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Piotr Sugier, Faculty of Biology and Biotechnology, Maria Curie-Skłodowska University in Lublin, Poland

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KO, MW, KS, PM, JM: field research, determination of species, writing the manuscript, preparation of distribution maps and illustrations

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ORIGINAL RESEARCH PAPER

Meadows with dandelions of the section *Palustria* in Pogórze Dynowskie, S Poland

Krzysztof Oklejewicz¹, Mateusz Wolanin¹, Krzysztof Szubart¹, Paweł Marciniuk², Jolanta Marciniuk^{2*}¹ Department of Botany, University of Rzeszów, Zelwerowicza 4, 35-601 Rzeszów, Poland² Department of Botany, Siedlce University of Natural Sciences and Humanities, Prusa 12, 08-110 Siedlce, Poland* Corresponding author. Email: jolanta.marciniuk@uph.edu.pl**Abstract**

The paper presents ecological characteristics of meadows with *Taraxacum* sect. *Palustria* in Pogórze Dynowskie. Field studies were carried out using the patrol method. Floristic description was made, methods of meadow use were evaluated and habitat conditions were determined based on Ellenberg's bioindication method on every meadow with marsh dandelions. Analyses were performed in eight sites with *T. mendax*, *T. paucilobum*, *T. polonicum*, *T. portentosum*, and *T. vindobonense*.

Keywords

marsh dandelions; ecology; S Poland

Introduction

Species of the genus *Taraxacum* attributed to the section *Palustria* are the plants associated with wet, extensively used meadows and pastures. They mainly form communities of the *Calthion*, *Alopecurion*, and *Molinion* alliances, class *Molinio-Arrhenatheretea*, and communities of the class *Scheuchzerio-Caricetea nigrae* [1–4]. A few sites of dandelions of this group spread all over the country have been recorded in Poland till now [4,5]. Most Polish marsh dandelions are threatened with extinction due to unfavorable changes in habitat conditions and the disappearance of appropriate phytocoenoses in many places [4]. These species are also considered endangered and are listed in the “Red list of vascular plants in the Czech Republic” [6]. In the opinion of the authors of the monograph on the section *Palustria* [2], the problem of habitat disappearance pertains to all species in the whole range of their occurrence.

From among 24 species of *Taraxacum* sect. *Palustria* found in Poland [4,7], Pogórze Dynowskie hosts seven of them. In this study, we consider six species, the seventh – *T. zajacii* – is a subject of a separate study [8]. Five species, namely *T. mendax*, *T. paucilobum*, *T. polonicum*, *T. portentosum*, and *T. vindobonense*, were found in well-preserved wet meadows. *Taraxacum hollandicum* was, however, found in a small patch of drying meadow at the edge of shrubs with *Alnus glutinosa*.

Material and methods

The studies on dandelions of the section *Palustria* were carried out in Pogórze Dynowskie within the borders drawn by Balon et al. [9]. In April 2014, all potential habitats for marsh dandelions were examined. Well-preserved meadows with marsh dandelions were found mainly in the valleys of two rivers: the Strug and the Stobnica (Fig. 1).

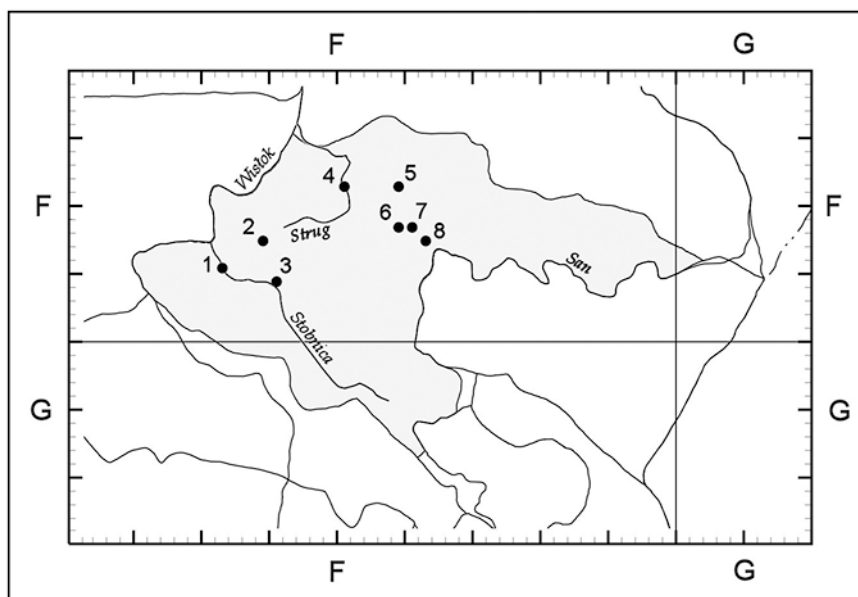


Fig. 1 Location of the studied meadows with marsh dandelions on the cartogram map of Pogórze Dynowskie. 1 – Godowa; 2 – Jawornik Niebylecki; 3 – Lutcza; 4 – Nowy Borek (Jaworznik); 5 – Hyżne; 6, 7, 8 – Harta.

The meadows were located in the ATPOL grid (2×2 km) [10]. Sites found in the previous years listed in the paper by Marciniuk [4] were also included. Floristic lists made in the observed meadows were then arranged in a working table. Based on the table, plant species co-occurring with marsh dandelions and species that migrate to these types of meadows from neighboring habitats or have a broader spectrum of occurrence were selected. Information on the effect of meadow use on the density of dandelion populations was also recorded in the field. Habitats were evaluated with the use of indicator numbers of Ellenberg et al. [11]. Nomenclature of the vascular plants follows Mirek et al. [12]. Syntaxonomic affiliation was adopted after Matuszkiewicz [13].

Results

The presence of dandelions of the section *Palustria* in Pogórze Dynowskie is limited to wet meadows located in 12 units of the ATPOL cartogram 2×2 km (Fig. 2). Plant patches referred in their physiognomy and species composition to the communities of *Alopecuretum pratensis*, *Cirsietum rivularis*, or *Scirpetum sylvatici*. In the prevailing number of cases, these were mown meadows. In total, 102 species of vascular plants were noted in these meadows (Tab. 1). Two species characteristic for the class *Molinio-Arrhenatheretea*, namely *Cardamine pratensis* and *Cerastium holosteoides*, were always present there. Almost at each locality we noted the species characteristic for *Calthion* (*Cirsium rivulare*, *Equisetum palustre*, and *Scirpus sylvaticus*), *Cynosurion* (*Trifolium repens*), and meadow species of a broad range of occurrence (*Ranunculus acris*, *Rumex acetosa*, and *Plantago lanceolata*). Less numerous and definitely less frequent were the species characteristic for various syntaxa of wet meadows (e.g., *Myosotis palustris*, *Filipendula ulmaria*, *Juncus effusus*, *Angelica sylvestris*, *Lychnis flos-cuculi*) or rare in Poland like *Taraxacum gelertii* belonging to the section *Celtica*. The presence of species characteristic for other syntaxonomic groups might be associated with their penetration from neighboring patches (e.g., *Agrostis stolonifera*, *Juncus inflexus*, *Galium palustre*, or *Carex nigra*) or with immigration from plant communities of quite different character (e.g., *Glechoma hederacea*, *Urtica dioica*, *Ficaria verna*, or *Anemone ranunculoides*). Noteworthy was the presence of dandelions of the section *Ruderalia* in floristic composition of the studied meadows. Despite rather low abundance, their list includes 27 species, some of which (*T. ancistrolobum*, *T. lucidum*, *T. oblongatum*, *T. sinuatum*, and

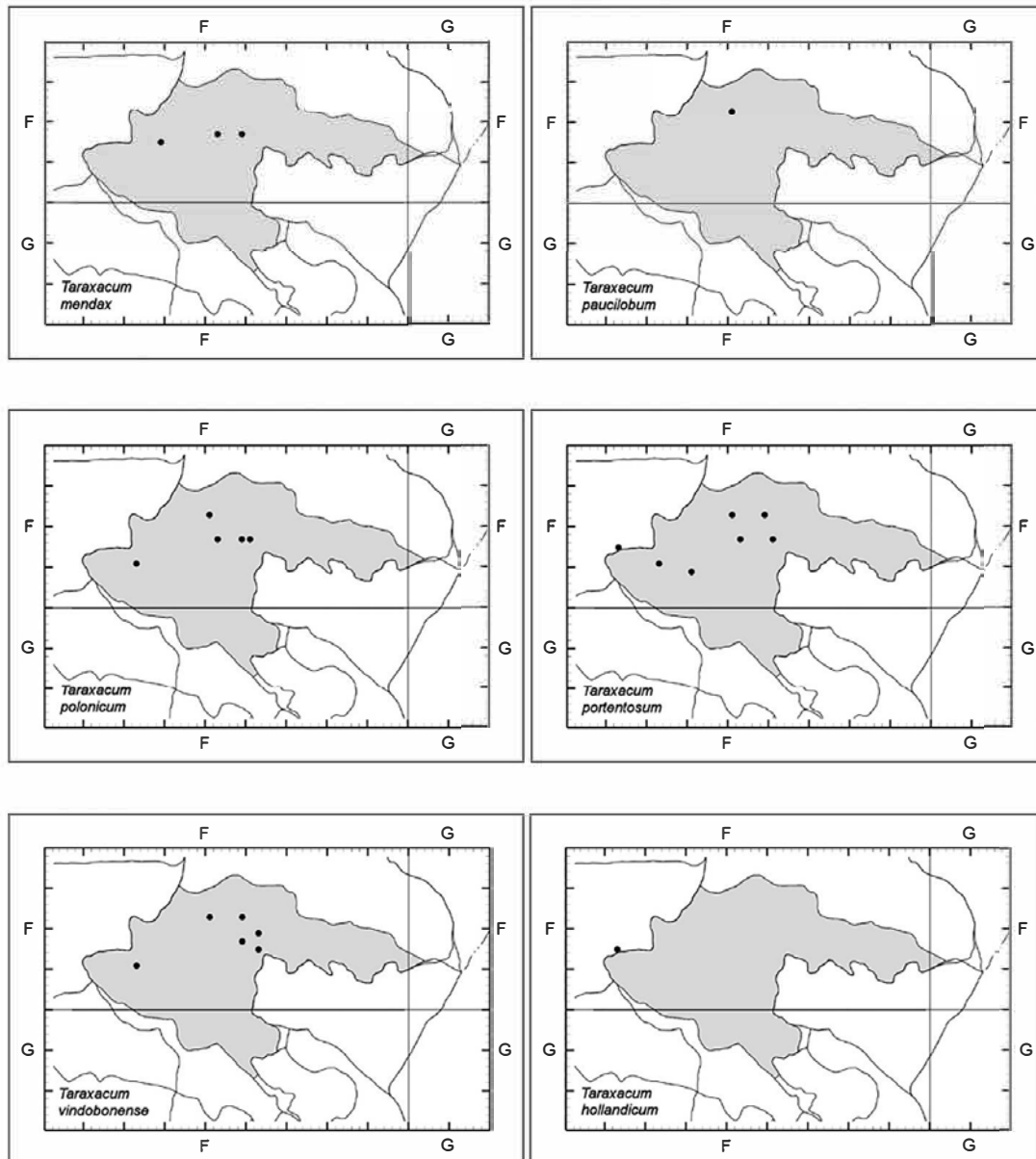


Fig. 2 Location of the sites of dandelions of the section *Palustria* on cartogram maps of Pogórze Dynowskie.

T. zdravovodense) were slightly more frequent (three findings of each). The presence of other ruderal dandelions (*T. amplum*, *T. clarum*, *T. corynodes*, *T. crassum*, *T. diastematicum*, *T. edmondsonianum*, *T. fascians*, *T. freticola*, *T. gesticulans*, *T. hemicyclum*, *T. hepaticum*, *T. ingens*, *T. lacerifolium*, *T. laticordatum*, *T. macranthoides*, *T. ochrochlorum*, *T. pallidipes*, *T. pannucium*, *T. pectinatiforme*, *T. piceatum*, *T. undulatifforme*, and *T. urbicola*) could be a result of their accidental penetration to the wet meadows from neighboring sites, including ruderal habitats. According to the bioindication method of Ellenberg et al. (Fig. 3), *Taraxacum* species of the section *Palustria* in Pogórze Dynowskie grow: in moderately warm conditions (indicator value for temperature T – 5 and 6) of sub-oceanic climate (indicator value for continentality K – 3 and 4), in good light conditions (indicator value for light L – 7), in moderately fertile (indicator value for nutrients N – 5 and 6) and wet (indicator value for humidity F – 6 and 7) soils of neutral to slightly alkaline pH (indicator value for soil reaction R – 6 and 7).

Tab. 1 The species composition of meadows with the participation of *Taraxacum* sect. *Palustria*.

Species	1	2	3	4	5	6	7	8
<i>Taraxacum</i> sect. <i>Palustria</i>								
<i>Taraxacum mendax</i>		+				+		
<i>Taraxacum paucilobum</i>				+				
<i>Taraxacum polonicum</i>	+			+		+	+	
<i>Taraxacum portentosum</i>	+		+		+		+	
<i>Taraxacum vindobonense</i>	+		+	+	+	+		+
<i>Taraxacum</i> sect. <i>Ruderalia</i>								
<i>Taraxacum amplum</i>	+							
<i>Taraxacum ancistrolobum</i>	+	+	+					
<i>Taraxacum clarum</i>			+		+			
<i>Taraxacum corynodes</i>			+					
<i>Taraxacum crassum</i>	+							
<i>Taraxacum diastematicum</i>	+	+						
<i>Taraxacum edmondsonianum</i>	+							
<i>Taraxacum fascians</i>			+	+				
<i>Taraxacum freticola</i>			+					
<i>Taraxacum gelertii</i> (sect. <i>Celtica</i>)			+					
<i>Taraxacum gesticulans</i>								+
<i>Taraxacum hemicyclum</i>		+						
<i>Taraxacum hepaticum</i>						+		
<i>Taraxacum ingens</i>		+						
<i>Taraxacum lacerifolium</i>		+						
<i>Taraxacum laticordatum</i>	+		+					
<i>Taraxacum lucidum</i>	+		+			+		
<i>Taraxacum macranthoides</i>	+							+
<i>Taraxacum oblongatum</i>	+	+	+					
<i>Taraxacum ochrochlorum</i>			+					
<i>Taraxacum pallidipes</i>			+					
<i>Taraxacum pannucium</i>		+						
<i>Taraxacum pectinatiforme</i>		+	+					
<i>Taraxacum piceatum</i>		+						
<i>Taraxacum sinuatum</i>				+		+		+
<i>Taraxacum undulatifforme</i>								+
<i>Taraxacum urbicola</i>	+							
<i>Taraxacum zdravovodense</i>		+	+				+	
<i>Calthion</i>								

Tab. 1 Continued

Species	1	2	3	4	5	6	7	8
<i>Caltha palustris</i>				+	+	+	+	
<i>Cirsium rivulare</i>	+		+	+	+	+	+	+
<i>Glechoma hederacea</i>	+	+	+				+	
<i>Juncus conglomeratus</i>	+					+		
<i>Juncus effusus</i>							+	
<i>Mentha longifolia</i>				+				
<i>Myosotis palustris</i>				+		+		
<i>Scirpus sylvaticus</i>	+	+		+	+	+	+	+
<i>Symphytum officinale</i>						+		
<i>Agropyro-Rumicion crispi</i>								
<i>Agrostis stolonifera</i>			+		+			
<i>Festuca arundinacea</i>			+					
<i>Juncus inflexus</i>			+	+	+			
<i>Potentilla anserina</i>		+	+	+				
<i>Ranunculus repens</i>			+	+	+	+	+	
<i>Rumex crispus</i>			+	+				
<i>Molinetalia</i>								
<i>Alopecurus pratensis</i>	+	+	+	+		+	+	+
<i>Angelica sylvestris</i>						+		+
<i>Equisetum palustre</i>	+		+	+	+	+	+	
<i>Filipendula ulmaria</i>	+					+		+
<i>Lychnis flos-cuculi</i>	+					+	+	
<i>Lysimachia nummularia</i>	+			+		+		
<i>Molinio-Arrhenatheretea</i>								
<i>Alchemilla monticola</i>		+						
<i>Bellis perennis</i>				+	+	+	+	
<i>Bromus hordeaceus</i>								+
<i>Cardamine pratensis</i>	+	+	+	+	+	+	+	+
<i>Carum carvi</i>			+					
<i>Cerastium holosteoides</i>	+	+	+	+	+	+	+	+
<i>Festuca pratensis</i>				+				
<i>Festuca rubra</i>	+	+						
<i>Geranium pratense</i>	+	+						+
<i>Holcus lanatus</i>	+			+	+			
<i>Lathyrus pratensis</i>	+		+			+		+
<i>Leontodon hispidus</i>							+	

Tab. 1 Continued

Species	1	2	3	4	5	6	7	8
<i>Lotus corniculatus</i>					+			
<i>Phleum pratense</i>						+		
<i>Plantago lanceolata</i>	+	+				+	+	+
<i>Ranunculus acris</i>	+	+	+	+	+	+		+
<i>Rumex acetosa</i>	+		+	+	+	+		+
<i>Trifolium pratense</i>		+	+				+	
<i>Trifolium repens</i>	+			+	+	+	+	+
<i>Vicia cracca</i>		+						
Others								
<i>Aegopodium podagraria</i>					+			
<i>Agropyron repens</i>		+						
<i>Ajuga reptans</i>								+
<i>Alnus incana c</i>		+						
<i>Anemone ranunculoides</i>								+
<i>Anthoxanthum odoratum</i>	+	+		+			+	
<i>Carex acutiformis</i>								+
<i>Carex brizoides</i>			+					
<i>Carex nigra</i>				+	+	+	+	
<i>Carex spicata</i>			+					
<i>Carex vulpina</i>	+							
<i>Erigeron annuus</i>		+						
<i>Ficaria verna</i>	+		+					+
<i>Galium palustre</i>	+							
<i>Hypochoeris radicata</i>								+
<i>Luzula campestris</i>		+						
<i>Mentha aquatica</i>						+		
<i>Mentha arvensis</i>				+				
<i>Phalaris arundinacea</i>			+					
<i>Pimpinella saxifraga</i>						+		
<i>Plantago media</i>				+				
<i>Polygonum amphibium</i>				+				
<i>Potentilla erecta</i>				+				
<i>Ranunculus auricomus</i>	+		+			+	+	
<i>Urtica dioica</i>		+			+			
<i>Veronica persica</i>					+			
<i>Vicia sepium</i>				+				

Tab. 1 Continued

Species	1	2	3	4	5	6	7	8
<i>Vicia tetrasperma</i>		+						

Explanations: 1 – Godowa; 2 – Jawornik Niebylecki; 3 – Lutcza; 4 – Nowy Borek (Jaworznik); 5 – Hyżne; 6, 7, 8 – Harta.

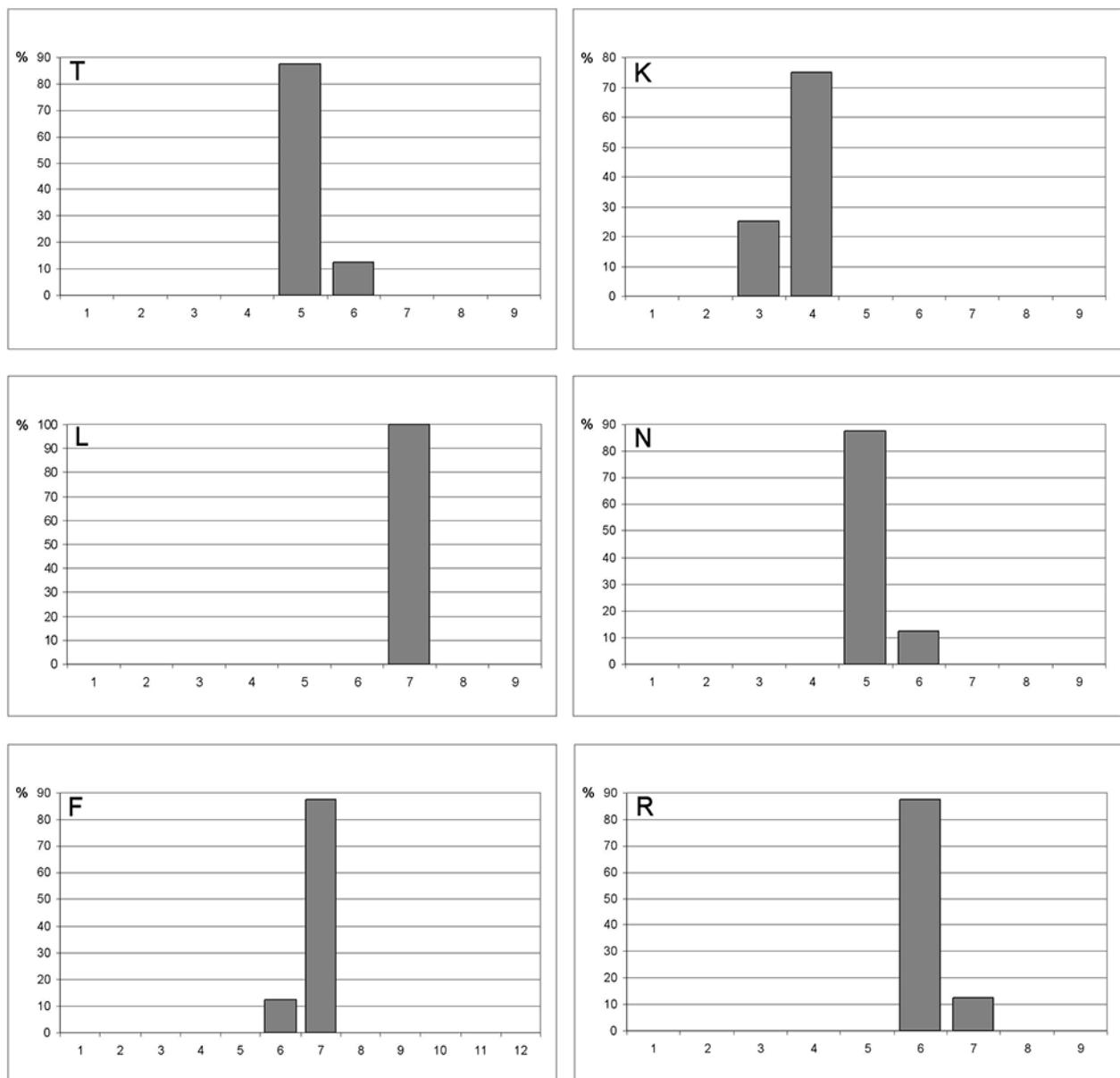


Fig. 3 Meadows with marsh dandelions in Pogórze Dynowskie. Ellenberg's indices: thermal conditions (T), climatic continentality (K), light availability (L), soil fertility (N), soil humidity (F), soil acidity (R). Axis *y* – percent of species belonging to a particular category of ecological parameters. 1–12 numbers on *x* axis – ecological indicator value.

Discussion

Plant communities with naturally occurring marsh dandelion are primarily hay meadows from which hay has been collected. The marsh dandelion population considerably decreased, and some species, observed in the previous vegetation seasons, even disappeared on the meadows which were not used or where the mown plants were left. This shows that these plants have low resistance to changes in habitat conditions. The disappearance of marsh dandelion was primarily determined by its low competitiveness (2–4). Marsh dandelion lost the competition with high meadow plants and could not grow through deposited litter. Oosterveld [14] wrote about a high sensitivity of species belonging to the specialized sections such as: *Erythrosperma*, *Celtica*, and *Palustria*, suggesting that the main threat to these plants in the Netherlands was the fertilization of meadows, especially with phosphorus compounds. Even moderate fertilization of meadows accelerates tillering and growth of grasses, significantly increasing their competitiveness. According to monographs of the section [2], only two species of marsh dandelion withstand such conditions, namely *T. vindobonense* and *T. hollandicum*. In Poland, the latter of these species is very rare [4], which does not allow us to identify its habitat preferences. However, the population studied by us, i.e., *T. hollandicum*, occurs on an unused, partly overgrown meadow, which confirms its high resistance to competition from high meadow plants. *Taraxacum vindobonense*, which is one of the most common species of the section *Palustria* occurring in Poland, has similar resistance. The optimum habitat for this species is unfertilized, extensively used meadows from the *Molinietalia* order; however, it is able to grow on quite intensively used and moderately fertilized meadows and pastures [2–4]. The other species of the section are very sensitive and die due to the lack of meadow use, or as a result of intensified utilization. This sensitivity of marsh dandelion can be a good indicator of the intensity of use of naturally valuable wet meadows. This indicator can also be very helpful when assessing the effectiveness of activities concerning biodiversity protection, undertaken within agri-environmental programs or conservation measures plans for Natura 2000 sites.

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Łąki z udziałem mniszków (*Taraxacum* sp.) z sekcji *Palustria* na Pogórzu Dynowskim

Streszczenie

Taraxacum sect. *Palustria* uznawana jest za najbardziej narażoną na wymarcie grupę mniszków w całym europejskim zasięgu. Również w Polsce wszystkie 24 dotychczas stwierdzone gatunki uważane są za silnie zagrożone. Na Pogórzu Dynowskim przeprowadzono badania patrolowe w kierunku poszukiwania łąk z udziałem mniszków błotnych. Na każdym odkrytym stanowisku wykonano spisy florystyczne, oszacowano liczebność populacji poszczególnych gatunków mniszków i określono sposób użytkowania łąk. Ponadto za pomocą liczb wskaźnikowych Ellenberga określono wymagania ekologiczne mniszków błotnych występujących w badanym regionie. Ogółem odkryto osiem stanowisk, na których stwierdzono występowanie siedmiu gatunków. W niniejszym opracowaniu uwzględniono sześć, tj. *T. mendax*, *T. paucilobum*, *T. polonicum*, *T. portentosum*, *T. vindobonense* i *T. hollandicum*. Poza *T. hollandicum*, który rośnie w strefie przejścia pomiędzy przesuszoną łąką i zaroślami olszowymi, wszystkie gatunki występują na wilgotnych łąkach użytkowanych kośnie. Pod względem fitosocjologicznym są to zbiorowiska nawiązujące swoją fizjonomią i składem gatunkowym do zespołów *Alopecuretum pratensis*, *Cirsietum rivularis* lub *Scirpetum sylvatici*. Mniszki błotne występowały licznie na łąkach o niskiej runi bez zalegającej nekromasy. Na łąkach gorzej utrzymanych występowały pojedyncze osobniki *T. vindobonense*, *T. mendax* i *T. hollandicum*. Według metody bioindykacyjnej Ellenberga *Taraxacum* sect. *Palustria* na Pogórzu Dynowskim występują: w warunkach klimatu suboceanicznego, w dobrych warunkach świetlnych, w warunkach umiarkowanie ciepłych, na glebach średnio żyznych, umiarkowanie wilgotnych, o odczynie obojętnym do lekko zasadowego.