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The sedge *Carex secalina* – critically endangered species in Poland: new locality in the breeding colony of black-headed gull *Chroicocephalus ridibundus*

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Abstract: A new locality of rye sedge *Carex secalina,* a critically endangered species was discovered on an island of Lake Kusowo, in the vicinity of Bydgoszcz (Kuyavian-Pomeranian Province), in June 2015. The species was found in a breeding colony of black-headed gull *Chroicocephalus ridibundus.* The population size was estimated at least at 30 individuals and all of them produced generative shoots. This locality of *C. secalina* is the northernmost in Poland and the only ascertained, apart from Inowrocław Plain. Colonization of the island by *C. secalina* was caused, probably, by zoochory as a result of accidental bringing of propagules by gulls, together with nesting material from outside the colony

Key words: *Carex secalina,* halophytes, endangered species, population size, island, breeding colony, gulls

1. Introduction

Rye sedge – *Carex secalina* Wahlenb. 1803 – is a perennial plant from the family of Cyperaceae, 10-30 cm in height. It forms dense tussocks consisting of numerous generative shoots and reproduces only by seeds. At the top of the stem, there are 1-3 male spikelets and below – 3 to 4 female spikelets can be found. It blooms in late May and early June (Piękoś-Mirkowa & Mirek 2006). In terms of habitat, the species is considered an obligate halophyte (Rutkowski 2004) and related to inland saline habitats. It grows in moist, extensively used pastures, on the banks of ponds and field water bodies. The species was also observed in ruderal sites (Lembicz *et al*. 2009).

C. secalina is a species with a broad but disjunctive Eurasian distribution range. Scattered localities of this plant are located in central, eastern and south-eastern Europe, throughout the Caucasus, Central Asia, south-eastern Siberia to Lake Baikal. Within its European distribution range, more numerous populations were found in south Germany, Austria, Hungary, south-eastern Ukraine and Russia (Meusel *et al.* 1965; Egorova 1999).

C. secalina is an endangered species in the European part of its range, placed on the European Red List of Vascular Plants and covered by the Bern Convention on the Conservation of European Wildlife and Natural Habitats. In Poland, it is protected under the Decree of the Minister of the Environment issued on the 9th October 2014, "On the Protection of Plant Species". *C. secalina* is also listed in the "Polish Red Data Book of Plants", where it is classified as critically endangered because of its rarity, scarce resources and habitat transformation, which is considered the main cause of this species regression. The species requires active protection.

Until the year 2000, *C. secalina* was considered extinct in Poland. Currently, places of its occurrence are limited to the Inowrocław Plain, near the town of Inowrocław, where it was recorded on 8 sites: Bąbolin, Jacewo, Turzany, Szymborze, Dulsk, Radojewice, Skotniki and in the vicinity of Sikorowo (Lembicz *et al.* 2009; Dominiak & Jakubas 2015).

2. Material and methods

The population of *C. secalina* on the island of Lake Kusowo was discovered by accident in the course of studies carried out on the breeding biology and migratory strategies of black-headed gull *Chroicocephalus ridibundus* Linnaeus 1766.

CHOROLOGY

The aim of this study was to: (*i*) characterise the habitat occupied by *C. secalina* and (*ii*) evaluate the size of its population.

The analysis of *C. secalina* population size on the island situated on Lake Kusowo was made in June 2015 by finding all specimens of this species. General assessment of species composition of island flora and species accompanying rye sedge was also performed.

3. Results

3.1. Location and characteristics of the habitat

The new locality of *C. secalina* was found on an island located on Lake Kusowo (geographical coordinates: 53°15'01,28''N; 18°08'29,91''E), in June 2015. It is situated 9 km north of Bydgoszcz (Kuyavian-Pomeranian Province), in the vicinity of villages Dobrcz and Kusowo. According to the ATPOL cartogram, a new locality is situated in the grid square CC17 (Zając & Zając 2001) (Figs. 1-2). It is 45 km away from the nearest previously known locality in the village of Bąbolin, in the ATPOL grid square CC59 (Zając & Zając 2001). The species was found on the island of approximately 0.82 hectare area, inside a breeding colony of black-headed gull *Chroicocephalus ridibundus*. The coastal vegetation of the island consisted of common reed *Phragmites australis* and cattail *Typha sp.* growing along the banks. The central part of the isle was overgrown by clusters of willow shrubs *Salix sp.* Surfaces inside the island were dominated by common nettle *Urtica dioica,* lady's thumb *Polygonum persicaria*, lamb's quarters *Chenopodium album*, as well as Welted thistle *Carduus crispus*, great willow herb *Epilobium hirsutum* and purple loosestrife *Lythrum salicaria* (Fig. 3).

3.2. Population condition and size

Population of *C. secalina* consisted of at least 30 tussocks. A large part of them was overgrown by a lush

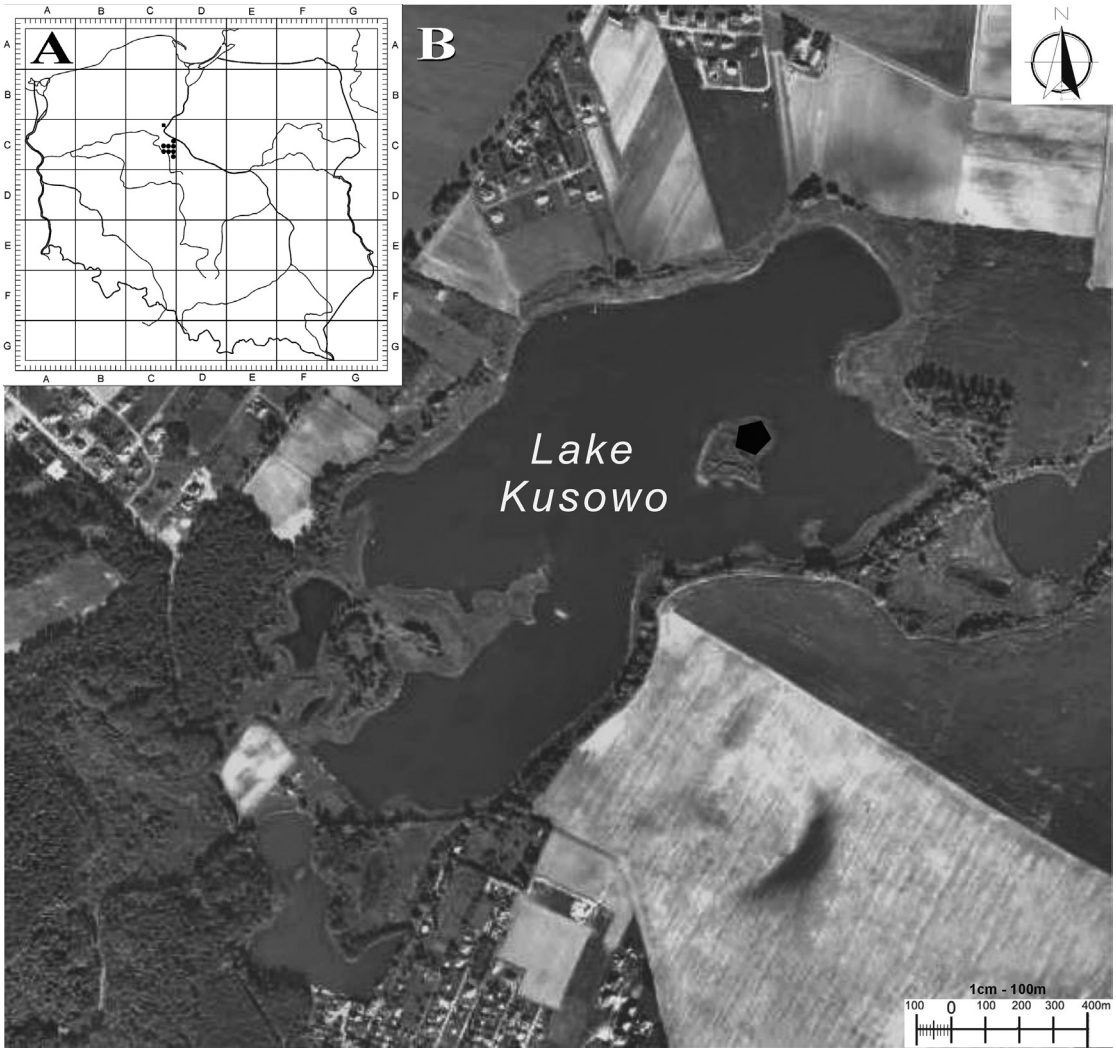

Fig. 1. Distribution of *Carex secalina* in Poland – A, and on the island on Lake Kusowo (the ATPOL grid square CC17) – B
Explanations: ■ – a new locality on Lake Kusowo; ⬟ – the part of island occupied by *C. secalina* population

Fig. 2. New locality of *Carex secalina* – the island on Lake Kusowo (photograph by R. Sandecki)

Fig. 3. Nitrophilous vegetation accompanying *Carex secalina* in the breeding colony of black-headed gull *Chroicocephalus ridibundus* on the island situated on Lake Kusowo (photograph by R. Sandecki)

Fig. 4. *Carex secalina* overgrown by lush growth of vegetation on the Lake Kusowo island (photograph by R. Sandecki)

Fig. 5. *Carex secalina* on the island situated on Lake Kusowo (53°15'01,28''N; 18°08'29,91''E), the Kujawy-Pomerania Province, Kusowo (photograph by R. Sandecki)

Fig. 6. Nesting material deposited by black-headed gull *Chroicocephalus ridibundus* on the tussock of *Carex secalina*, Lake Kusowo island (photograph by R. Sandecki)

growth of vegetation caused by the accumulation in the soil of nutrients derived from excrement deposition, collected nesting material, decomposed, unhatched eggs as well as dead chicks and adult birds (Fig. 4). Only a small part of the population occupied open spaces, not covered by competitive vegetation (Fig. 5). All recorded individuals produced generative shoots. Deposition of nesting material by gulls was observed on several tussocks of rye sedge growing on the island (Fig. 6).

4. Discussion

The newly discovered locality of rye sedge *C. secalina* is the northernmost site of the species in Poland. The origin of this locality of *C. secalina* on

the island on Lake Kusowo is probably related to the black-headed gull breeding colony there. To build nests, these birds use mainly plant parts available in the immediate vicinity of the colony, very rarely transporting nesting material from a distance of 200-300 meters and only exceptionally from places remote more than 3 km (Mauersberger 1977; Indykiewicz 2001). It may be assumed that rye sedge diaspores were dragged to the island by nest-building birds (epizoochory), which transported material from a distance of up to several hundred meters away from the breeding colony. Thus, the occurrence of *C. secalina* in the immediate vicinity of Lake Kusowo could be justified.

The transport of seeds through endozoochory inside the digestive tract and their subsequent expulsion with excrements or in the form of pellets can not be excluded, although it seems unlikely due to the fact that the main component of the diet of gulls is food of animal origin. In studies conducted by Indykiewicz (2001) on black-headed gulls nesting on an island on Lake Myślęcinek, remote from the reviewed locality of 12 km, it was found that almost 92% of gastric contents of chicks were insects, and the remaining 8% were other invertebrates, remains of vertebrate animals and different sizes of plant fragments found in 61.5% of the analysed samples.

A different view on the role of black-headed gulls regarding the spread of propagules was presented by Bukaciński *et al.* (1994), who conducted research on this species breeding on the islands of middle Vistula. They suggest that the role of these birds in the dispersion of propagules of weed seeds is limited and the key role in this respect can be attributed to the stream of water, which accumulates large amounts of organic matter and viable seeds along the island shorelines.

The locality of rye sedge discovered currently differs in terms of habitat character from those previously described in literature. Habitat conditions on the island are affected by fluctuations of water levels of Lake Kusowo and by the presence of black-headed gull colony during the breeding season, whose breeding population comprises ca. 1100 pairs (Indykiewicz, unpublished data). The presence of birds in such high numbers affects soil conditions, among other things, by increasing levels of nitrogen and phosphorus through accumulation of allochthonous organic matter as nesting material, dead birds, eggs, pellets or droppings (Hogg & Morton 1983; Bukaciński *et al.* 1994), leading to habitat eutrophication. The presence of *C. secalina* in this locality, therefore, confirms the view that it is a nitrophilous plant (Bogdanowicz *et al.* 2014). Faeces deposition also plays a significance role because, apart from its fertilizing effect, it also diminishes photosynthesis as well as respiration, while excessive accumulation of faeces can lead to the destruction of vegetation cover as a result of toxic effects of high concentrations of ammonium nitrogen (Gillham 1956, 1961; Sobey & Kenworthy 1979; Hogg & Morton 1983; Breslina 1987; Hogg *et al.* 1989). The effect of birds on the vegetation cover of the island is also evident in trampling, digging of scrapes or pulling out plants to build nests, causing mechanical damages of shoots, which *C. secalina* seems to be resistant to, as confirmed by its presence in pastures, where high generative reproduction compensates the damage caused by grazing animals (Bogdanowicz *et al.* 2014).

Variable water conditions which can lead to flooding of the island surface in the years with high water levels as well as lush growth of vegetation caused by an advancing process of habitat eutrophication are main threats to the existing population of *C. secalina* on the island located on Lake Kusowo.

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