

Resources of *Polystichum aculeatum* (L.) Roth (Dryopteridaceae, Pteridophyta) in the Sandomierska Upland (south-eastern Poland)

MAREK PODSIEDLIK

ul. Osobna 21, PL-25-034 Kielce, Poland; e-mail: adeno2@op.pl

ABSTRACT: The paper presents the distribution, habitat preferences and size of populations of *Polystichum aculeatum* in the Sandomierska Upland. So far, populations from the Krakowsko-Częstochowska Upland, Roztocze, and the Świętokrzyskie Mts. have been regarded as the largest ones at the lower altitudes, although the majority of them is composed of several to several dozen individuals, and only one consists of about 100 plants. Three new locations of this species are described from loess ravines in the Sandomierska Upland near villages: Rożki, Radoszki and Wierzbiny. Populations consist of 227, 11 and 21 individuals, respectively.

ABSTRAKT: Artykuł przedstawia rozmieszczenie, wymagania siedliskowe oraz zasoby populacji *Polystichum aculeatum* na Wyżynie Sandomierskiej. Do tej pory populacje z Wyżyny Krakowsko-Częstochowskiej, Roztocza i Gór Świętokrzyskich były uważane za najbardziej zasobne spośród odnotowanych w niższych położeniach. Liczyły od kilku do kilkudziesięciu osobników, tylko w jednym przypadku około 100. Trzy nowe stanowiska tego gatunku zostały opisane z lessowych wąwozów na Wyżynie Sandomierskiej koło wsi: Rożki, Radoszki i Wierzbiny. Populacje liczą odpowiednio: 227, 11 i 21 osobników.

KEY WORDS: *Polystichum aculeatum*, pteridophytes, Sandomierska Upland

Introduction

Polystichum aculeatum (L.) Roth is a mountain species, typical of mountain forests. It is widely distributed in North Africa, Asia Minor, the Caucasus, in western, central and southern Europe, in the British Isles, and in Scandinavia. Maps of the *P. aculeatum* s. s. distribution are provided by Jalas and Suominen (1972). The range of distribution of *P. aculeatum* s. l. has been mapped by

PODSIEDLIK M. 2008. Resources of *Polystichum aculeatum* (L.) Roth (Dryopteridaceae, Pteridophyta) in the Sandomierska Upland (south-eastern Poland). – In: E. Szczeńśniak, E. Gola (eds), Club mosses, horsetails and ferns in Poland – resources and protection. – Institute of Plant Biology, University of Wrocław, Wrocław, p. 95–101.

Hultén and Fries (1986); it additionally includes south-western Asia and the Far East to Japan. It is difficult to precisely define the distribution range because of varied opinions on the taxonomic status of the species (Gibby 1985).

Bróz and Przemyski (1987) report that in southern Poland the natural range of *P. aculeatum* is limited to mountains and uplands. Populations in the remaining lowlands are mostly historical or ephemeral. Within Poland (Zarzycki, Szelağ 2006) *P. aculeatum* is classified as vulnerable (V), i.e. a species that is endangered at isolated localities situated beyond the main area of its occurrence. Also, it is included in regional “red lists” in areas located close to the Sandomierska Upland. In the Świętokrzyskie Mts., it is classified as vulnerable (V; Bróz 1990) and, similarly, in the Lubelska Upland, Western Roztocze, Volhynia and Polesie Lubelskie (VU; Kucharczyk, Wójciak 1995). It is extinct in the wild in central Poland (EW; Jakubowska-Gabara, Kucharski 1999).

According to the literature, lowland populations of *P. aculeatum* are composed of several to several dozen individuals, and cover small areas (Bróz, Przemyski 1987). For example, in the mesoregions located close to the Sandomierska Upland Bróz (1991) and Bróz and Przemyski (1988) found single clumps in the Podgrodzie village and in “Krzemionki Opatowskie” (“Flint of Opatów”), a nature reserve in the Iłża Foothills. Maciejczak and Bróz (1992) described populations of this fern in the Świętokrzyskie Mts. (Dymińskie, Posłowickie and Zagórskie ranges) as extremely rare. In other parts of the Świętokrzyskie Mts. (Łysogórskie, Jeleniowskie, Cisowskie, Orłowińskie ranges, and Bardziańskie Hills) it is very infrequent, represented by only one or a few clumps (Bróz, Przemyski 1989; Cieśliński, Ćmak 1975). About 100 clumps were found on Sieradowska Mt. (“Sieradowska Góra” nature reserve; Bróz 1977). The fern grows there in the patches of several plant associations: *Dentario glandulosae-Fagetum* W. Mat. 1964, *Tilio-Carpinetum* Tracz. 1962, and in a fir-beech forest. A compilation made by Bróz, Przemyski (1987) suggests that *P. aculeatum* was present in the Miechów-Sandomierz section at three sites in ravines on soils developed from loess. In Poland, it is a character species of the phytosociological alliance *Tilio platyphylli-Acerion pseudoplatani* Klika 1955 (Matuszkiewicz 2008).

1. Material and methods

Field research was conducted in the summer of 2006. At all sites, individuals of the species were counted and phytosociological relevés were made according to the method of Braun-Blanquet (1964). The sites were assigned to a square (2.5 km × 2.5 km) on the ATPOL grid (Zajac 1978).

Names of vascular plants follow Mirek *et al.* (2002), while names of syntaxa follow Matuszkiewicz (2008). The regional division used in the description of the studied area is based on the Polish geobotanical (Szafer 1977) and physico-geographical classifications (Kondracki 2001).

2. Results

Three new populations of *Polystichum aculeatum* were found in the studied area.

The first one consists of two patches. The first patch is situated in the south-western branch of a ravine (Wąwóz Rożki) near the Rożki-Kolonia village. Here, as many as 124 individuals of *P. aculeatum* grow on walls of a loess ravine with north-eastern and north-western exposure, in shrub communities dominated by *Sambucus nigra*. An important threat for the fern species here is the expansion of *Solidago gigantea*, *Robinia pseudoacacia*, *Acer negundo* and *Urtica dioica*. The other patch of *P. aculeatum* is located about 400 m east of the first one, in the main part of the ravine. This group is composed of 103 individuals, growing on the northern slope of the loess ravine; a slope angle reaches 10–45°. The major component of the surrounding shrub community is *Corylus avellana*. In both patches, succession towards *Tilio-Carpinetum* is observed. The group of newly discovered populations *P. aculeatum* is located within ATPOL square FE 8132. A relevé recorded the species is shown in Tab. 1.

The second population is found in another ravine (Wąwóz Granicznik), which was earlier proposed to be protected as a nature reserve (Głazek 1968a, b). This population is located in the north-western branch of a large ravine (Wąwóz Doły Wierzbiny) between Radoszki and Wierzbiny villages, where 11 individuals of the species occur on a northern loess wall with a slope angle of 10° (Fig. 1). The major component of the shrub community is again *Corylus avellana*. The vegetation succession is progressing towards *Tilio-Carpinetum*. This population is located within ATPOL square FE 8133.

The third population occurs on an isolated loess slope in the south-eastern branch of yet another ravine (Wąwóz Mała Zapaść) between Radoszki and Lenarczyce villages. The patch is composed of 21 individuals on a slope with northern exposure and an inclination of 45°. The shrub community here is dominated by *Sambucus nigra*. Succession towards *Tilio-Carpinetum* is observed there. An important threat in this stand is the expansion of *Acer negundo*, *Urtica dioica*, and *Solidago gigantea*. This population is located within ATPOL square FE 8133.

Tab. 1. Communities with *Polystichum aculeatum* in the Sandomierska Upland; 1– Rożki, 2 – RadoszkiTab. 1. Zbiorowiska z *Polystichum aculeatum* na Wyżynie Sandomierskiej; 1– Rożki, 2 – Radoszki

| Succesive number of relevé (Nr kolejny zdjęcia) | 1 | 2 |
|--|----------|----------|
| Date (Data) | 28.07.06 | 01.08.06 |
| Exposition (Ekspozycja) | NW | NE |
| Angle (°), (Nachylenie) | 30 | 10–45 |
| Cover of shrubs layer b (%) (Zwarcie warstwy krzewów) | 80 | 60 |
| Cover of herb layer c (%) (Pokrycie warstwy zielnej) | 50 | 50 |
| Area (m ²), (Powierzchnia) | 300 | 300 |
| Number of species (Liczba gatunków) | 33 | 27 |
| <i>Polystichum aculeatum</i> | 2.2 | 1.2 |
| Ch. Ass. <i>Tilio-Carpinetum</i> | | |
| <i>Carex pilosa</i> | 1.2 | 1.2 |
| <i>Carpinus betulus</i> b | + | + |
| <i>Carpinus betulus</i> c | + | + |
| Ch. Cl. <i>Quercus-Fagetea</i> | | |
| <i>Corylus avellana</i> b | 1.2 | 2.2 |
| <i>Euonymus europea</i> b | 1.2 | 1.2 |
| <i>Euonymus europea</i> c | + | + |
| <i>Melica uniflora</i> | 1.2 | 1.2 |
| <i>Aegopodium podagraria</i> | 1.2 | 1.2 |
| <i>Lysimachia nemorum</i> | 1.2 | 1.2 |
| <i>Brachypodium sylvaticum</i> | 1.2 | 1.2 |
| <i>Dryopteris filix-mas</i> | 1.2 | + |
| <i>Hepatica nobilis</i> | + | 1.2 |
| <i>Tilia cordata</i> b | + | 1.1 |
| <i>Tilia cordata</i> c | + | + |
| <i>Acer pseudoplatanus</i> b | + | + |
| <i>Acer pseudoplatanus</i> c | + | + |
| <i>Milium effusum</i> | + | + |
| <i>Ulmus glabra</i> b | + | . |
| Accompanying species (towarzyszące) | | |
| <i>Rubus idaeus</i> c | 1.2 | 1.2 |
| <i>Sambucus nigra</i> b | 2.2 | + |
| <i>Sambucus nigra</i> c | + | + |
| <i>Urtica dioica</i> | 2.2 | + |
| <i>Impatiens parviflora</i> | 1.2 | + |
| <i>Geum rivale</i> | 1.2 | + |
| <i>Dactylis glomerata</i> | 1.2 | . |
| <i>Cornus sanguinea</i> b | + | + |
| <i>Cornus sanguinea</i> c | + | 1.2 |
| <i>Anthriscus sylvestris</i> | + | 1.2 |
| <i>Robinia pseudoacacia</i> b | 1.1 | + |
| <i>Robinia pseudoacacia</i> c | + | + |
| <i>Populus tremula</i> b | 1.1 | + |
| <i>Sorbus aucuparia</i> c | + | + |
| <i>Acer negundo</i> b | + | + |
| <i>Conyza canadensis</i> | + | + |
| <i>Rubus caesius</i> c | 1.2 | . |
| <i>Solidago gigantea</i> | 1.1 | . |
| <i>Heracleum sphondylium</i> | + | . |
| <i>Lapsana communis</i> s. s. | + | . |
| <i>Geranium robertianum</i> | + | . |
| <i>Asplenium trichomanes</i> | . | + |

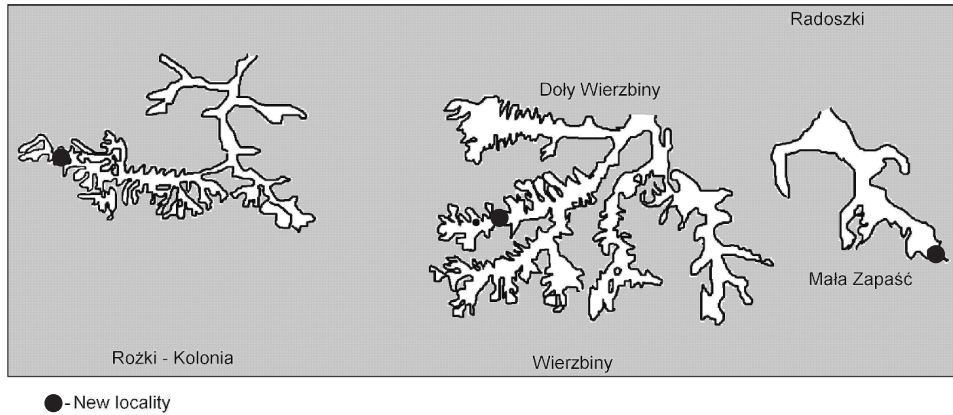


Fig. 1. Localization of *Polystichum aculeatum* in loess ravines in studied area

Ryc. 1. Lokalizacja *Polystichum aculeatum* w wąwozach lessowych na badanym obszarze

3. Conclusions

About 260 individuals of *P. aculeatum* were found in the examined area of the Sandomierska Upland. Ferns usually grow on loess slopes with north-western, northern and north-eastern exposures, and slope angles of 10° to 45°. The plant succession of the shrub communities, where this taxon was found, is progressing towards the *Tilio-Carpinetum* association. In all sites, juvenile individuals were observed.

The major threats to *P. aculeatum* in the studied area include:

- changes of microclimate, light conditions, temperature, and humidity, due to inadequate forest management;
- water erosion of loess soils;
- leaching of artificial fertilizers from the nearby arable fields, and of toxic chemicals from sprayed orchards;
- expansion of species such as *Solidago gigantea*, *Robinia pseudoacacia*, *Acer negundo* and *Urtica dioica*;
- formation of illegal dumping sites and their burning in the immediate neighbourhood of the sites.

The three newly discovered populations (Wąwóz Rożki, Wąwóz Granicznik and Wąwóz Mała Zapaść) are the only populations of this species in the Sandomierska Upland. The population in Wąwóz Rożki, composed of 227 individuals, is the largest in the Sandomierska Upland and one of the largest in the Kielecka Upland. Because of the decline of *P. aculeatum* in the Polish Lowland, this stand should be protected as a so-called “ecological area”.

References

- BRAUN-BLANQUET J. 1964. Pflanzensozologie. – Springer Verlag, Wien, 865 pp.
- BRÓZ E. 1977. Notatki florystyczne z Gór Świętokrzyskich, Cz. I. – *Fragm. Flor. Geobot.* **13**(3/4): 296–301.
- BRÓZ E. 1990. Lista wymierających i zagrożonych gatunków roślin naczyniowych Krainy Świętokrzyskiej. – *Roczn. Świętokrz.* **17**: 97–106.
- BRÓZ E. 1991. Archeologiczne i przyrodnicze wartości rezerwatu „Krzemionki Opatowskie” na Kielecczyźnie. – *Chrońmy Przyr. Ojcz.* **47**(6): 27–38.
- BRÓZ E., PRZEMYSKI A. 1987. Wymieranie gatunków z rodzaju *Polystichum* paprotnik na obszarze Prowincji Niżowo-Wyżynnej Polski. – *Chrońmy Przyr. Ojcz.* **43**(5/6): 17–30.
- BRÓZ E., PRZEMYSKI A. 1988. Nowe stanowiska rzadkich oraz zagrożonych gatunków roślin naczyniowych na Wyżynie Środkowomałopolskiej i jej pobrzeżach. – *Fragm. Flor. Geobot.* **33**(3–4): 239–249.
- BRÓZ E., PRZEMYSKI A. 1989. Nowe stanowiska rzadkich gatunków roślin naczyniowych z lasów Wyżyny Środkowomałopolskiej, Cz. II. – *Fragm. Flor. Geobot.* **24**(1/2): 15–25.
- CIEŚLIŃSKI S., ČMAK J. 1975. Paprocie Świętokrzyskiego Parku Narodowego. – *Stud. Kieleckie* **4**: 21–33.
- GIBBY M. 1985. Cytological observations on Indian subcontinent and Chinese *Dryopteris* and *Polystichum* (Pteridophyta: Dryopteridaceae). – *Bull. Br. Mus. nat. Hist. (Bot.)* **14**(1): 1–42.
- GLĄZEK T. 1968a. Flora kserotermiczna Wyżyny Sandomierskiej i Przedgórze Hżeckiego. – The Xerothermic Flora of the Sandomierz Upland and the Hża Forehills. – *Wyd. Art.-Graf.*, Kraków.
- GLĄZEK T. 1968b. Roślinność kserotermiczna Wyżyny Sandomierskiej i Przedgórze Hżeckiego. – *Monogr. Bot.* **25**: 1–135.
- HULTÉN E., FRIES M. 1986. Atlas of North European Vascular Plants, **1**. Maps 1–996. – *Koeltz Scenitfic Books*, Konigstein, 498 pp.
- JAKUBOWSKA-GABARA J., KUCHARSKI L. 1999. Ginące i zagrożone gatunki zbiorowisk naturalnych i półnaturalnych Polski Środkowej. – *Flor.Geobot. Ser. Polonica* **6**: 55–74.
- JALAS J. SUOMINEN J. 1972. Atlas Florae Europaeae. Distribution of vascular plants in Europe, **1**. Pteridoptera (Psilotaceae to Azollaceae). – Helsinki, 121 pp.
- KONDRACKI J. 2001. Geografia regionalna Polski, *Wyd. 2*. – Państwowe Wydawnictwo Naukowe, Warszawa.
- KUCHARCZYK M., WÓJCIAK J. 1995. Ginące i zagrożone gatunki roślin naczyniowych Wyżyny Lubelskiej, Rostocza, Wołynia Zachodniego i Polesia Lubelskiego. – *Ochr. Przyr.* **52**: 33–46
- MACIEJCZAK B., BRÓZ E. 1992. Changes in the vascular flora of the city and suburban zone of Kielce (Central Poland) and present state. – *Veröff. Geobot. Inst. ETH, Stiftung Rübel, Zürich* **107**: 374–385.

- MATUSZKIEWICZ W. 2008. Przewodnik do oznaczania zbiorowisk roślinnych Polski. *Vademecum Geobotanicum*. – PWN, Warszawa, 537 pp.
- MIREK Z., PIĘKOŚ-MIREK H., ZAJĄC A., ZAJĄC M. 2002. Flowering plants and pteridophytes of Poland. A checklist. *Biodiversity of Poland*, **1**. – W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, 442 pp.
- SZAFER W. 1977. Szata roślinna Polski niżowej. – In: SZAFER W., ZARZYCKI K. (eds), *Szata roślinna Polski*, **2**. – Państwowe Wydawnictwo Naukowe, Warszawa, p. 93–104.
- ZAJĄC A. 1978. Założenia metodyczne „Atlasu rozmieszczenia roślin naczyniowych w Polsce”. – *Wiad. Bot.* **22**(3): 145–155.
- ZARZYCKI K., SZELĄG Z. 2006. Red list of the vascular plants in Poland. – In: MIREK Z., ZARZYCKI K., WOJEWODA W., SZELĄG Z. (eds), *Red list of plants and fungi in Poland*. – W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, p. 9–20.

Zasoby *Polystichum aculeatum* (L.) Roth (Dryopteridaceae, Pteridophyta) na Wyżynie Sandomierskiej

Polystichum aculeatum na Wyżynie Sandomierskiej przywiązany jest do zalesionych wąwozów i parowów lessowych. Jest taksonem wymierającym na polskim niżu. Zdecydowanie największą trwałością odznaczały się populacje na Wyżynie Krakowsko-Częstochowskiej, Roztoczu i w Górach Świętokrzyskich. Powyższe populacje uważane były za najbardziej zasobne, liczące od kilku do kilkudziesięciu osobników, tylko w jednym przypadku około 100 osobników. Zasoby obserwowanych populacji na nowych stanowiskach na Wyżynie Sandomierskiej wynoszą kolejno: Wąwóz Rożki: 227, Wąwóz Granicznik: 11, Wąwóz Mała Zapaść: 21 osobników (ryc. 1). Na badanych stanowiskach obserwowano około 260 osobników *Polystichum aculeatum*, na stokach o nachyleniu od 10° do 45° i ekspozycji północno-zachodniej, północnej i północno-wschodniej. Sukcesja zarośli, w których rośnie badany takson, zmierza w kierunku zespołu *Tilio-Carpinetum* (tab. 1). Na wszystkich stanowiskach obserwowano osobniki juwenilne. Stanowisko w Wąwozie Rożki jest najbardziej zasobnym ze stanowisk na Wyżynie Sandomierskiej i jednym z najliczniejszych na Wyżynie Kieleckiej.