium specimen of *Carex scoparia* from the locality described in the present paper.

Table 1. – Comparison of selected features of *Carex* sect. *Ovales* representatives occurring in Europe. The values were obtained by measuring the plants at the site Lelés (*C. scoparia*). The features of *C. ovalis* and *C. muskingumensis* were measured on herbarium material (private herbarium of R.Ř., and Herbarium BRNU).

Character	<i>C. ovalis</i>	<i>C. scoparia</i>	<i>C. muskingumensis</i>
Fertile culms length (cm)	(25–) 40–73 (–100)	(35–) 55–80 (–87)	70–100
Sterile culms length (cm)	10–30	40–60	45–70
Leaf width (mm)	2.2–3.5	3.0–3.8	3.3–5.2
Inflorescence length (cm)	(17–) 23–32 (–37)	(22–) 26–35 (–38)	60–80 (–90)
Number of spikes in inflorescence	(3–) 4–7 (–8)	(6–) 7–10 (–11)	(6–) 7–11 (–13)
Spike length (mm)	(6–) 8–12	7–11 (–12)	(12–) 13–20 (–24)
Shape of spike	ovate-broadly ovate-obovate	sphaerical-broadly ovate-obovate	fusiform-oblong cylindric
Perigynium length (mm)	(3.5–) 3.8–4.6 (–5.0)	4.0–4.7 (–5.2)	(5.5–) 6.2–7.2 (–8.0)
Perigynium width (mm)	(1.1–) 1.5–1.8 (–2.0)	(1.1–) 1.2–1.5	(1.6–) 1.7–2.0 (–2.2)

## Description<sup>1</sup>

Nomen: *Carex scoparia* Schkuhr in Willd., Sp. Pl. 4: 230, 1805.

Syn.: *Carex leporina* sensu Michx., Fl. bor.-amer. 2: 170, 1803, non L.; *Vignea scoparia* (Schkuhr) Reichenb. in Moessler, Handb., ed. 2: 1613, 1834; *C. scoparia* a. vera Tuckerm., Enum. Meth., 17, 1843; *C. lagopodioides* b. *scoparia* Boeck., Linnaea 39: 114, 1875.

Densely caespitose plant; rootstock short, dark brown, fibrillose. Culms 0.15–1.0 m high, usually much exceeding the leaves and high sterile culms, sharply triangular, the angles very rough below the inflorescence. Leaves 2–6 to a fertile culm, on the lower half, flat or canaliculate, blades 5–50 cm long, 1.5–3 mm wide, yellowish green, rough towards apex; sheaths tight, white-hyaline ventrally, prolonged at apex. Inflorescence oblong, linear-oblong or globose head (sometimes a moniliform, flexuous), 10–50 × 5–15 mm, spikes 3–12, gynaeandrous, 6–16 × 3–9 mm, lower bracts small, setaceous, the upper lacking. Scales acute, ovate or oblong-ovate, dull, light-brownish or straw-coloured with white-hyaline margins and 3-nerved green center, nearly as wide as the perigynia but conspicuously exceeded by the beaks. Staminate flowers inconspicuous. Perigynia numerous, flat, thin and scalelike, barely distended over the achene, appressed or erect ascending, 4–6.5 (–7) mm × 1.2–2 (–2.6) mm, on average 5.2 mm long, greenish, white or straw-coloured, lanceolate to narrowly ovate-lanceolate, nerved on both faces, relatively wide (compared to *C. crawfordii* Fern.) wing-margined to the base, serrulate to below the middle, tapering into a flat, serrulate, shallowly bidentate beak 1.2–2 mm long. Achenes lenticular, oval-oblong, 1–1.5 mm × 0.5–0.75 mm, brownish, stipitate, apiculate, jointed with the deciduous style. Stigmas 2, short, reddish-brown.

## Taxonomical notes on *Carex scoparia* and its comparison with other species of sect. *Ovales*

*Carex scoparia* belongs to subsect. *Festucacae* of the sect. *Ovales*, which includes about 15 markedly similar representatives. This group is characterized by relatively short

<sup>1</sup> The description is based on literature (Mackenzie 1940, Gleason 1958, Hermann 1970) and reflects much wider variation of the species characters than presented in Table 1.

contracted inflorescences, forming of conspicuous sterile shoots with long erect leaves and by lanceolate to narrowly ovate-lanceolate, membranous perigynium with hyaline, wing margin to the base. The native *C. ovalis* lacks sterile leafy shoots, the fertile shoots are shorter and the utricles are ovate to ovate-lanceolate without prominent hyaline margins. Structure and appearance of the inflorescence are, however, very similar in these two species. *C. muskingumensis*, found in the Czech Republic as an alien species (Jedlička 1949, Grüll 1952) forms conspicuous, tall sterile shoots and fertile shoots with long erect leaves but the structure of the inflorescence (length and shape of the spikes) as well as the length and articulation of the inflorescence are quite different from *C. ovalis*.

*C. crawfordii*, found in the Netherlands as an introduced species (den Held et Kortselius 1964), is another taxon very closely related to *C. scoparia*; some authors even do not consider them as separate species and treat the former as *C. scoparia* Schkuhr var. *minor* Boott. *C. crawfordii* is distinguished from *C. scoparia* by a few features, mainly the smaller stature, sterile, leafy shoots being absent or weaker developed, narrower (up to subulate) and shorter perigynia and almost equally long acuminate glumes (*C. scoparia*: longer, lanceolate utricles, shorter, acuminate glumes which are not mucronate). Also, the beak teeth is more prominent in *C. scoparia* than in *C. crawfordii* and the broader membranous perigynium margins are situated in the upper two thirds in *C. scoparia*, while being narrow in *C. crawfordii* (Kükenthal 1909, Gleason 1958). The other related species, *C. bebbii* Olney and *C. oronensis* Fern., have the inflorescence very similar to *C. scoparia* and *C. crawfordii* but their perigynia are different.

Wiegand (1926) compared the size of perigynia in *C. crawfordii* and *C. scoparia*. The length was 3.6–3.8 mm, and 4.1–4.7 mm, respectively, and the width was 0.7–1.3 mm in the former, and 1.5 mm in the latter species.

*C. scoparia* is markedly similar in habit to *C. ovalis* by its inflorescence. The nature of the perigynium of *C. ovalis* is quite different: its shape is ovate to ovate-lanceolate, plano-convex in cross-section, narrowly winged at top, the glumes are lanceolate-elliptic and are as long as the perigynia.

*C. scoparia* is conspicuous because of its relatively tall, erect stems including erect sterile shoots, reaching up to 2/3 of the length of the fertile shoots. In our plants, the inflorescence mostly borne basal setaceous bract 5–35 mm long (note that this feature is missing from the descriptions of former authors). At maturity, the bract is a little longer

Table 2. – Results of soil analyses. The nitrogen content is given in % (Mehlich II extract), those of other elements in mg/kg. See text for details on the sites.

Parameter	Site		
	1a	1b	2
N	0.30	0.36	0.41
P	2.0	2.0	3.0
K	122.0	106.0	137.0
Ca	4024.0	3856.0	4167.0
Mg	451.0	429.0	482.0
pH	7.1	6.9	6.8

than that of *C. ovalis*. The spikes are more compact and occur in greater number than in *C. ovalis*; on some inflorescences, the lower spikes are separated. After flowering their colour is light straw to greenish beige, ripe ones are light brown. The perigynium is membranous, very thin, moderately curved, in the upper half broadly hyaline. The glumes are of the same colour as the perigynia (see Table 1 for other features).

*C. scoparia* is a very variable species with several varieties and forms in the whole distribution area; these differ in inflorescence length, colour of scales and perigynium length. Plants from Lelés probably belong to var. *scoparia* (Scoggan 1978).

### Determination key of the Central European species of *Carex* sect. *Ovales*:

- 1a. Inflorescence nodose, often interrupted in the lower part, 60–90 mm long; spikes to 25 mm long, fusiform to oblong cylindric, acute; utricles 5.5–8.0 mm long ..... *C. muskingumensis*
- 1b. Inflorescence mostly dense ovoid head, rarely with a separated spike in lower part, 17–38 mm long; spikes 6–12 mm long, oblong to obovate, obtuse; utricles 4.0–5.5 mm long ..... 2
- 2a. Sterile shoots ascending, not very conspicuous, reaching up to 1/3 of the height of the fertile ones, utricles plano-convex, ovoid, abruptly tapering into a beak ..... *C. ovalis*
- 2b. Beside fertile stems, sterile shoots arise from the tussocks, reaching up to 2/3 of the length of the fertile ones; utricles membranous, lanceolate to narrowly lanceolate, gradually tapering into a beak ..... *C. scoparia*

### Ecology of the species

Both neighbouring localities of *C. scoparia* near the village of Lelés are ecologically similar. The species grows in the marginal part of stands of *Caricion gracilis* Neuhäusl 1959 em. Balátová-Tuláčková 1963, in all cases in the most flooded part of the oxbow bank. These habitats are wet for most of the year, remaining at least damp in the summer. The species was also exceptionally found on banks or bottoms of periodically drying-up pools, distant from oxbows. The vegetation in which *C. scoparia* grows consists of two layers. Tall sedges such as *Carex gracilis* and *C. riparia* usually dominate the upper layer, accompanied by *Lysimachia vulgaris*, *Iris pseudacorus*, *Inula britannica*, *Lythrum salicaria*, *Leersia oryzoides* and *Sium latifolium*. The lower layer is formed by *Agrostis stolonifera*, *Argentina* (= *Potentilla*) *anserina*, *Potentilla reptans*, *Ranunculus repens*, *Mentha arvensis* and *Galium palustre*. *C. scoparia* belongs to the upper layer; its cover is, however, mostly lower than that of *Carex gracilis*. It most often colonizes marginal parts of *Carex gracilis* communities where the vegetation cover is less dense.

The soils on which *C. scoparia* grows are clayish-sand type of Fluvisol with very high content of  $Mg^{2+}$  and  $Ca^{2+}$  (Table 2).

The floristic composition of stands in which *C. scoparia* reached relatively high cover is documented by the following phytosociological relevés, using the 7-grade scale of Braun-Blanquet:

Rel. 1: Site 1a – margin of a moist depression, area 25 m<sup>2</sup>, cover = 85 %, date: 11 August 1994. *Carex scoparia* 1, *C. gracilis* 1, *C. vulpina* 1, *Agrostis stolonifera* 3, *Poa palustris* +, *Elytrigia repens* +, *Lysimachia vulgaris* 1, *Argentina* (= *Potentilla*) *anserina* 1, *Potentilla reptans* +, *Inula britannica* 1, *Lythrum salicaria* +, *Galium palustre* +, *Leersia oryzoides* +, *Iris pseudacorus* r, *Ranunculus repens* r, *Mentha arvensis* r, *Sium latifolium* r.

Rel. 2: Site 1b – margin of an oxbow, area 25 m<sup>2</sup>, cover = 85 %, date: 11 August 1994. *Carex scoparia* 3, *C. gracilis* 3, *C. vulpina* +, *Agrostis stolonifera* 2, *Poa palustris* 1, *Lysimachia vulgaris* 1, *Argentina* (= *Potentilla*) *anserina* 1, *Inula britannica* 1, *Galium palustre* 1, *Lythrum salicaria* +, *Leersia oryzoides* +, *Pseudolysimachion longifolium* +, *Iris pseudacorus* r, *Ranunculus repens* r, *Mentha arvensis* r, *Sium latifolium* r, *Chaiturus marrubiastrum* r, *Lycopus exaltatus* r.

Relévé no. 3: Site 2 – margin of an oxbow, area 16 m<sup>2</sup>, cover 75 %, date: 11 August 1994. *Carex scoparia* 2, *C. gracilis* 2, *C. riparia* 2, *Agrostis stolonifera* 1, *Lysimachia vulgaris* 1, *Argentina* (= *Potentilla*) *anserina* 1, *Potentilla reptans* +, *Galium palustre* 1, *Calystegia sepium* 1, *Lythrum salicaria* +, *Mentha arvensis* +, *Ranunculus repens* +, *Vicia cracca* +, *Iris pseudacorus* r, *Alisma plantago-aquatica* r.

### Notes on the chorology of the species with respect to its secondary occurrence in Central Europe

The distribution area of *C. scoparia* in North America includes the southern part of Canada from Newfoundland to British Columbia. Its northern border reaches up to the State of Alberta (Edmonton). In the eastern states of the USA it is considered a very common species; to the south it occurs in Arizona, New Mexico, Arkansas and South Carolina, reaching Florida. To the west it occurs in the states of Colorado, Idaho, Oregon and Washington (Kükenthal 1909, Mackenzie 1940, Gleason 1958, Hermann 1970). In North America, it is considered on a temperate boreal, transcontinental species (Scoggan 1978, Robertson 1984).

The highest altitude is reported from North Carolina, i.e. 1890 m a.s.l. (Britton et Brown 1913). Hermann (1970), however, gives the altitudinal range of 910 to 3000 m a.s.l.

*C. scoparia* occurs in damp places, marshes, bogs, fens, open swamps, mostly muddy sites, damp and wet meadows, scrub, wood fringes, shores, meadows along brooks, grassy brook banks, and pond banks (Kükenthal 1909, Victorin 1935, Mackenzie 1940, Gleason 1958, Hermann 1970). Scoggan (1978) gives a different range of habitat types: woods, thickets and open places. In Newfoundland it grows on dry roadside wastes, occasionally it is found in gravel soils at the edge of alder swamps and mountain maple thickets. It is considered a hemerophilous species, has a low nutrition requirements and is seldom grazed; however, it produces abundant seeds (Robertson 1984). Ecological remarks are also found on the sheets of herbarium specimens, i.e. grassy banks and meadows along brooks (Fernald 1914 PRC), pond banks (s.c. 1906 PRC).

The species is well naturalized in its new locality in Slovakia, growing in natural to seminatural riparian vegetation along oxbows. Such habitats correspond well to the data from literature.

The introduction of *C. scoparia* to Central Europe, which represents a distance of at least 8,000 km to the east of the border of its original distribution area, is very remarkable, given the absence of any other site known from the European continent. The occurrence thus seems to be an incidental, dot-like and possibly temporary introduction.

Several ways of introduction can be considered. The occurrence of the species in the limose zone of an oxbow and the very low specific weight of the perigynia may indicate spread by both floods in plains of larger rivers and waterfowl. The original source of diaspores, however, has not been identified.

Possible introduction with American cereals through the transit railway station at Čierná nad Tisou or the station at Čop (closest to the Latorica river), and subsequently by floods to the site near Lelés, is not very likely. The species has been recorded as a weed (or

cereal weed) neither in the literature nor during the long-term thorough research carried out by V. Jehlík in the Čierná nad Tisou railway station and its surroundings since 1964. Also, it would have hardly persisted under rather extreme ecological conditions in Eastern-Slovakian and Ukrainian railway stations. *C. scoparia* is not mentioned as an alien from the territory of either the former USSR or the Ukraine. The eastern route of adventive plants which was supplying Eastern Slovakia with aliens in the past 30 years does not seem to hold for *C. scoparia*.

The fact that the species has established in two sites located about 0.5 km apart indicates relatively young naturalization. As floods in the Latorica floodplain have been eliminated some 20 years ago, the species could probably only have been spread by waterfowl. The species was collected by Š. Husák (Botanical Institute of the Academy of Science, Třeboň) at the locality described in the present paper as early as in 1982, as was revealed by the revision of his private herbarium.

Both microsites are situated very close to a small parking lot along the road near the bridge across the Latorica river; introduction of diaspores by an accidental visitor from overseas cannot be therefore excluded. The possibility of a garden escape is also improbable as the species has not been known from a few botanic gardens nearby and is also absent from the Index Seminum of the Botanic Garden of Košice.

Concerning the introduction of *C. scoparia* to Eastern Slovakia, it is necessary to obtain more information on the biology of the species or the way it migrates outside its original distribution area in the North America. A thorough floristic investigation of the adventive area could possibly bring about more precise information on its adventive distribution and mode of introduction to Slovakia.

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## Souhrn

V srpnu 1992 jsme v oblasti Východoslovenské nížiny našli v pobřežní vegetaci slepých ramen řeky Latorica, v blízkosti obce Lelés, severoamerickou ostřici *Carex scoparia* Schkuhr, ze sekce *Ovales*. Tento nález představuje první údaj o zavlečení tohoto druhu mimo americký kontinent a druh lze označit za další neindigenofyt pro území Slovenska i střední Evropy. Druh je na novém stanovišti dobře naturalizován na dvou blízkých lokalitách v porostech přirozeného až polopřirozeného charakteru (*Caricion gracilis*) v litorálu slepých ramen. Tato stanoviště jsou převážnou část roku podmaččená, v letním období alespoň vlhká.

*Carex scoparia* je původní v Severní Americe (jižní část Kanady a území USA), kde je považována za temperátně boreální, transkontinentální druh. Zavlečení *C. scoparia* do střední Evropy je velmi pozoruhodné, otázka způsobu zavlečení však zůstává otevřená. Druh je schopen se šířit jak záplavami v nivách větších řek, tak i vodními ptáky; primární zdroj diaspor zatím nelze identifikovat.

Morfologické znaky, jak vegetativních, tak i generativních částí dosti výrazně odlišují *C. scoparia* od dosud známých, jak zavlečených, tak původních druhů sekce *Ovales* na území bývalého Československa: *C. muskingumensis* a *C. ovalis*. *C. scoparia* je nápadná poměrně vysokými, vzpřímenými fertilními lodyhami a zvláště sterilními výhony, které sahají až do 2/3 výšky fertilních lodyh. Květenství je u nalezených rostlin většinou podepřeno štětinovitým listenem o délce 5–35 mm. Květenství je za zralosti o málo delší než u *C. ovalis*, klásky jsou více nahloučené a ve větším počtu oproti *C. ovalis*; některá květenství mají oddálené spodní klásky. Barva je po odkvětu světle slámová až zelenavoběžová, u zralých světle hnědá. Mošnička je pergamovitá, velmi tenká a plochá, kopinatá až vejčité kopinatá, mírně prohnutá, nad polovinou široce na

obvodu blanitá, s prosvítající nažkou, postupně zúžená v dlouhý zobánek. U *C. ovalis* je charakter mošničky zcela jiný: plankonvexní tvar na příčném průřezu, tvar vejčitý až vejčité kopinatý, s lemem jen podél náhle zúženého zobánku.

Klíč k určení středoevropských zástupců rodu *Carex* sect. *Ovales*

1a. Květenství rozvolněné, často v dolní části přetrhované, 60–90 mm dlouhé; klásky až 25 mm dlouhé, větvenitě až podlouhle válcovité, špičaté; mošničky 5.5–8.0 mm dlouhé . . . . . *C. muskingumensis*

1b. Květenství většinou v hustou vejčitou hlávku stažené, vzácně ve spodní části s oddáleným kláskem, 17–38 mm dlouhé; klásky 6–12 mm dlouhé, oválné až obvejčité, na vrcholu tupé; mošničky 4.0–5.5 mm dlouhé . . . . . 2

2a. Sterilní výhony šikmo vystoupavé, málo nápadné, dosahují nejvýše do 1/3 výšky fertálních lodyh; mošničky na průřezu plankonvexní, v obrysu vejčité, náhle zúžené v zobánek . . . . . *C. ovalis*

2b. Mimo fertální lodyhy vyrůstají z trsu vzpřímené sterilní výhony dosahující až 2/3 výšky lodyh fertálních; mošničky na průřezu ploché, pergamenovité konzistence, v obrysu kopinaté až úzce kopinaté, pozvolna zúžené v zobánek . . . . . *C. scoparia*

## Literatura

- Britton N. et Brown H. A. (1913): Illustrated flora of the northern United States, Canada and the British possessions. Vol. 1. – New York.
- Gleason H. A. (1958): The new Britton and Brown illustrated flora of the northeastern United States and adjacent Canada. Vol. 1. – Lancaster.
- Grüll F. (1952): *Carex muskingumensis* Schw. na novém stanovišti. – Čs. Bot. Listy, Praha, 5: 39–40.
- den Held H. et Kortselius J. (1964): *Carex crawfordii* Fern. Weer in Nederland. – Gorteria, Leiden, 2: 21–22.
- Hermann F. J. (1970): Manual of the *Carices* of the Rocky Mountains and Colorado Basin. – Forest Service, Washington.
- Jedlička J. (1949): *Carex muskingumensis* Schwein., nová adventivní ostřice pro ČSR. – Čs. Bot. Listy, Praha, 2: 11–12.
- Kükenthal G. (1909): *Cyperaceae-Caricoideae*. – In: Engler A., Das Pflanzenreich, Vol. 4/20, Leipzig.
- Mackenzie K. K. (1940): North American *Cariceae*. Vol. 1. – New York.
- Robertson A. (1984): *Carex* of Newfoundland. – Minister of Supply and Services Canada, St. John's, 252 pp.
- Scoggan H. J. (1978): The flora of northeastern Canada. Vol. 2. – National Mus. Natur. Sci., Ottawa, 545 pp.
- Smejkal M. (1980): Komentovaný katalog moravské flóry. – Univerzita Jana Evangelisty Purkyně, Brno, 301 p.
- Wiegand K. M. (1926): The flora of the Cayuga Lake Basin, New York. – Ithaca, New York.

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