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Chosen aspects of threatened moss species occurrence in urban areas – a case study of Katowice

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Abstract: Fifty eight moss species were noted in the area of Katowice, which have been listed as threatened locally or threatened in the country. Almost 80% of these are rare species, which occur in up to 5 localities within the area discussed. They are scattered all over the town. However, their density distinctly increases in forest areas (up to 5 species per 1 km²). Their habitat preferences, synanthropization degree, as well as dynamic tendencies, are analysed in the paper presented. An interesting group of species consists of those recorded exclusively in anthropogenic habitats – especially those occurring on a concrete, rock-like substrate or on epigeic initial habitats. Very characteristic is the distribution of *Weissia controversa* – it grows only in abandoned, barren places around a zinc and lead smelting works, where the substrate pH ranges from 7 to 8. It should be noted that 3 localities of *Discelium nudum* were recorded – a moss which not so long ago ceased to be considered as extinct in Poland.

Key words: threatened moss species, urban areas, Katowice, Poland

A town creates a specific mosaic of habitats. Different species can find their own place in such conditions to various degrees. So, species described as threatened are in a special situation there. Mosses listed in this group represent a different synanthropization degree, which is dependent upon the habitat preferences of the given species.

During the floristic studies in Katowice, the occurrence of 176 moss species was recorded (Fojcik & Stebel 2001). A relatively large group is formed by moss species counted as threatened – 58 species, which is 33% of the flora noted (Table 1). Among them, 9 are mosses considered to be endangered in Poland (Ochyra 1992). The others belong to those considered to be endangered regionally (Stebel 1998).

The distribution pattern of representatives of the group described is to a significant degree influenced by the spatial structure of the town, but especially by the differentiation and set of main complexes used by the space. The area of Katowice is distinctly divided into a forest-agricultural southern part and typically urbanised northern part (locally also varied with afforested areas). Threatened species are scattered all over the town. However, their density distinctly increases in

forests (Fig. 1). The highest density – 4-5 species per 1 km² – was noted in 13 squares (almost all of them of different degrees of afforestation). This is connected with a significant domination of species which prefer natural and semi-natural habitats these persist relatively longer in forest areas.

Threatened mosses can be divided into 4 groups, according to their general habitat preferences: (i) species of water, marshy and wet habitats (45%); (ii) epigeic species of natural and semi-natural communities (22%); (iii) epiphytic, epixylic and epipetric species (17%); (iv) initial habitat species (16%).

This is a general division. However, the proportions between the main ecological groups of threatened mosses in Katowice area are indicated quite precisely. It should be added that, in some cases, preferences are not always reflected by the habitat taken by the given species in the field, e.g. typical epigeic *Ptilium crista-castrensis* and *Leucobryum glaucum* were recorded on the basis of their single localities as epixylic species (decaying logs become overgrown with them). In the case of typical epigeic *Rhytidiadelphus triquetrus*, only single branches were noted on the bark of wayside poplar trees in the mixed forest. This is connected with the

migration of mosses into secondary habitats. The process is forced by the degeneration of a community structure (most frequently mosses are covered with other

plants or the thick layer of litter on the forest floor). However, the majority among the mosses discussed are those connected with water, marshy and wet habitats –

Table 1. Threatened moss species in the city of Katowice (species names according to Ochyra *et al.* 2003)

Species name	Threat category		Frequency in the Katowice area	Habitats	
	Poland	Region		Natural and seminatural	Anthropogenic
<i>Abietinella abietina</i>	-	R	very rare	-	+
<i>Aloina rigida</i>	-	R	very rare	-	+
<i>Amblystegium radicale</i>	R	R	rare	+	-
<i>Anacamptodon splachnoides</i>	E	?	very rare	+	-
<i>Atrichum angustatum</i>	-	I	very rare	+	+
<i>Brachythecium campestre</i>	-	I	rare	+	-
<i>Brachythecium mildeanum</i>	-	E	very rare	-	+
<i>Brachythecium rivulare</i>	-	V	rare	+	-
<i>Bryum pallescens</i>	-	I	very rare	-	+
<i>Campylidium calcareum</i>	-	I	very rare	+	-
<i>Campylium polygamum</i>	-	I	very rare	+	-
<i>Campylium stellatum</i>	-	R	very rare	+	-
<i>Cirriphyllum piliferum</i>	-	R	rare	+	+
<i>Dicranella varia</i>	-	I	frequent	+	+
<i>Dicranum polysetum</i>	-	R	very rare	+	-
<i>Didymodon luridus</i>	-	I	very rare	-	+
<i>Didymodon tophaceus</i>	-	I	very rare	-	+
<i>Diphyscium foliosum</i>	-	R	very rare	+	-
<i>Discelium nudum</i>	Ex	I	very rare	+	+
<i>Drytodon muehlenbeckii</i>	-	E	very rare	+	-
<i>Eurhynchium striatum</i>	-	I	fairly frequent	+	+
<i>Fissidens exilis</i>	-	R	very rare	+	-
<i>Fontinalis antipyretica</i>	-	V	very rare	+	-
<i>Helodium blandowii</i>	V	E	very rare	+	-
<i>Leptodictyum humile</i>	I	R	fairly frequent	+	-
<i>Leucobryum glaucum</i>	-	V	very rare	+	-
<i>Orthodicranum tauricum</i>	R	-	very rare	+	-
<i>Orthotrichum speciosum</i>	-	E	very rare	+	-
<i>Oxyrrhynchium schleicheri</i>	-	R	very rare	+	-
<i>Oxyrrhynchium. speciosum</i>	-	I	very rare	+	-
<i>Philonotis caespitosa</i>	V	R	very rare	+	+
<i>Plagiomnium elatum</i>	-	I	very rare	+	-
<i>Plagiomnium ellipticum</i>	-	I	fairly frequent	+	-
<i>Plagiomnium medium</i>	-	V	very rare	+	-
<i>Plagiothecium succulentum</i>	-	I	very rare	+	-
<i>Pleuridium subulatum</i>	-	R	very rare	+	-
<i>Pogonatum aloides</i>	-	R	rare	+	+
<i>Polytrichastrum longisetum</i>	-	R	very rare	+	-
<i>Pottia modica</i>	-	I	very rare	-	+
<i>Pseudocrossidium hornschuchianum</i>	-	I	rare	-	+
<i>Ptilium crista-castrensis</i>	-	E	very rare	+	-
<i>Rhodobryum roseum</i>	-	V	very rare	+	-
<i>Rhytidiadelphus triquetrus</i>	-	V	very rare	+	-
<i>Sciuro-hypnum plumosum</i>	-	E	very rare	+	+
<i>Sciuro-hypnum reflexum</i>	-	I	very rare	+	-
<i>Sciuro-hypnum starkei</i>	-	I	very rare	+	+
<i>Sphagnum angustifolium</i>	-	I	very rare	+	-
<i>Sphagnum capillifolium</i>	-	E	very rare	+	-
<i>Sphagnum compactum</i>	-	R	very rare	+	-
<i>Sphagnum girgensohnii</i>	-	R	fairly frequent	+	-
<i>Sphagnum magellanicum</i>	-	E	very rare	+	-
<i>Sphagnum papillosum</i>	V	V	very rare	+	-
<i>Sphagnum riparium</i>	-	E	very rare	+	-
<i>Sphagnum russowii</i>	-	E	very rare	+	-
<i>Sphagnum subsecundum</i>	-	R	very rare	+	-
<i>Sphagnum teres</i>	-	R	very rare	+	-
<i>Trematodon ambiguus</i>	R	E	very rare	+	-
<i>Weisia controversa</i>	-	R	rare	-	+

Explanations: Ex – extinct and probably extinct, E – endangered, V – vulnerable, R – rare, I – indeterminate, ? – data deficient; in Poland (Ochyra 1992); in Region (Stebel 1998)

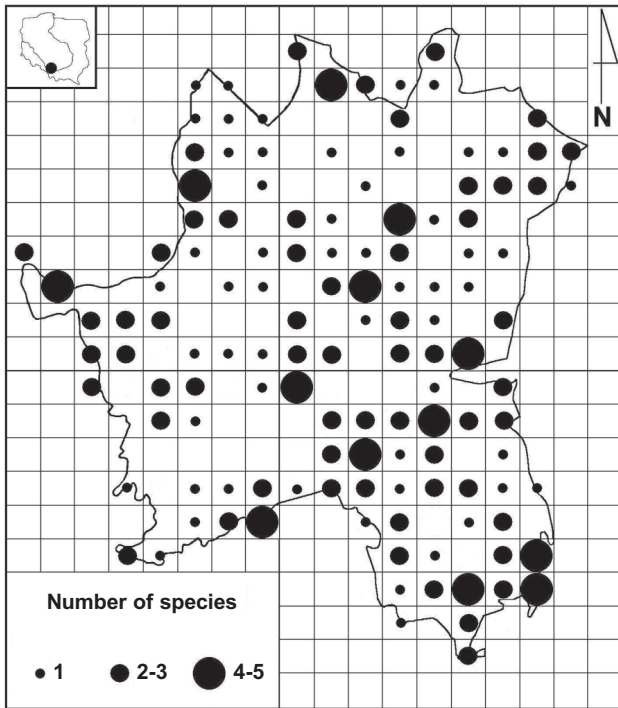


Fig. 1. Density of threatened moss species in the city of Katowice

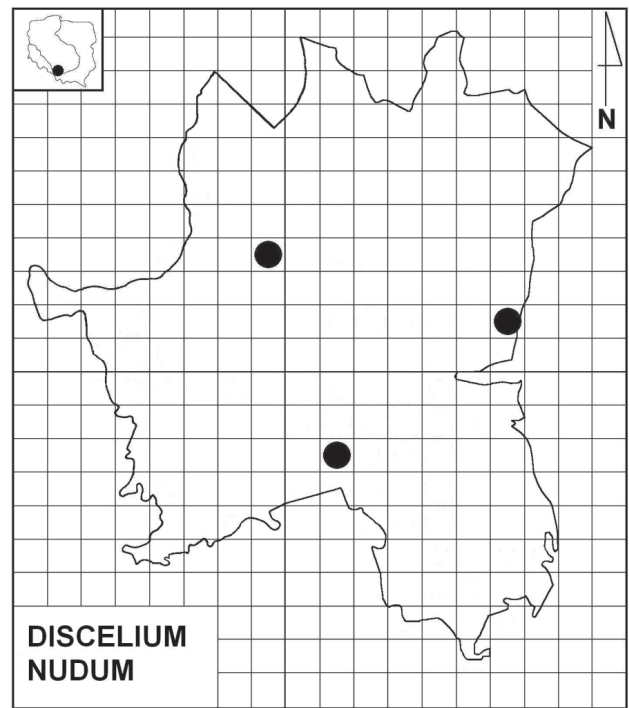


Fig. 2. Distribution of *Discelium nudum* (Dicks.) Brid. in the city of Katowice

which are most liable to deformations and extraordinarily sensitive to these processes. The only locality of *Fontinalis antipyretica* – representing this group of species – has been found as a dying population, which covers a stone in the bed of a water course that has been dry for a long time.

The frequency of occurrence of threatened species in the Katowice area is differentiated. The majority of mosses – 46 (79%) – are very rare species recorded in 1 to 5 localities. The others occurred rarely (7 species with 6-10 localities) or quite frequently (4 species with 11-25 localities). Only *Dicranella varia* was counted as a frequent species (39 localities). This species is a good example of adaptation to urban conditions. Most frequently it was found in loamy wastelands, where the soil was usually mixed with slag and concrete pieces.

Species recorded exclusively in anthropogenic habitats make up 16% of the analysed group. They create two distinct ecological groups – epipetric species occurring on a concrete, rock-like substrate (e.g. *Bryum pallescens*, *Didymodon tophaceus*) as well as epigeic

ones growing in initial habitats (e.g. *Pottia modica*, *Pseudocrossidium hornschurchianum*). Very characteristic is the distribution of *Weissia controversa* – it occurs exclusively in wastelands around zinc and lead smelting works in the Wełnowiec and Szopienice quarters. An interesting species is *Discelium nudum* found in loamy ruderal habitats – mainly of anthropogenic origin (Fig. 2). The species not so long ago ceased to be considered as extinct in Poland.

Some general tendencies, observed by different authors in relation to urban areas, have been confirmed in the group of threatened mosses from Katowice: (i) high participation of water and other hygrophilous species in the group of retreating species; (ii) expansion of acidophilous epiphytes (e.g. *Orthodicranum tauricum*); (iii) dissemination of epipetric species into (mainly) concrete, rock-like substrata; (iv) high participation of neutro- and calciphilous species in central parts of the town, where habitats are alkalisied by deposition of industrial dusts and enriched by an admixture of different rock-like pieces (e.g. slag, concrete).

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