

## ***Carex derelicta*, a new species from the Krkonoše Mountains (Czech Republic)**

*Carex derelicta*, nový druh ostřice z Krkonoš

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A new species of the *Carex flava* complex (*Cyperaceae*) is described from the Czech Republic. It is known only from the type locality and is assumed to be endemic to the Krkonoše Mts. Its systematic position along with karyological and ecological notes are presented here. The new entity proposed, *Carex derelicta*, is included in the subsection *Serotinae* of the section *Ceratocystis*. The distinctive features of this species are its combination of globose to shortly cylindrical female spikes, glumes of female spikes equalling or exceeding the perigynia; perigynia 2.0–2.5 mm long, not inflated, vivid green, beaks 0.4–0.7 mm long and achenes completely filling perigynia. The chromosome number  $n = 35$  is the first reported for this taxon.

**Key words:** *Carex flava* group, chromosome number, determination key, Giant Mts, taxonomy

### **Introduction**

The *Carex flava* group (section *Ceratocystis* Dumort.) is distributed throughout the world and one of the most complex within the genus *Carex*. It is also one of the most thoroughly studied groups within the *Cyperaceae* as a whole. For a comprehensive list of the papers on the systematics of *Carex flava* group see Pykälä & Toivonen (1994) and Hedrén (2003). In the Czech Republic, the *Carex flava* complex has been studied by Holub (Holub 1960, 1965, 1999) and Havlíčková-Štěpánková (Havlíčková 1982, 1983, Štěpánková 1984, Stoeva & Štěpánková 1988, 1990).

There are several possible explanations of the complexity of this group. A great phenotypic plasticity, hybridization and introgression results in morphologically unclear populations. In contrast, genetic isolation by geographical distance of several populations results in new, often endemic, morphologically distinct forms. Such morphologically conspicuous plants were recorded in the glacial cirque Velká kotelná jáma, Krkonoše Mts (Giant Mts), by the famous Czech botanist Josef Holub (Holub 1960, 1965). They were provisionally named *C. oederi* Retz. subsp. *pseudoscandinavica* (Holub et al. 1979) or *C. viridula* Michx. subsp. *pseudoscandinavica* (Holub 1999, Grulich & Řepka 2002). While studying the *Carex flava* complex in the Czech Republic, Havlíčková (1983) published diacritical morphological characters and ecological notes on this population. Unfortunately up to now, this conspicuous species has not been validly described.

## Description of the new species and comments

### *Carex derelicta* Štěpánková, spec. nova

Type: Bohemia borealis, montes Corcontici, in fissura rupis humidis in convexum Velká kotelná jáma, sub jugamento inter convexum Velká et Malá kotelná jáma, lat. bor. 50°46', long. orient. 15°32', alt. ca 1320 m s. m., leg. J. Štěpánková 26. 7. 1991 (holo: PRA-0696, iso: PRA-0697; PR 11985).

Description: Herbae cespitosae; culmi plerumque 10–25 cm alti, glabri. Folia basilaria 1.2–2.2 mm lata, canaliculata, culmum non prominentia; vaginae basilariae pallide brunneae, glabrae; folia caulina 2–3, 1.0–2.0 mm lata, canaliculata. Spicae pistillates 2–3(–5), globosae usque breviter cylindricae, 4–10 mm longae, superiores approximatae, inferiores remotae, raro omnes remotae; squamae pistillates utriculis aequilongae vel prominentes. Utriculi 2.0–2.5 mm longi, 1.3–2.0 mm lati, corpus obovatus, non vesicarius, ad achenium arcte appressus, in rostrum abrupto contractus; rostrum breviter serrulatum 0.4–0.7 longum. Achenium 0.9–1.3 mm longum, 0.7–1.1 mm latum. Stigmata 2. Antherae 3.

Description: Cespitose in small clumps, perennial. Culms 10–25 cm tall, conspicuously exceeding the basal leaves, erect, obtusely triangular in cross section, smooth. Basal leaves 1.2–2.2 mm wide, canaliculate (in cross section), glabrous; basal sheaths glabrous, not reticulate-split, pale brown. Cauline leaves 2–3, 1.0–2.0 mm wide, canaliculate, with well developed sheaths; ligula very poorly defined; mouth of ventral face of leaf sheath concave or truncate, white or pale brown, hyaline. Staminate spike solitary, terminal, shortly pedunculate or sessile; staminate scales 2.8–3.5 mm long, ovate, subacute to acute, glabrous, brown with a stramineous or pale brown center and sometimes very narrow hyaline margins, 1 (–3)-veined. Pistillate spikes 2–3 (–5); upper ones crowded and the lower one remote or rarely all distant, globose to shortly cylindrical, 4–10 mm long, 3–6 mm wide at maturity; pistillate scales 1.5–2.5 mm long, equal or exceeding perigynia, ovate, acute to acuminate, sometimes with short awn, glabrous, brown with a stramineous or pale brown center and sometimes very narrow hyaline margins, 1-veined; lowermost bract leaf-like, conspicuously exceeding the inflorescence, the upper ones often setaceous, from shorter than to slightly exceeding the inflorescence. Perigynia straight, obliquely patent, 2.0–2.5 mm long, 1.3–2.0 mm wide at maturity, vivid green to yellowish brown, never grey green, glabrous; body of the perigynium ovoid, not inflated, abruptly contracted to the straight beak 0.4–0.7 mm long, clearly bifid, smooth at the margin. Achenes 0.9–1.3 mm long, 0.7–1.1 mm wide, closely included in the body of perigynium, ovoid, pale brown, short stipitate. Stigmas 2. Anthers 3 (Fig. 1, 2).

### Chromosome number

Chromosome number:  $n = 35$ . Locality: Czech Republic, Krkonoše Mts, Velká kotelná jáma glacial cirque. 50°46' N, 15°32' E, ca 1320 m a.s.l., coll. J. Štěpánková 1991.

Chromosome numbers of five plants, collected randomly in the field and cultivated in the experimental garden of the Institute of Botany at Průhonice, were counted. In early spring, just as the staminate spikes emerged from the leaf rosettes they were collected and fixed in a fresh solution of ethanol and acetic acid (3 : 1). The squash method and staining with lacto-propionic oreceine were used. Metaphase of the first meiotic division in the pollen mother cells was studied. Regular meiosis was observed in all cases, with complete pairing of chromosomes (Fig. 3). The chromosome number  $n = 35$  is that most often reported for the *C. serotina* group (e.g., Schmid 1982, Stoeva & Štěpánková 1988, 1990, Halkka et al. 1992, Luceño & Castroviejo 1993).



Fig. 1. – *Carex derelicta*, general habit.



Fig. 2 – *Carex derelicta*, young inflorescence.

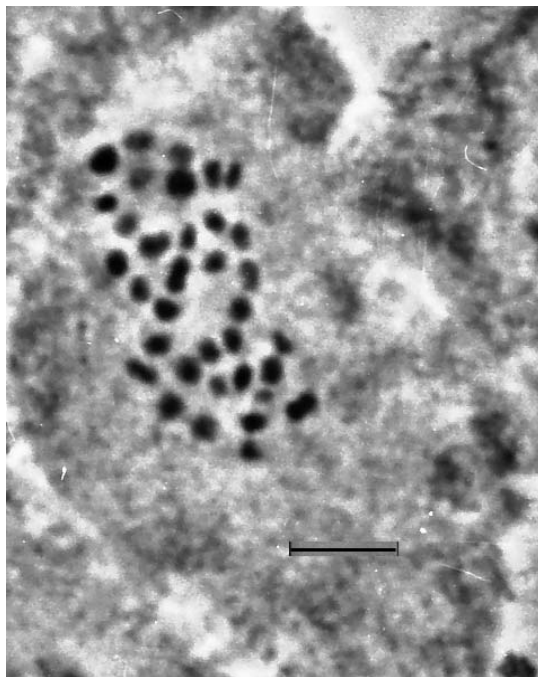


Fig. 3. – Metaphase of the first meiotic divisions of a pollen mother cell of *Carex derelicta*;  $n = 35$ . Scale bar = 10  $\mu\text{m}$



Fig. 4. – Mature inflorescence: a – *Carex scandinavica*, b – *C. derelicta*, c – *C. oederi*, d – *C. demissa*.

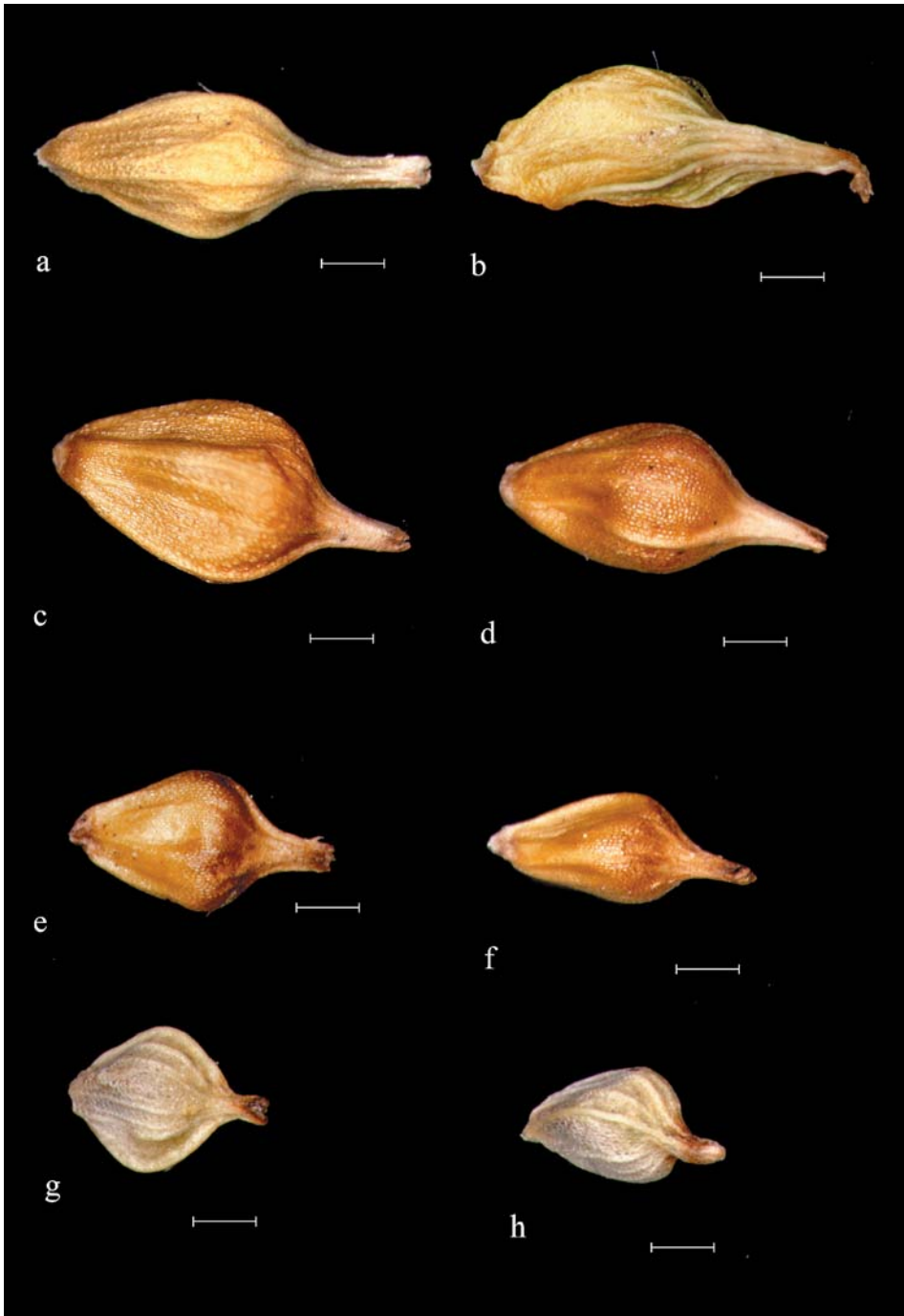


Fig. 5 – Perigynia of species of *Carex* subsect. *Serotinae*: a – *Carex demissa*, frontal view, b – *C. demissa*, lateral view, c – *C. oederi*, frontal view, d – *C. oederi*, lateral view, e – *C. derelicta*, frontal view, f – *C. derelicta*, lateral view, g – *C. scandinavica*, frontal view, h – *C. scandinavica*, lateral view. Scale bar = 500  $\mu$ m.

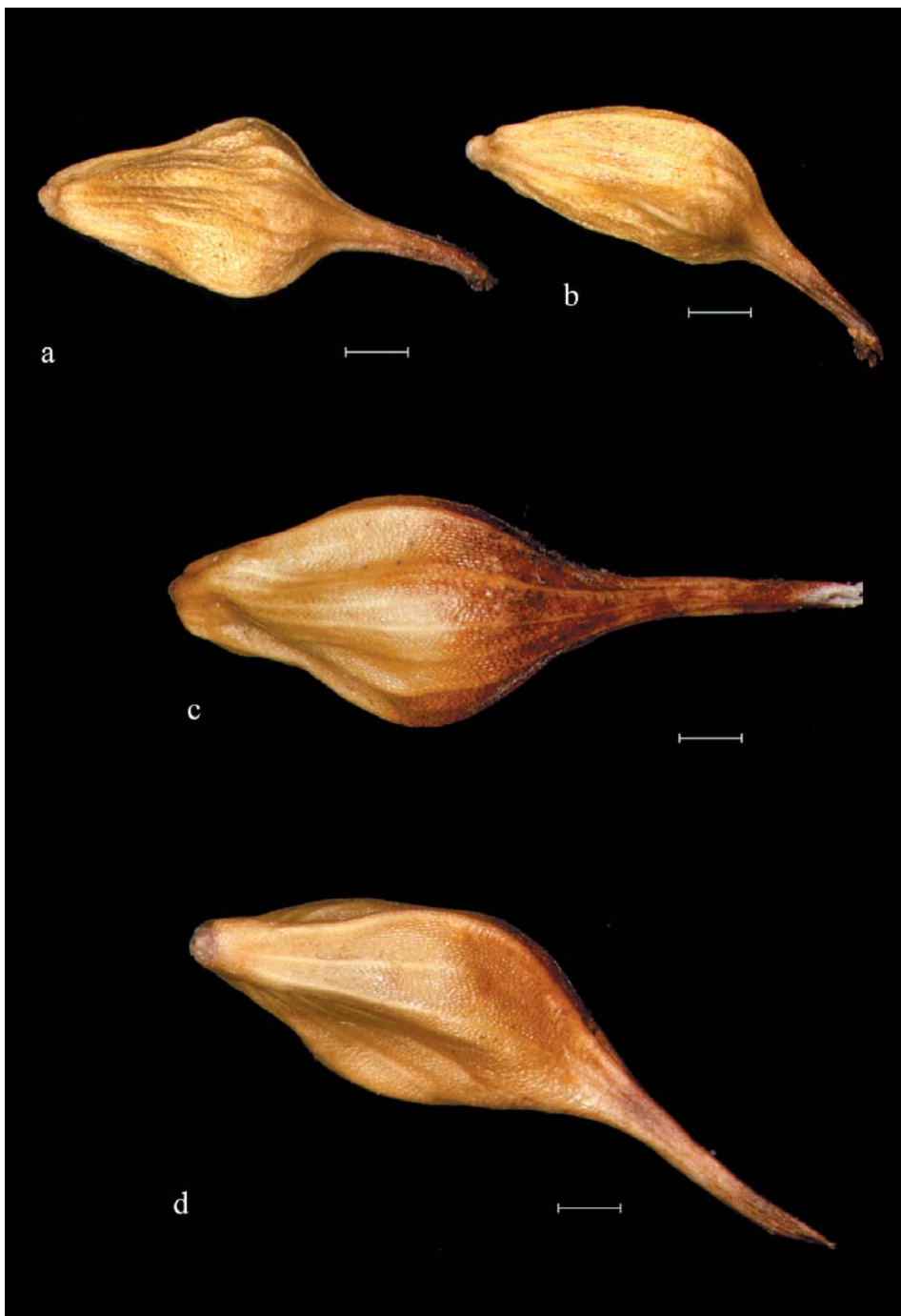


Fig. 6 – Perigynia of species of *Carex* subsect. *Flavae*: a – *Carex lepidocarpa* – frontal view, b – *C. lepidocarpa* – lateral view, c – *C. flava* – frontal view, d – *C. flava*, lateral view. Scale bar = 500  $\mu\text{m}$ .

### Key to the species of the *Carex flava* group in the Czech Republic

- 1a Perigynia at maturity deflected, 3.5–6.5 mm long, with beak curved down, 1.2–2.0 mm long; plants up to 80 cm high ..... **2**
- 1b Perigynia at maturity straight, 2.0–4.5 mm long, with beak straight, 0.4–1.4 mm long; plants usually up to 40 cm high ..... **3**
- 2a Male spike usually sessile, upper first and second female spikes close together, lowest one sometimes more distant, the lowest bract 2–4× longer than inflorescence; perigynium 5.0–6.5 mm long, body of perigynium gradually narrowed into the beak 1.5–2.0 mm long, achene fills 1/3–1/2 of perigynium body ..... *C. flava* L.
- 2b Male spike pedunculate, all female spikes distant from each other, lowest bract ± as long as inflorescence or shorter, perigynium 3.5–5.5 mm long, body of perigynium ± abruptly contracted into a beak 1.2–1.6 mm long; achene fills ± 1/2 of body of perigynium ..... *C. lepidocarpa* Tausch
- 3a Perigynia 2.5–4.5 mm long, with beak 1.0–1.4 mm long, male spike pedunculate, female spikes distant from one another, upper sometimes close together, lowest one remote (often nearly basal) ..... *C. demissa* Hornem.
- 3b Perigynia 2.0–3.0 mm long, with beak 0.4–1.2 mm long, male spike sessile or shortly pedunculate, female spikes close together or distant from one another, lowest one not more distant than at 1/2 of the stem ..... **4**
- 4a Glumes of female spikes equalling or exceeding the perigynia; perigynia 2.0–2.5 mm long, not inflated, beaks 0.4–0.7 mm long, achene completely fills the perigynium, basal leaves 1.2–2.2 mm wide ... *C. derelicta* Štěpánková
- b Glumes of female spikes shorter than perigynia; perigynia 2.5–3.0 mm long, more or less inflated, beaks 0.5–1.2 mm long, achene incompletely fills the perigynium, basal leaves 2–4 mm wide ..... *C. oederi* Retz.

### Systematic position

*Carex flava* group is characterized by very complicated patterns of variation between and within highly polymorphic individual taxa. This has resulted in a great number of classifications and nomenclatural concepts for this group. One of the most recent treatments is that of Egorova (1999). This concept is based on material from a great part of Eurasia and reflects both the morphological and phylogenetic relationships within the group. According to this treatment, representatives of *Carex flava* group are split to the two subsections – *Flavae* Carey and *Serotinae* T. V. Egorova (both from the section *Ceratocystis* Dumort.). Based on morphological and karyological characteristics, *C. derelicta* belongs to the subsection *Serotinae*. *Carex derelicta* is most similar to *C. scandinavica* E. W. Davies (≡ *Carex oederi* subsp. *pulchella* Lönnr.), a rare maritime species described from Sweden. The main differences between these species are given in Table 1. A comparison of the inflorescences and perigynia of the most similar members of the subsection *Serotinae* are given in Figs 4–6.

Table 1. – Morphological differences between *Carex derelicta* and *C. scandinavica*.

Character	<i>C. derelicta</i>	<i>C. scandinavica</i>
Female spikes	globose to shortly cylindrical	ovoidal to cylindrical
Perigynium	2.0–2.5 mm long	1.5–2.3 mm long
Colour	vivid green to yellowish brown	grey green
Length of the beak	0.4–0.7 mm	0.2–0.4 mm

The most plausible hypothesis of origin of *Carex derelicta* depends on two factors: (i) the restricted distribution on a small site in a glacial cirque suggests relict status, and (ii) the intermediate pattern of its morphological characters between that of the NW European *C. scandinavica* and other taxa of the subsection *Serotinae* indicates that reticulate evolution was important in its speciation. Hence two evolutionary processes may explain the

origin of the distinct population in the Krkonoše: refugial isolation of the NW European *C. scandinavica* (or close relative of it), which persisted in the Krkonoše Mts as a glacial relict, and its subsequent introgression with some other taxon of the subsection *Serotinae*. Without genetic analysis a parental combinations cannot be adequately determined. However, as *C. demissa*, together with *C. derelicta* are only representatives of the subsection *Serotinae* occurring in the Krkonoše Mountains, *C. demissa* is the most probable candidate for the second putative parental species.

### Distribution and ecology

*Carex derelicta* is known only from the type locality at the Velká kotelná jáma glacial cirque, and is assumed to be endemic to the Krkonoše Mts (e.g., Havlíčková 1983, Holub 1999). A relatively rich population of these plants is restricted to the wet small valley situated below the crest separating the Velká and Malá kotelná jáma glacial cirques, where there are moist flats consisting of muscovitic albitic mica-schist. As the locality lies under an outcrop of base-rich rocks of crystalline limestone and erlan, it is probable that leaching of  $\text{Ca}^{++}$  ions influences the soil conditions in this stand. *Carex derelicta* occurs predominantly in open spring vegetation, regularly subjected to natural disturbance by water. The plant communities mainly associated with *Carex derelicta* is *Swertio-Anisothecion squarrosi*. *Carex derelicta* occasionally occurs in the community *Saxifrago oppositifoliae-Festucetum versicoloris* (alliance *Agrostion alpinae*) – alpine basiphilous grassland occurring on the neighbouring rocky slopes. Rarely and ephemerally it is recorded in *Sphagno compacti-Molinietum caeruleae* (from the alliance *Calamagrostion villosae*) subalpine grasslands dominated by *Molinia caerulea*, which grow on adjacent sites.

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### Souhrn

V příspěvku je popsán nový druh ostřice, *Carex derelicta* Štěpánková, z Velké kotelné jámy v Krkonoších. Druh patří do subsekcce *Serotinae* T. V. Egorova sekce *Ceratocystis* Dumort. Hlavní diakritické znaky jsou: samičí klásky kulovité až krátce válcovité, plevy samičích klásků stejně dlouhé nebo delší než mošničky, mošničky 2.0–2.5 mm dlouhé, 1.3–2.0 mm široké, tělo mošničky vejčité, nenafouklé, těsně k nažce přitisklé, v zobánek náhle zúžené; zobánek mělce vykrojený, 0.4–0.6 mm dlouhý. Nažky 0.9–1.3 mm dlouhé, 0.7–1.1 mm široké.

Klíč k určení druhů skupiny *Carex flava* (ze sekce *Ceratocystis*) rostoucích v České republice:

- 1a** Mošničky za zralosti dolů sehnuté, 3.5–6.5 mm dlouhé, zobánek 1.2–2.0 mm dlouhý, dolů zakřivený; rostliny až 80 cm vysoké ..... **2**
- 1b** Mošničky za zralosti rovnovážně odstálé, 2.0–4.5 mm dlouhé, zobánek 0.4–1.4 mm dlouhý, rovný; rostliny obvykle do 40 cm vysoké ..... **3**
- 2a** Samčí klásek většinou přisedlý, samičí nahloučené nebo dolní krátce oddálený, nejdolejší listen 2–4× delší než květenství; mošničky 5.0–6.5 mm dlouhé, tělo mošničky postupně zúžené v 1.5–2.0 mm dlouhý zobánek, nažka vyplňuje 1/3–1/2 těla mošničky ..... ***C. flava* L.**



- 2b** Samčí klásek stopkatý, všechny samičí klásky navzájem oddálené, nejdolejší listen stejně dlouhý nebo kratší než květenství; mošničky 3.5–5.5 mm dlouhé, tělo mošničky  $\pm$  náhle zúžené v 1.2–1.6 mm dlouhý zobánek; nažka vyplňuje  $\pm 1/2$  těla mošničky ..... *C. lepidocarpa* Tausch
- 3a** Mošničky 2.5–4.5 mm dlouhé, s 1.0–1.4 mm dlouhým zobánkem, samčí klásek dlouze stopkatý, samičí navzájem oddálené, nebo horní nahloučené, dolní oddálený, často až do dolní 1/2 lodyhy ..... *C. demissa* Hornem.
- 3b** Mošničky 2.0–3.0 mm dlouhé, s 0.4–1.2 mm dlouhým zobánkem, samčí klásek přisedlý nebo krátce stopkatý, samičí nahloučené nebo dolní oddálený, nanejvýš však do 1/2 lodyhy ..... **4**
- 4a** Plevy samičích klásků delší nebo stejně dlouhé jako mošničky; mošničky 2.0–2.5 mm dlouhé, zobánek 0.4–0.7 mm dlouhý; nažka zcela vyplňuje tělo mošničky; dolní listy 1.2–2.2 mm široké ..... *C. derelicta* Štěpánková
- 4b** Plevy samičích klásků kratší než mošničky; mošničky 2.5–3.0 mm dlouhé, zobánek 0.5–1.2 mm dlouhý; nažka neúplně vyplňuje tělo mošničky; dolní listy 2–4 mm široké ..... *C. oederi* Retz.

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