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ANALYSIS OF SOME ECOLOGICAL AND BIOLOGICAL ASPECTS
OF *Scheuchzeria palustris* L. OCCURRING ON THE EXAMPLE
OF A STAND IN THE CZARNY ŁUG RESERVE
NEAR WOLBÓRZ (CENTRAL POLAND)

Ryszard Plackowski*, Joanna Sender**

* 9 Maja str. 6/14, 97-300 Piotrków Trybunalski, Poland, e-mail: plackowski@interia.pl

** Department of Hydrobiology and Protection of Ecosystems, University of Life Sciences in Lublin
Dobrzańskiego 37 str., 20-262 Lublin, Poland

Abstract. *Scheuchzeria palustris* is a species regarded as an arctic-boreal relic and critically endangered. The study was conducted on one of the recent stands in the Łódź region, in the Czarny Ług Reserve, located near Wolbórz. The primary aim of the study was to know the amount of this species and the associated species. Quantitative, morphological and floristic features were analysed. In the study area occurred about 150 specimens per 1 m². Among the associated species were found species representing classes: *Scheuchzerio-Caricetea Nigrae* and *Oxycocco-Sphagnetetea*. *Eriophorum angustifolium* was dominant among the first class species (60% coverage), while *Andromeda polifolia* and *Oxycoccus palustris* from the second class. From here it can be assumed that the succession will be in the direction of *Scheuchzerio-Caricetea Nigrae*. However, high water levels may inhibit this process. Specific biotic and abiotic conditions allow for the survival of this species. This is visible, among other things, in the mosaic structure of the studied stand.

Key words: *Scheuchzeria palustris*, Ellenberg numbers, habitat conditions, nature reserve, natural inventory

INTRODUCTION

Scheuchzeria palustris is a species regarded as an arctic-boreal relic [Kulczyński 1972]. Currently in Poland *Scheuchzeria palustris* has the status VU – vulnerable to extinction [Kaźmierczakowa 2016]. In the area of the Łódź region this species is critically endangered [Olaczek 2012]. According to the Regulation of the Environment Minister from 9 October 2014, relating to the protection of plant species [Rozporządzenie... 2014] this species is protected by the law in Poland.

Scheuchzeria palustris is quite common in western Pomerania [Tobolski 2006] and in Łęczna-Włodawa Lake District [Fijałkowski 1994, Urban and Wójciak

2013]. This species also appeared in the reserve Piskorzaniec [Wnukowa and Wnuk 1971], but in 2016 it was not confirmed there (own observations). From the urbanized areas, the data on the occurrence of *Scheuchzeria palustris* are very often historical information, among others, from the Małopolskie Voivodship [Bartoszek Dubiel *et al.* 1998], from the area of the Coal Mine of Bełchatów [Olaczek *et al.* 1990, Jakubowska-Gabara *et al.* 2011].

From the Łódź region there were recorded 4 places of *Scheuchzeria palustris* occurrence. The occurrence positions in the area of Bełchatów, Radomsko and Trzebnica no longer exist [Jakubowska-Gabara *et al.* 2011]. The position near Wolbórz, described by Kucharski and Grzyl [1993] is one of the most abundant and is located in the Czarny Ług reserve.

The Czarny Ług Reserve (N 50°28'00", E 19°56'00") is a relatively small 2.55 ha nature reserve. It is part of the Sulejów Landscape Park.

According to Kondracki [1994] this area is located within the boundaries of the High plains and the Central Małopolska Uplands. In terms of geobotanical division this area belongs to the territory of the Northern Borderland [Szafer 1972]. According to a newer division [Zajac *et al.* 2001] it is situated between the Łódź-Wieluń High Plains Region and Central-Małopolska Uplands. Both divisions suggest the occurrence of arctic-boreal and atlantic species, as elements of the flora direction. An example of the species from the first group and occurring in the reserve is *Hydrocotyle vulgaris* [Chechottowa 1926], the second group is represented by *Carex chordorrhiza*, *C. limosa* and *Scheuchzeria palustris* [Kulczyński 1927].

Due to the progressive degradation of the *Scheuchzeria palustris* stands, studies were conducted to assess the condition of this species, based on morphological and floristic analyzes. The main aim of the study was to know the number of individuals of this species and accompanying species. It was also important to point out the factors influencing the morphological structure of this species.

MATERIAL AND METHODS

The Czarny Ług Reserve is situated in the valley of the Pilica River, where the soils are associated with wet and muddy habitats, while peat bogs form peat deposits rich in organic matter. The climate is characterized by an average annual temperature of about 8°C, and the sum of precipitation ranges from 600 to 700 mm [Olaczek and Tranda 1989].

Valorization works were commissioned by the Regional Directorate for Environmental Protection (RDOŚ) in Łódź. No live material of *Scheuchzeria palustris* was collected, analyses were carried out in place, in the field.

Due to the presence of bushes with species of the genus *Salix*, large diversity of habitats and numerous depressions with stagnant water, access to homogeneous patches was very difficult. The selected place was expose, the surface

about 20 m², with lots of fruiting shoots of *Scheuchzeria palustris* and with a slight layer of shrubs. The study was conducted in August 2016. At the intersection of two diagonal squares there were 12 wheels with an area of 0.01 m² each. A scale proposed by Brunaud *et al.* [1988] was used for the quantitative ranges. The authors proposed the following ranges: 0–5, 5–10, 10–20, 20–50, 50–100, 100–200 and > 200 shoots in these fields.

Studies were made by Braun-Blanquet method [Scamoni 1955], nomenclature established follow Mirek *et al.* [2002]. The accompanying species were used to evaluate conditions according to Ellenberg's index method [Zarzycki *et al.* 2002]. Herbicides were determined by the guide Rutkowski [1998], while bryophytes according to Frahm and Frey [1987]. The syntaxsonomic division was adopted by Matuszkiewicz [2002]. The values of ecological indicators are consistent with Zarzycki *et al.* [2002].

In addition, groundwater level has been identified by several measurements in randomly selected places with a resolution of 1 cm.

RESULTS AND DISCUSSION

The studied area was covered with shrub layer (B): single, herbs (C): 80%, bryophytes (D): 70%; average water level was 8 cm.

Among the plant species which formed the individual layer occurred:

Shrubs: (B): *Pinus sylvestris* + (*Vaccinio-Piceetea*), *Ulmus laevis* + (*Alnetea glutinosae*), *Betula pubescens* + (*Vaccinio-Piceetea*).

A layer of herbs (C): *Scheuchzeria palustris* + (*Scheuchzerio-Caricetea nigrae*), *Andromeda polifolia* 1 (*Oxycocco-Sphagnetetea*) *Carex nigra* + (*Scheuchzerio-Caricetea nigrae*), *Drosera rotundifolia* + (*Oxycocco-Sphagnetetea*), *Eriophorum angustifolium* 4 (*Scheuchzerio-Caricetea nigrae*), *Juncus articulatus* + (*Scheuchzerio-Caricetea nigrae*), (*Oxycocco-Sphagnetetea*), *Oxycoccus palustris* 2, *Pinus sylvestris* (siewki) +, *Vaccinium uliginosum* + (V.P.), *Vaccinium vitis-idaea* + (*Vaccinio-Piceetea*).

A layer of Bryophytes (D): *Sphagnum fallax* (others), 4.3, *Polytrichum strictum* + (O.P.).

A total of 18 specimens of *Scheuchzeria palustris* were analyzed on the examined area (covering 1200 cm²). The most abundant species were *Oxycoccus palustris* and *Eriophorum angustifolium* (Table 1). A strong expansion on the analyzed surface showed the last species. The bryophytes layer was respected as stable. On exposed sites a specific floating mat was observed, dominated by *Sphagnum fallax*. *Ulmus laevis*, a shrub assigned to Class *Alnetea glutinosae*, appeared in the shrub layer.

Table 1. *Scheuchzeria palustris* shoots number and the range of accompanying plant species occurring in analyzed surface; acc. the scale [Brunaud *et al.* 1988]

Sample number	1	2	3	4	5	6	7	8	9	10	11	12
Number of specimens (n)	1	1	–	1	2	1	1	9	–	–	–	2
Range of other species presence	50–100 E.a. 50–100 O.p.	50–100 E.a. 10–20 O.p.	50–100 E.a.	50–100 E.a.	10–20 E.a. 10–20 O.p.	20–50 E.a. 20–50 O.p.	50–100 E.a.	50–100 E.a. 50–100 O.p.	50–100 E.a. 10–20 O.p.	50–100 E.a. 10–20 O.p.	50–100 E.a. 10–20 O.p.	50–100 E.a. 10–20 O.p.

Shortcuts: E.a. = *Eriophorum angustifolium*; O.p. = *Oxycoccus palustris*

The height of the analyzed shoots of *Scheuchzeria palustris* ranged from 6 cm to 19 cm (mean 12 cm) and the number of bags from 8 to 32 (average 17), each with numerous seeds.

Specimens of *Scheuchzeria palustris* were unequally distributed on the studied surface. The variation in the specimens height and the number of seeds production also confirms this diversity. The reasons for these differences can be: variations in terrain, water relations and game penetration.

Existing pits and depressions with water, as well as the groundwater movement clearly direct the succession and distribution of *Scheuchzeria palustris* and are a condition of their existence as a hydrophite [Casper-Krautsch 1981, Parvienov 2013].

The high water level prevented the development of the layer of trees and limited the development of the shrubs. This was especially true of *Betula pubescens*. Similar relationships were observed in the pond, near Czestochowa, where the birch was first deprived of leaves, and then withered. Probable cause is roots decay in conditions of strong hydration [own observations].

The habitat conditions of *Scheuchzeria palustris* were characterized by good, full access to light, moderately cool and temperate, well moistened, indicating oligotrophicity of the soil. The average level of water retention was 8 cm above the surface. Attention is paid to the content of organic matter (H) typical for this type of habitat, with the presence of *Andromeda polifolia*. The pH value (R) is intermediate between the highmoor peatbog (*Opheliophala Sphagnetea*) and transitional moor (*Scheuchzerio-Caricetea nigrae*) (Table 2). The presence of *Oxycoccus palustris* and *Eriophorum angustifolium* may indicate this.

Table. 2. Ecological indicator values of dominant species acc. to Ellenberg [Zarzycki *et al.* 2002]

Specification	L light value	T temperature value	W soil mois- ture value	Tr trophy value	R soil acidity pH	H organic matter value
<i>Scheuchzeria palustris</i>	3.4	3.2	4.5	1.9	2.7	2.1
<i>Eriophorum angustifolium</i>		3.0	5.0	3.0	3.0	3.0
<i>Oxycoccus palustris</i>		4.0	1.5	1.5	2.0	3.0

There is very little literature on *Scheuchzeria palustris*' quantitative relationships. Jakubowska-Gabara *et al.* [2011] and Olaczek [2012] conducted the evaluation of the number of *Scheuchzeria palustris* per m². The authors present distribution from 100 to 150 specimens per 1 m². However, these works do not

include the analysis of coexisting species. In case of research in the Czarny Ług reserve, there were about 150 specimens per square meter.

Studies on *Scheuchzeria palustris* syntaxonomy are relatively numerous. Matuszkiewicz [2002] attributes *Scheuchzeria palustris* to the association of *Caricetum limosae*, just as Oberdorfer [1994], while Rybniček *et al.* [1984] to the *Scheuchzerio-Sphagnetum cuspidate* assemblage. Due to the small number of species growing on the studied area, it was difficult to uniquely identify it to a particular syntaxonomic unit. There were species both classes *Scheuchzerio-Caricetea nigrae* and *Oxycocco-Sphagnetea*.

Most studies in the literature concerns the protection and reasons for the degradation of *Scheuchzeria palustris*. Among the causes of degradation are primarily mechanical devastation, that is dewatering and soil-water changes, including eutrophication [Sebald and Seybold 1998].

The analyzed patch as well as surrounding areas create a valuable peat association [Tobolski 2006].

CONCLUSIONS

The analyzed features of *Scheuchzeria palustris* testify to the good adaptation of this species on the studied area.

The survival of the relict species depends on abiotic factors like water and sediments, that confirms Ellenberg' numbers, as well as biotic factors, such as expansion of *Eriophorum angustifolium* and other species typical for highmoor peatbogs.

The high state of water level does not allow the strong spared of *Eriophorum angustifolium* and some woody species such as *Betula pubescens* on study area.

The *Scheuchzeria palustris* stand in the Czarny Ług Reserve was characterized by a high mineral content and a strong connection with water. Moreover *Andromeda polifolia* presence indicated that the soil of study area contained humus.

Due to the extreme occurrence of *Scheuchzeria palustris*, as dying breed of sedge, it is suggested inclusion this species in the national monitoring network or at least regional.

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ANALIZA ASPEKTÓW EKOLOGICZNO-BIOLOGICZNYCH
Scheuchzeria palustris L. NA PRZYKŁADZIE STANOWISKA W REZERWACIE
CZARNY ŁUG KOŁO WOLBORZA (CENTRALNA POLSKA)

Streszczenie. *Scheuchzeria palustris* to gatunek uważany za relikty arktyczno-borealny, krytycznie zagrożony wyginięciem. Badania prowadzono na jednym z nielicznych już stanowisk na terenie województwa łódzkiego w rezerwacie Czarny Ług, położonym niedaleko Wolborza. Podstawowym celem badań było poznanie ilości osobników tego gatunku oraz gatunków towarzyszących. Analizowano cechy ilościowe, morfologiczne oraz florystyczne. Analizowany płat posiadał ok. 150 okazów bagnicy na 1 m². Towarzyszyły jej zarówno gatunki z klasy *Scheuchzerio-Caricetea Nigrae*, jak i z *Oxycocco-Sphagnetum*. Z pierwszej grupy dominantem była *Eriophorum angustifolium* (60% pokrycia), z drugiej zaś *Andromeda polifolia* i *Oxycoccus palustris*. Można stąd domniemać, że sukcesja będzie zachodzić w kierunku *Scheuchzerio-Caricetea Nigrae*. Jednak panujący wysoki poziom wody może niniejszy proces zahamować. Specyficzne warunki biotyczne i abiotyczne pozwalają na trwanie tego gatunku. Uwidacznia się to m.in. w mozaikowatej strukturze opisywanego stanowiska.

Słwa kluczowe: *Scheuchzeria palustris*, liczby Ellenberga, warunki siedliskowe, inwentaryzacja, rezerwat przyrody