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A NEW LOCALITY OF WEEPING ALKALIGRASS *CAREX SECALINA* (CYPERACEAE) IN POLAND

Martyna Dominiak, Emilia Jakubas

M. Dominiak, Department of Plant Taxonomy, Adam Mickiewicz University, Umultowska 89, 61-614 Poznań, Poland, e-mail: martynadominiak@o2.pl

E. Jakubas, Department of Hydrobiology, Institute of Environmental Biology, Faculty of Biology, Adam Mickiewicz University, Umultowska 89, 61-614 Poznań, Poland, e-mail: emijak@amu.edu.pl

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Abstract. A rare and protected species of the sedge *Carex secalina* was recorded in Dulsk near Inowrocław (Kujawy-Pomerania Province) in June 2014. It occupied the shores of ephemeral midfield water reservoirs in the complex of intensively used crop fields. Two subpopulations of this sedge with 36 tussocks in total were found. In the first subpopulation, the tussock diameter reached up to 25 cm, with 12–16 generative shoots per a tussock, while in the second subpopulation, the diameter was up to 10.5 cm, with 2–11 generative shoots. The rapid spread of this halophyte species is probably connected with the presence of permanent soil seed bank. This observation indicates a high potential of *Carex secalina* to colonise new habitats.

Key words: *Carex secalina*, halophytes, threatened species, habitat conditions, population size, reproduction

INTRODUCTION

Carex secalina Willd. ex Wahlenb. 1803 (weeping alkaligrass) is an obligatory halophyte with a disjunctive Eurasian range (Meusel et al. 1965, Żukowski et al. 2005, Eliáš et al. 2012). It occurs in the scattered and isolated localities in Europe and Asia and is considered rare over the whole area of its distribution. In several European countries, the species has a status of vulnerable (VU category, e.g. in Austria and Czech Republic) or critically endangered (CR category, e.g. in Slovakia) (Eliáš et al. 2012). In Poland, it is included in red lists as an endangered (E) (Zarzycki & Szeląg 2006) or critically endangered (CR) species (Chmiel et al. 2001, Żukowski et al. 2005, Eliáš et al. 2012). In the European part of its range, the species is relatively numerous only in Hungary, Germany and southern parts of Ukraine and Russia (south of the Dnieper and Volga Rivers estuaries) (Eliáš et al. 2012). The Asian part of *Carex secalina* range consists of isolated localities scattered from the south Ural in the West, through Kazakhstan, to Lake Baikal in the East (Meusel et al. 1965, Egorowa 1999). Weeping alkaligrass is also mentioned in the flora of North America as an alien species, accidentally introduced and naturalized (Werier & Naczi 2012).

Carex secalina occupies wet or marshy meadows and pastures (of the class *Festuco-Puccinellietea* and *Scorzonero-Juncetea*), often highly saline (Lembicz et al. 2009, Eliáš et al. 2012). It also occurs on the shores of lakes, temporary water holes and broads, as well as in anthropogenic habitats (e.g. field margins, roadsides, marl and peat pits, fertilizer storage yards and pond banks). Weeping alkaligrass is a perennial, tussock plant, reproducing only by seeds. Its seeds show high germination capacity (Lembicz et al. 2011). Besides typical dioecious inflorescences, individuals of *Carex secalina* may produce also bisexual inflorescences (Lembicz et al. 2006). The species starts to reproduce in the first year of its life (Lembicz et al. 2011). Individuals cultivated in the uniform, stable conditions of field experiment may live even up to 6 years and produce over 300 generative shoots per year (Bogdanowicz et al. 2011).

The aim of this work was to: (1) characterise the habitat conditions and species composition of the studied locality of weeping alkaligrass and (2) evaluate the size of the species population and reproduction rate.

LOCATION OF A NEW LOCALITY

The new locality of *Carex secalina* was found in the town of Dulsk in June 2014. It is situated 5 km east of Inowrocław (Kujawy-Pomerania Province), on the right side of the road from Sikorowo to the Dziennice-Góra crossing (Fig. 1), in the ATPOL grid square CC68 (Zając & Zając 2001).

MATERIAL AND METHODS

The field studies were conducted during the June-August period. In the studied locality of *Carex secalina*, a phytosociological relevé was made using the classical Braun-Blanquet method (Dierschke 1994). The basic physical and chemical parameters of ground water (electrolytic conductivity, pH and chloride con-

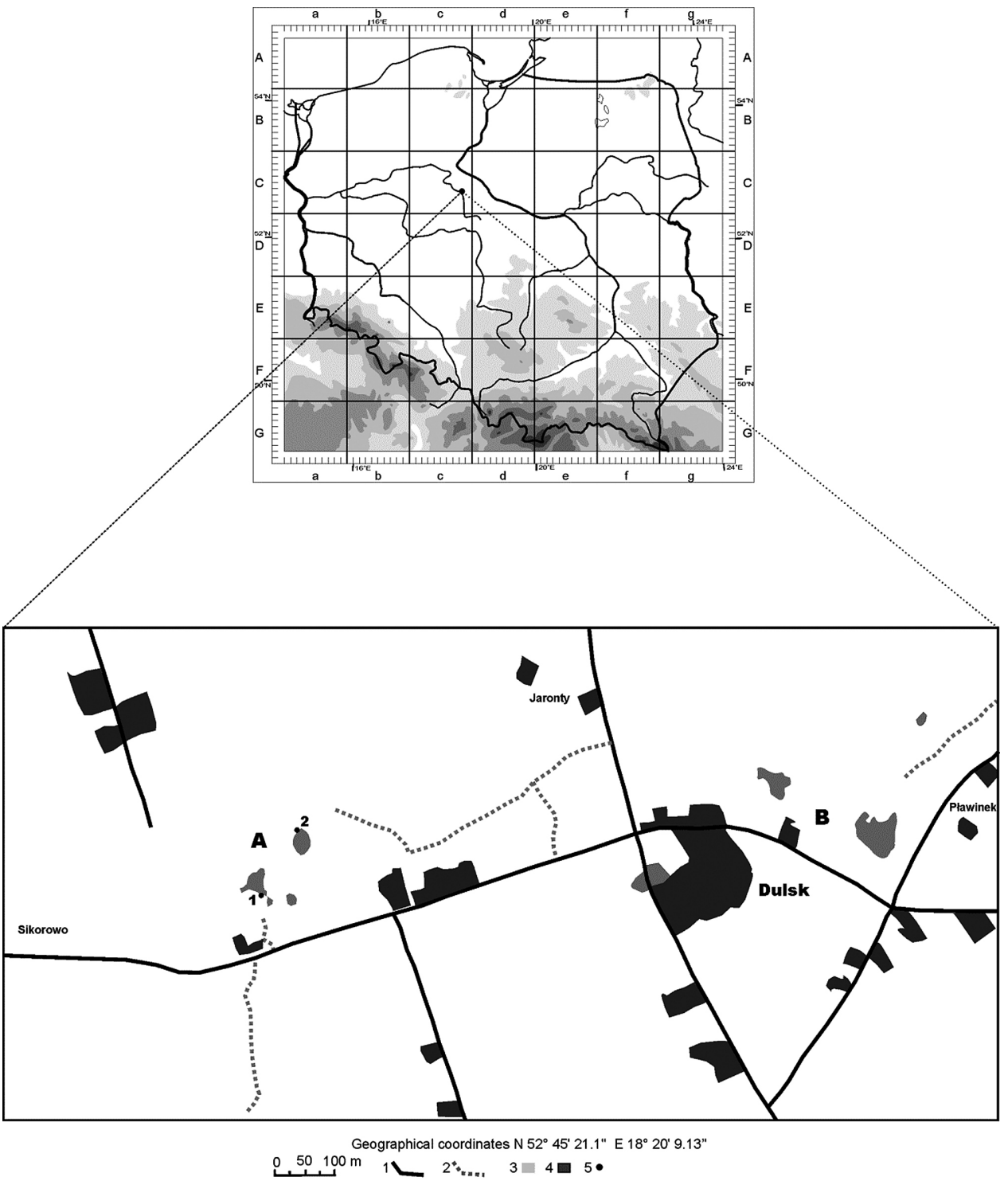

Fig. 1. Location of the new locality of *Carex secalina* (in the ATPOL grid square CC68): A – new localities, B – localities not confirmed from literature data

Abbreviations: 1 – road, 2 – watercourse, 3 – temporary ponds, 4 – sites subpopulation (1 and 2). See detailed in the text.

tent) were determined in the patch. In addition, water samples were collected from the related water bodies for laboratory analyses. Both pH and electrolytic conductivity were measured directly in the field using a multiparameter system (YSI 556 MPS), while the chloride content and salinity of the collected samples were measured in laboratory conditions.

Also, the size of population was determined in the field and the following parameters were measured: (1) tussock diameter, (2) tussock height, and (3) number of generative shoots. In total, 36 tussocks of *Carex secalina* were analysed. The nomenclature of vascular plant species was given after Mirek et al. 2002. The names of plant communities were adopted after Ratyńska et al. 2010.

RESULTS

NEW LOCALITY – CHARACTERISTICS

The new locality of *Carex secalina* is situated 1.5 km east of the site previously reported in literature (e.g. Żukowski et al. 2005, Lembicz et al. 2009), located along the nameless water bodies lying between Dulsk and Pławinek. The presence of *Carex secalina* in this place has not been confirmed after 2012 (Lembicz et al. pers. comm., own observations). In 2012, the species occurred on the edges of ephemeral water bodies in the complex of intensively used crop fields. Its population was situated on the field margin and along the banks of two, out of three, water bodies in this area. These water bodies are characterised by high water level fluctuations and partially or completely dry up during summers. In summer 2012, their water surface areas were as follows: 400 m^2, 30 m^2 and 170 m^2.

POPULATION DESCRIPTION

Subpopulation 1 comprised two individuals growing among the rush vegetation (*Phragmites australis*) of the largest water body (Fig. 2). The tussocks had 18–25 cm in diameter and contained 12–16 generative shoots. Subpopulation 2 occurred on the exposed banks of the water body situated furthest to the north (Fig. 2). It covered an area of 11 m^2 and comprised 34 tussocks, mostly of one-year-old seedlings. The average diameter of these tussocks was 2.3 cm in, while the largest one measured 10.5 cm. The tussock height ranged from 3.7 to 8.3 cm (5.4 cm on average). All individuals produced generative shoots. Their number ranged from 2 two 11 (5.5 on average).

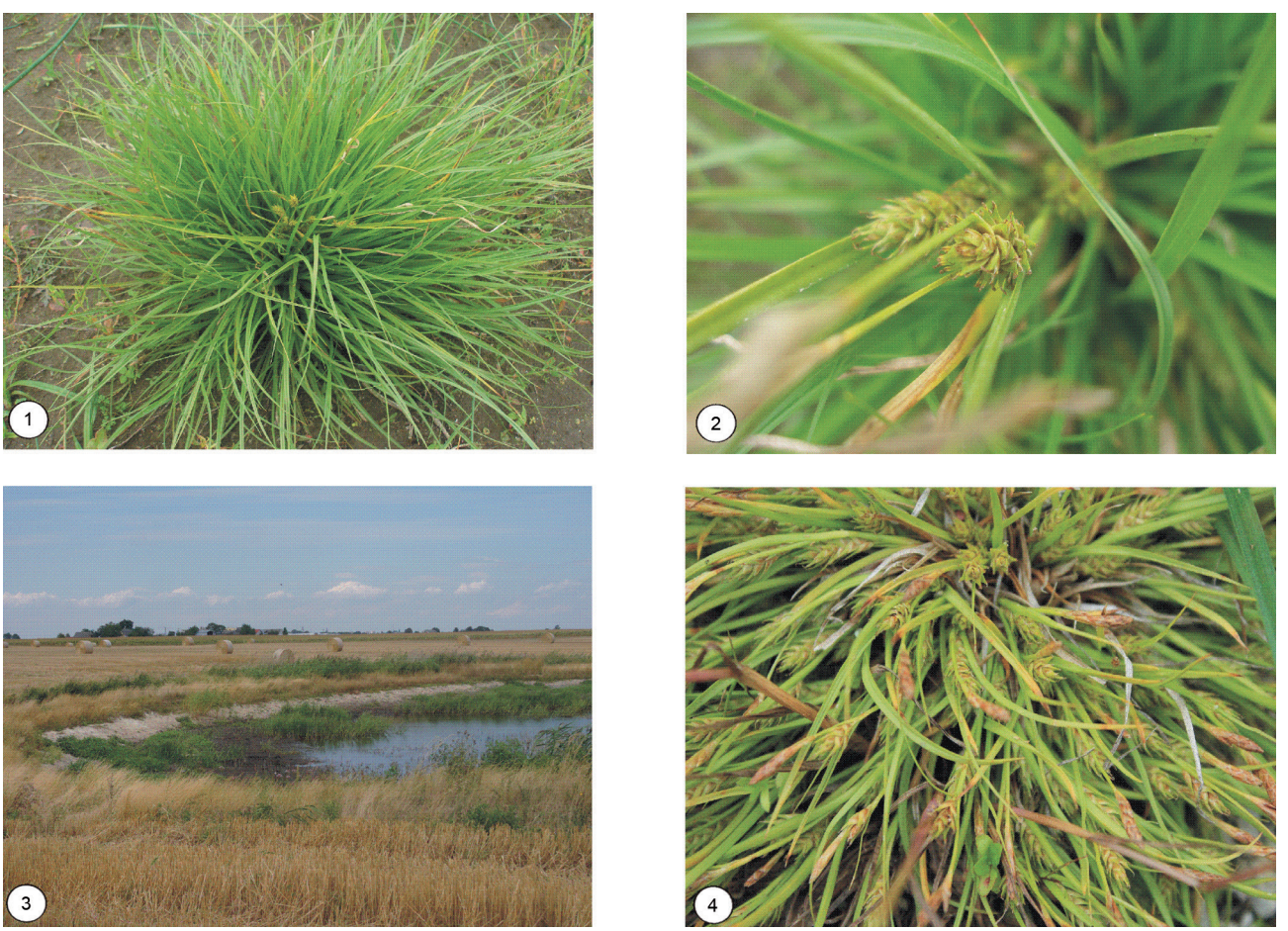

Fig. 2. Subpopulations of *Carex secalina* in the new locality: 1, 2 – subpopulation 1 among rush vegetetation; 3, 4 – subpopulation 2 on the exposed banks of the midfield water body

HABITAT CONDITIONS AND SPECIES COMPOSITION

The new population of *Carex secalina* occurred on the shores of eutrophic water bodies (1.2 m in depth) dominated by macrophytes. Their waters were characterised by high electrolytic conductivity (840 μS · cm^{-1}), alkaline pH (7.8) and high nutrients concentration. The chloride content was 18–22 mg Cl · l^{-1}. Vegetation of these water bodies was dominated by *Ceratophyllum submersum* and *Polygonum amphibium* f. *natans*. The shallow muddy banks were overgrown by *Phragmites australis, Butomus umbellatus* and *Bolboschoenus maritimus*, while the dried banks were occupied by communities with *Oenanthe aquatica*. The two tussocks of *Carex secalina* found in the gap of rush vegetation (subpopulation 1) were accompanied by such species as: *Alisma lanceolata, Schoenoplectus tabernaemontani* and *Peplis portula*.

Subpopulation 2 occurred on the steep banks of the third water body, between the field margin (dominated by *Trifolium fragiferum*) and the pond bank (patches of *Scirpetum maritimi* and *Polygonetum natantis*).

The *Carex secalina* presence was documented with a phytosociological relevé: date – 15.07.2014, area – 10 m^2, cover – 50%, species composition: *Carex secalina* 1.2, *Lycopus europaeus* 3.2, *Trifolium fragiferum* 3.3, *Carex hirta* 3.2, *Tussilago farfara* 2.2, *Bidens tripartita* 2.2, *Potentilla anserina* 1.1, *Chenopodium rubrum* 1.1, *Lolium perenne* 1.1, *Poa pratensis* +, *Rumex maritimus* +, *Chamomilla suaveolens* +, *Carex vulpina* +, *Plantago major* +, *Leontodon autumnalis* +, *Lactuca serriola* +, *Conyza canadensis* +, *Ranunculus sceleratus* r, *Lotus tenuis* r, *Oenanthe aquatica* r, *Taraxacum officinale* agg. r, *Epilobium adnatum* r.

Weeping alkaligrass was concentrated on the limestone ground (limestone debris) with the organic fraction of lake sediments. The ground water level in the analysed patch was 0.48–0.60 m below the ground level. The water was alkaline (pH = 8.2) and moderately mineralized (680 μS · cm^{-1}). The chloride concentration in the soil substrate was 38 mg Cl · l^{-1}.

DISCUSSION

The detailed data about the occurrence of *Carex secalina* in Poland, indicate that both historic and contemporary localities of this species are connected with the Kujawy region (Bock 1908, Chmiel et al. 2001, Żukowski et al. 2005 and Lembicz et al. 2009). In the beginning of the 20th century, nine localities were reported (Bock 1908). After the second world war, the species was regarded as extinct in the whole region (Żukowski et al. 2005). In 2000, two historic localities were confirmed and one new was found (Żukowski et al. 2005, Lembicz et al. 2009), while after 2000, eight new localities were discovered (Lembicz et al. 2009). After 2012, the species was not confirmed in two of these new localities: (1) pasture along the banks of two nameless water bodies between Dulsk and Pławinko and (2) pasture in the village of Bąbolin (Lembicz et al. pers. comm., own observations).

The origin of the newest population of weeping alkaligrass found in Dulsk in 2014 is difficult to determine. This locality can be considered an example of spontaneous spread or population regeneration. The population occupies an ephemeral habitat, which suggests that the species tolerates moderate disturbance. In 2012, this locality was flooded as a result of a freshet of the Noteć river. The high water level lasted until the late summer. Probably, the occurrence of this rare sedge and its appearance in the new locality in 2014, is connected with the presence of permanent soil seed bank. As it has been shown by experimental studies, the seeds of *Carex secalina* are characterised by a high germination capacity, which is retained for years (Lembicz et al. 2006, Bogdanowicz et al. 2011). Also, it is the first locality in which generative shoots were found in juvenile individuals. However, it cannot be excluded that the species seeds were brought into this area with calcium fertilizer.

Large populations of weeping alkaligrass were noted in the habitats that are extensively used as pastures and are affected by cattle grazing and trampling. *Carex secalina* was most often observed in sub-halophytic and temporarily flooded habitats, in the vicinity of small water bodies or, even, in the immediate proximity of farm buildings. Water bodies usually involve ponds or small lakes that serve as watering places for grazing animals (e.g. Żukowski et al. 2005, Lembicz et al. 2009).

A similar habitat character, connected with extensively used banks of temporary midfield water bodies, has the analysed locality in Dulsk. However, the elevated level of salinity and chloride concentration in soil and ground waters was not confirmed in this site. It should be also emphasized that in the studied locality, no other accompanying obligatory halophytes were found, which occurred in the previously described localities in the vicinity of Inowrocław, such as, *Glaux maritima* and *Puccinellia distans* (Lembicz et al. 2009).

Particularly interesting is the occurrence of a large group of one-year-old seedlings in the studied locality. This observation provides a new insight into the biology of *Carex secalina* in the conditions of Central Europe, indicating the species ability to colonise new localities. The thorough monitoring of *Carex secalina* populations, as well as the determination of their dynamic tendencies and potential spread capacity in the vicinity of Inowrocław are required.

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