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BISCUTELLA LAEVIGATA L. IN THE POLISH UPLANDS – NEW DATA ON ITS DISTRIBUTION FROM NIDA BASIN

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ABSTRACT. *Biscutella laevigata* L. is a mountain taxon, recorded mainly in the mountains of central Europe and in the northern part of the Mediterranean region. In Poland it mostly occurs in the Western Tatra Mts and in anthropogenic lowland sites on calamine heaps near Olkusz and Bolesław in the Silesia-Kraków Upland. A new locality of *B. laevigata* in the Małopolska Upland (Nida Basin: Zagórzyce) in southern Poland is reported. Approximately 1000-1500 shoots were recorded in a xerothermic grassland of the *Festuco-Brometea* class on alkaline soils. The locality is natural based on habitat conditions and *B. laevigata* may be classified as a glacial relict. Phytosociological relevés of *B. laevigata* lowland localities are presented.

KEY WORDS: *Biscutella laevigata*, distribution, habitat, glacial relict, Małopolska Upland, Nida Basin, Poland

INTRODUCTION

Biscutella laevigata L. belongs to the family Brassicaceae. It is a multizonal mountain species of the Alpic-Central-European distribution type (Zając 1996, Zając and Zając 2009), and it occurs mostly in the mountains of central and northern Europe and in the northern part of the Mediterranean region (Malinowski 1910, Pawlus 1985, Jalas et al. 1996), from the eastern Pyrenees to the Transylvanian Alps (Gasser 1986). It is a rare glacial relict (Szafer 1930, Szata roślinna... 1972). In Europe the species is most often reported from the community of the order *Seslerion variae* and *Festuco-Sedetalia*, as well as the alliances *Potentillion caulescentis*, *Androsacion vandellii*, *Thlaspion rotundifolii*, *Seslerio-Festucion pallentis*, *Seslerio-Asterion alpini*, *Xerobromion*, *Mesobromion* and *Erico-Pinion* (Peniasteková 1981, Rothmaler Exkursionsflora... 2002). In Poland it is a characteristic species of the *Seslerietea variae* class (Matuszkiewicz 2006).

The aim of this paper is to characterise a new locality of *B. laevigata* in the Polish lowland, to discuss its origin and present conservation issues. A phytosociological analysis of localities near Olkusz and Bukowno was also performed.

DISTRIBUTION IN POLAND AND ECOLOGICAL DESCRIPTION

Although it is a mountain taxon, mainly alpine, *B. laevigata* has so far been reported from Poland from two geographically isolated regions: the Western Tatra Mts and the Silesia-Kraków Upland (calamine heaps near Olkusz). The status of the populations reported from single, separate localities in Lower Silesia is not clear (Szata roślinna... 1972, Pawlus 1985, Atlas... 2001; Fig. 1).

In the Tatra Mts *B. laevigata* usually grows on rocks, screes and in grasslands, on the soil rich in calcium carbonate, from the lower montane belt up to the mountain pasture belt, 880-2123 m a.s.l. (Pawlus 1985). It grows on soils containing increased amounts of zinc, lead and cadmium in the topsoil layer both in the Tatra Mts and in the Silesia-Kraków Upland. It is characteristic of the class *Seslerietea variae* in the Tatra Mts (Matuszkiewicz 2006), and it is abundant on old, heavy-metal ore heaps, mainly zinc and lead, in lowland localities. Ernst (1974) included calamine vegetation patches occurring in Poland near Olkusz and Bolesław into the association *Armerietum halleri* (the class *Violetea-calaminariae*) as its impoverished, borderland form. This has been confirmed by phytosociological relevés in Bolesław and Bukowno (Grodzińska and Szarek-Łukaszewska 2009), and grasslands containing *B. laevigata* have also been included here in the association *Armerietum halleri* (Kapusta et al. 2010). The occurrence, biology and ecology of the species on calamine heaps have also been studied frequently (e.g. Wóycicki 1913, Dobrzańska 1955, Pawłowska et al. 1996, Wierzbicka 1999, Grodzińska et al. 2001, Mesjasz-Przybyłowicz et al. 2001, Orłowska et al. 2002).

The species is classified as vulnerable and is red listed due to its distribution at isolated localities outside the main distribution range (Zarzycki and Szeląg 2006).

Fig. 1. Distribution of *Biscutella laevigata* in Poland (after Zając and Zając 2001, in ATPOL grid 10 × 10 km); ▲ – new locality, ■ – presently existing station, ○ – status of station unknown or unsertain

TAXONOMIC ISSUES AND VARIABILITY

Biscutella laevigata L. 1771, Mantissa Alt.: 255.

Biscutella laevigata is one of the most polymorphic taxa in the European flora and a number of lower rank units have been differentiated within it (Tutin et al. 1993). There are two cytogenetic types in the taxon: diploid populations (extra-alpine) and tetraploid populations (with the range centre in the Alps). The placement of all diploids in one species and tetraploids in another species proposed by Manton (1934) turned out to be impossible. Morphological diversity of the population is so weak that they should be treated as subspecies of one species (Tutin et al. 1993). Tetraploids occur primarily in the south of Europe, in the Alpine regions of France, Germany, Switzerland, Austria, Italy and Slovenia (Tremetsberger et al. 2002). The research conducted by Skalińska et al. (1949) demonstrated that Polish populations of *B. laevigata*, both in the Tatra Mts and in the lowland near Olkusz, were diploid (2n = 18). The diploid populations are thought to be interglacial relicts that survived Pleistocene vicissitudes in ice-free parts of the Alps while tetraploid populations are interpreted as post-glacial immigrants (Manton 1934).

Biscutella laevigata L. subsp. *gracilis* Mach.-Laur. and *B. laevigata* L. subsp. *kerneri* Mach.-Laur. are two subspecies that may occur in Poland. The key characters, however, are not distinct and they often overlap (Pawlus 1985, Tutin et al. 1993). The occurrence of *B. laevigata* subsp. *kerneri* in Poland has been questionable (Jalas et al. 1996, Tremetsberger et al. 2002). Rutkowski (2004) only reports *B. laevigata* subsp. *gracilis* from Poland.

Several studies have investigated morphological variability of *B. laevigata* on heaps (Godzik 1991, 1993). Comparative studies of heap and mountain populations of *B. laevigata* have also been conducted (Wierzbicka and Pielichowska 2002). Research revealed that morphological differences between populations were not constant and they had not been genetically fixed. A few minor, genetically fixed characters caused by adaptation to xerothermic conditions distinguished the populations. The light-green, strongly tomentosed leaves limited water transpiration from tissue in the *B. laevigata* heap population while the increase in parenchyma cell size prevented the loss of water and the leaves were dark-green, covered with wax and sparse hairs in its mountain population. *Biscutella laevigata* plants from heap populations were more tolerant to lead than those from mountain populations (Wierzbicka 2002).

The above research confirms the intrapopulational and interpopulational morphological variability and the genetic variability of the species, often conditioned by different ecologic circumstances and different migration

routes. The taxon *B. laevigata* in Poland and within its range worldwide requires thorough taxonomic examinations supported with molecular methods.

MATERIALS AND METHODS

Field studies were carried out during the flowering period of *B. laevigata* from mid May until the end of August in 2006-2009. The distribution of its localities was mapped using the ATPOL grid based on cartogram units 10 × 10 km (Zając 1978). The nomenclature of the vascular plant species listed in the phytosociological table follows Mirek et al. (2002) and the nomenclature of syntaxa is used after Matuszkiewicz (2006). Phytosociological relevés were made using the method of Braun-Blanquet (1964). Herbarium specimens are deposited in the Herbarium of the Jan Kochanowski University in Kielce (KTC).

RESULTS

New locality of Biscutella laevigata

The locality is situated E of Zagórzyce near Kozubów in the Pińczów administrative district, the Świętokrzyskie Voivodeship. The species was reported from the western slope of the Mozgawka river valley, between the Smyków village and Zagórzyce, Pod Górami, ATPOL EF23, in 2006 (Fig. 2). It is the area of the Garb Wodzisławski hummock mesoregion in the Nida Basin macroregion in the Małopolska Upland (Kondracki 2002; Fig. 1). According to Szafer (1977), the area is situated in the Pińczów subdistrict, the Miechów-Pińczów district of the Kraina Miechowsko-Sandomierska region.

The distances from the new locality to the nearest known and confirmed locations are: 70 km – the vicinity of Olkusz, 73 km – Bolesław, in Silesia and ca 137 km – the Dolina Małej Łąki valley, 139 km – Czerwone Wierchy, in the Tatra Mts.

Population size and habitat conditions

The occurrence area at the new locality is about 95 ares based on a GPS locator and an orthophotomap. The estimated number of specimens in the population is about 1000-1500 shoots.

The *Biscutella laevigata* population occupies the steep west- and southwest-facing slope of the hill extending from the Nida river valley to the bend of its tributary, the Mozgawa river. The hill is covered with loess deposit, eroded on steeper slopes and revealing carbonate substratum in places of erosion. It is formed of Miocene limestone rocks. There are shallow skeleton-rich calcareous rendzina soils with a high content of stone rubble. The high incline (about 30° on average) of the slope causes rinsing off of finer soil fractions making the soil shallow or absent in places. *Biscutella laevigata* occurs in an overgrowing xerothermic grassland. Plant communities with *B. laevigata* from Zagórzyce are presented in Table 1 (relevés 1-8). The coenosis is composed of three layers. The shrub layer consists of young pine seedlings and xerothermic shrubs typical of the class *Rhamno-Prunetea*. The field layer is dominated by calciphilous species (basiphytes) and xerothermic species characteristic of the class *Festuco-Brometea*. Syntaxonomically, the community is similar to the association *Inuletum ensifoliae*, although with a significant contribution of other associations belonging both to the alliances *Festuco-Stipion* and *Cirsio-Brachypodion pinnati*, and even *Seslerio-Festucion duriusculae*. *Biscutella laevigata* is characteristic of mountain communities of the class *Seslerietea variae*, but it is not accompanied by any other species typical of this class in the lowland. This community also consists of other protected and geographically interesting plants: *Anemone sylvestris*,

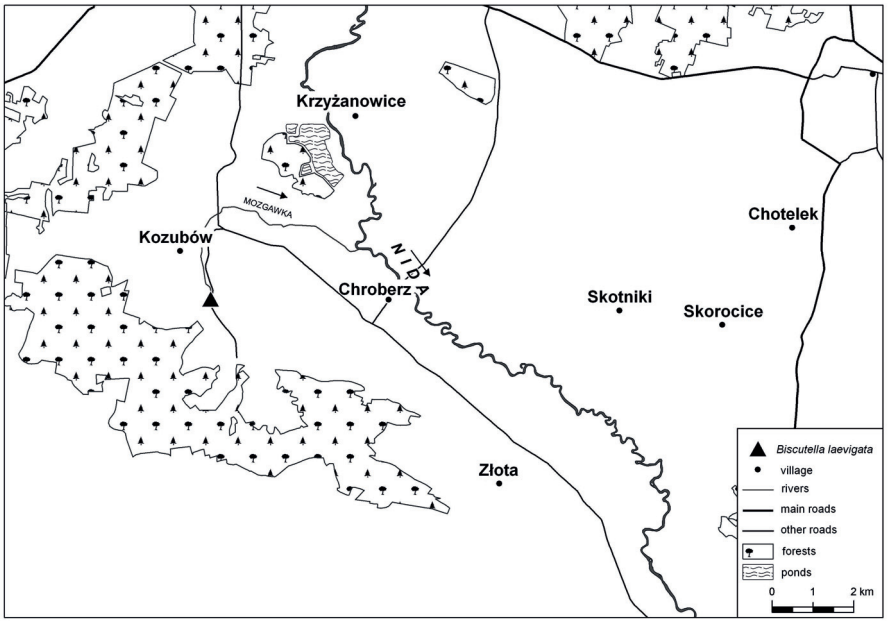

Fig. 2. New locality of *Biscutella laevigata* in the Nida Basin

Table 1. Plant communities with *Biscutella laevigata* in the Polish Uplands

No. of relevé	1	2	3	4	5	6	7	8	9	10	11	
Date	24.08. 2006	24.08. 2006	24.08. 2006	11.07. 2009	24.08. 2006	11.07. 2009	24.08. 2006	11.07. 2009	30.06. 2007	30.06. 2007	25.08. 2006	Constancy
Location	Zagórzyce	Zagórzyce	Zagórzyce	Zagórzyce	Zagórzyce	Zagórzyce	Zagórzyce	Zagórzyce	Bukowno	Bukowno	Olkusz	
Exposure	SW	NW	N	W	S	W	SWW	W	E	SE	–	
Inclination [°]	10	10	20	30	20	45	30	30	5	–	–	
Area of relevé [m²]	100	100	100	100	100	100	100	100	100	100	100	
Cover of tree layer a [%]	–	–	–	–	–	–	5	–	10	10	50	
Cover of shrub layer b [%]	20	10	10	40	10	5	20	10	20	20	10	
Cover of herbaceus layer c [%]	70	50	40	80	70	30	75	90	60	60	60	
Cover of moss layer d [%]	30	30	10	>5	15	10	20	>5	20	>5	50	
Number of species	77	63	52	71	49	38	47	32	42	27	44	
Biscutella laevigata	**2**	**2**	**2**	**2**	**1**	**1**	**2**	+	**2**	**3**	**2**	**V**
Pinus sylvestris a	.	.	.	.	.	.	+	.	1	1	4	II
Pinus sylvestris b	2	1	1	1	+	+	+	+	2	1	1	V
Pinus sylvestris c	+	.	+	+	+	+	+	.	+	+	.	IV
Juniperus communis subsp. *communis* b	1	1	+	3	+	.	+	.	.	.	+	III
Juniperus communis subsp. *communis* c	+	+	+	.	.	.	+	.	+	.	+	III
Cerasus avium b	.	.	.	+	+	.	.	+	.	.	.	II
Cerasus avium c	+	+	+	+	.	.	.	.	.	.	.	II
Frangula alnus b	+	.	.	.	.	.	.	+	.	.	.	I
Quercus petraea c	.	.	.	+	.	+	.	.	.	.	.	I
Ch. *Festuco-Brometea*												
Potentilla arenaria	2	+	+	1	1	+	1	+	+	+	+	V
Scabiosa ochroleuca	+	+	+	1	.	+	+	+	+	+	.	V
Asperula cynanchica	+	1	1	+	1	+	+	+	.	.	.	IV
Euphorbia cyparissias	+	+	+	+	+	+	+	1	.	.	.	IV
Festuca pallens	2	2	2	2	3	3	1	1	.	.	.	IV
Carex humilis	2	1	.	3	+	+	4	1	.	.	.	IV
Campanula sibirica	1	+	+	+	+	+	+	.	.	.	.	IV
Plantago media	2	+	+	+	+	+	+	.	.	.	.	IV
Thymus kosteleckyanus	+	1	+	+	1	.	+	+	.	.	.	IV
Achillea pannonica	+	+	+	+	.	+	.	+	.	.	.	III
Aster amellus	2	2	2	2	1	.	+	.	.	.	.	III
Brachypodium pinnatum	1	+	+	+	+	.	.	5	.	.	.	III
Carlina vulgaris	+	+	+	+	.	.	+	.	+	.	.	III
Helianthemum nummularium subsp. *obscurum*	+	+	.	.	.	+	.	+	+	.	1	III
Salvia verticillata	+	1	+	2	.	.	+	.	.	.	.	III

Table 1 – cont.

No. of relevé	1	2	3	4	5	6	7	8	9	10	11	
Avenula pratensis	.	+	+	.	.	+	.	.	.	.	.	II
Carex michelii	2	+	+	.	.	.	.	.	.	.	.	II
Centaurea stoebe	1	.	.	+	.	.	+	+	.	.	.	II
Dianthus carthusianorum	.	.	.	+	.	.	.	.	2	+	1	II
Festuca rupicola	.	+	.	1	.	.	.	+	.	.	.	II
Thesium linophyllon	.	+	.	+	.	.	+	.	.	.	.	II
Thymus marschallianus	1	+	+	.	.	.	.	.	.	.	.	II
Centaurea scabiosa	.	+	+	.	+	.	.	.	.	.	.	II
Alyssum montanum	.	.	.	.	.	.	.	.	+	+	.	I
Artemisia campestris subsp. *campestris*	1	.	.	.	+	.	.	.	.	.	.	I
Koeleria macrantha	.	+	.	.	.	.	+	.	.	.	.	I
Onobrychis viciifolia	1	.	+	.	.	.	.	.	.	.	.	I
Seseli annuum	+	.	+	.	.	.	.	.	.	.	.	I
Veronica spicata subsp. *spicata*	+	.	.	+	.	.	.	.	.	.	.	I
Viola rupestris	+	.	.	.	.	+	.	.	.	.	.	I
Cl. *Molinio-Arrhenatheretea*												
Anthyllis vulneraria	+	+	+	+	+	+	+	+	2	+	+	V
Leontodon hispidus subsp. *hispidus*	2	+	+	+	.	.	+	.	2	.	1	IV
Achillea millefolium	+	.	+	+	+	.	.	.	.	+	.	III
Centaurea jacea	+	+	+	+	.	.	.	+	.	.	.	III
Daucus carota	+	.	+	+	+	.	.	.	1	.	.	III
Leucanthemum vulgare	+	+	.	+	.	.	+	.	.	.	+	III
Lotus corniculatus	.	.	.	+	.	+	.	.	2	1	+	III
Avenula pubescens	.	+	+	+	.	+	.	.	.	.	.	II
Galium boreale	.	.	+	.	.	.	+	+	.	.	+	II
Galium mollugo	.	.	.	.	.	.	.	.	2	+	1	II
Pastinaca sativa	.	+	+	.	+	.	.	.	.	.	+	II
Plantago lanceolata	.	+	.	.	.	.	.	+	+	+	.	II
Prunella vulgaris	+	+	+	.	.	.	.	.	.	.	.	II
Rumex acetosa	.	.	.	.	.	.	.	.	+	+	+	II
Trifolium pratense	+	.	.	+	.	.	+	.	.	.	.	II
Arrhenatherum elatius	.	.	.	+	+	.	.	.	.	.	.	I
Dactylis glomerata subsp. *glomerata*	.	.	.	+	.	+	.	.	.	.	.	I
Knautia arvensis	.	.	.	.	.	+	.	.	.	+	.	I
Cl. *Rhamno-Prunetea*												
Rosa canina b	+	+	.	1	+	+	+	.	.	.	.	III
Berberis vulgaris b	+	+	.	+	.	.	.	.	.	.	.	II
Berberis vulgaris c	.	.	+	.	+	.	+	.	.	.	.	II

Table 1 – cont.

No. of relevé	1	2	3	4	5	6	7	8	9	10	11	
Rosa rubiginosa b	+	+	+	+	.	.	.	.	.	.	.	II
Rosa canina c	.	.	.	+	.	.	+	.	.	.	.	I
Cl. *Trifolio-Geranietea sanguinei*												
Coronilla varia	+	+	+	+	+	.	+	2	.	.	.	IV
Galium verum	+	.	.	+	+	.	+	+	.	.	.	III
Medicago falcata	1	1	.	+	+	.	+	+	.	.	.	III
Anemone sylvestris	.	+	+	.	1	.	.	.	.	.	.	II
Fragaria viridis	.	.	+	.	.	+	.	.	.	.	.	I
Cl. *Artemisietea vulgaris*												
Echium vulgare	+	+	+	+	+	+	.	+	.	.	.	IV
Picris hieracioides	1	1	+	+	+	.	+	.	.	.	.	III
Reseda lutea	.	.	.	.	.	.	.	.	+	+	.	I
Others												
Carlina acaulis	+	+	+	+	+	+	+	+	+	.	+	V
Euphrasia stricta	1	2	1	+	+	+	1		+	+	+	V
Linum catharticum	+	+	+	+	.	+	+	+	+	+	1	V
Ononis spinosa	2	1	+	+	+	+	+	+	.	.	.	IV
Pimpinella saxifraga	1	1	+	+	1	.	+	.	+	.	1	IV
Sanguisorba minor	+	+	+	1	+	+	.	1	.	.	.	IV
Abietinella abietina d	1	2	1	+	+	+	+	.	.	.	.	IV
Bryum sp. d	2	1	+	.	2	.	2	+	2	.	3	IV
Homalothecium lutescens d	1	2	1	+	+	+	+	.	.	.	+	IV
Briza media	+	+	+	+	.	+	+	.	.	.	.	III
Calamagrostis epigejos	+	+	.	+	+	+	+	.	.	.	.	III
Convolvulus arvensis	+	+	.	.	+	+	.	+	.	.	.	III
Salvia pratensis	1	1	+	2	.	.	1	+	.	.	.	III
Cladonia sp. d	+	+	+	.	+	.	+	.	1	.	.	III
Cardaminopsis arenosa	.	.	.	.	.	.	.	.	+	+	+	II
Festuca ovina	.	.	.	.	.	.	.	.	1	2	3	II
Hieracium pilosella	1	+	.	.	+	.	.	.	.	.	.	II
Hypericum perforatum	+	+	.	+	+	.	.	.	.	.	.	II
Silene vulgaris	.	.	.	.	.	.	.	.	1	1	1	II
Thymus pulegiodes	.	.	.	.	.	.	.	.	2	+	1	II
Brachytheciastrum velutinum d	.	.	.	+	+	.	+	.	.	.	.	II
Cladonia chlorophaea d	+	.	.	.	+	.	+	.	.	.	+	II
Fissidens sp. d	+	.	.	.	+	.	+	.	.	.	.	II
Pohlia nutans d	1	.	.	.	+	.	+	.	.	.	.	II
Carex ericetorum	.	.	.	.	.	.	.	.	+	.	+	I
Cuscuta epithymum	+	.	.	.	+	.	.	.	.	.	.	I

Table 1 – cont.

No. of relevé	1	2	3	4	5	6	7	8	9	10	11	
Elymus hispidus subsp. *hispidus*	+	.	.	.	+	.	.	.	.	.	.	I
Elymus repens	.	+	.	+	.	.	.	.	.	.	.	I
Gypsophila fastigiata	.	.	.	.	.	.	.	.	+	+	.	I
Hieracium piloselloides	+	.	.	.	.	.	.	+	.	.	.	I
Thymus serpyllum	.	.	.	+	.	+	.	.	.	.	.	I
Rosa dumalis b	+	+	.	.	.	.	.	.	.	.	.	I

Sporadic species: Ch. *Festuco-Brometea*: *Acinos arvensis* 4; *Arabis hirsuta* 1; *Asperula tinctoria* 9; *Bothriochloa ischaemum* 1; *Carex supina* 6; *Filipendula vulgaris* 1; *Linum flavum* 2; *L. hirsutum* 4 (1); *Phleum phleoides* 1; *Stipa capillata* 1; *Veronica austriaca* 1; **Ch. *Molinio-Arrhenatheretea*:** *Agrostis stolonifera* 11; *Carex hirta* 9; *Festuca pratensis* 4; *Leontodon autumnalis* 10; *Molinia caerulea* 10; *Rhinanathus minor* 9; *Taraxacum officinale* s.l. 6; **Ch. *Rhamno-Prunetea*:** *Crataegus monogyna* b 4, c 2; *Euonymus europaeus* b 4, c 4; *Ligustrum vulgare* b 4, c 2; *Prunus spinosa* c 1; *Rhamnus cathartica* b 4; *Viburnum opulus* b 4, c 2; **Ch. *Trifolio-Geranietea sanguinei*:** *Agrimonia procera* 4; *Anthericum ramosum* 11; *Viola hirta* 3; **Ch. *Artemisietea vulgaris*:** *Carduus crispus* 5; *Cirsium vulgare* 10; **Others:** *Acer platanoides* c 9; *Agrostis capillaris* 9; *Antennaria dioica* 11; *Arenaria serpyllifolia* 4; *Armeria maritima* 9; *Betula pendula* a 10, a 9, b 10 (1), c 10; *B. pubescens* a 11; *Botrychium lunaria* 6; *Campanula rotundifolia* 11; *Cerastium vulgatum* 4; *Ceratodon purpureus* 9; *Cladonia furcata* 11 (1); *Conyza canadensis* 5; *Crataegus* sp. c 1; *Cruciata glabra* 11; *Epipactis atrorubens* 11 (1); *Erigeron acris* 1; *Herniaria glabra* 9; *Hieracium* sp. 4; *Frangula alnus* c 11; *Fraxinus excelsior* a 9; *Larix decidua* b 10, a 11; *Malaxis monophyllos* 11; *Medicago lupulina* 4; *Monotropa hypopitys* 11; *Padus serotina* c 11; *Picea abies* a 11; *Pleurozium schreberi* 11; *Poa compressa* 4; *Polygala amara* subsp. *brachyptera* 11 (1); *Populus tremula* c 10; *Potentilla erecta* 9; *Prunella grandiflora* 11; *Pyrus communis* c 2; *Quercus robur* c 11; *Ranunculus bulbosus* 9 (1); *R.* sp. 11 (1); *Robinia pseudoacacia* c 10; *Rumex thyrsiflorus* 9; *Scabiosa canescens* 1; *Sorbus aucuparia* subsp. *aucuparia* b 2; *Tussilago farfara* 6; *Viola tricolor* 9.

Bothriochloa ischaemum, Campanula sibirica, Carex michelii, C. supina, Carlina acaulis, Linum hirsutum, L. flavum, Stipa capillata.

Threats to the species at the new locality

The locality should be considered to be vulnerable but not yet endangered. The phytocoenotic instability of the xerothermic grassland community is the main source of threat. Like other grassland phytocoenoses, the community undergoes succession and develops into a forest community. The area is privately owned and was used for grazing in the past. Currently grazing is only done in the lower parts of the slope (moderate cow pasturage). A considerable decrease in stress caused by feeding brought about the occurrence of seedlings of pine and other trees and shrubs in the grassland. Trees and shrubs cause an increase in overshadowing and humidity of the substrate, which will lead to the recession of xerothermic species and development of mesotrophic species, and thus eutrophisation of the substrate. These processes may additionally stop slope erosion. Slope erosion and the development of plant-free areas are basic conditions of the spread of *B. laevigata*. This species probably has a very low competitive potential as compared to other perennial grassland species with often dense growth. Active conservation methods, extensive use, pasturing and removal of numerous tree and shrub seedlings are the most efficient ways to protect *B. laevigata*.

DISCUSSION

It is very important to identify the origin of the new locality and to determine whether the site is natural and the locality is a relict. This may be indirectly determined based on the conditions of the species' occurrence. All known localities in the Silesia – Kraków Upland are synanthropic: the vicinity of Olkusz – pine pole forests on old calamine heaps, the vicinity of Bolesław – mine excavations (calamine heaps) with much less advanced forest succession. The field layer at these localities contains species of different syntaxonomic classes, with the greatest contribution of meadow species (Table 1, Fig. 3).

The situation is different at the new locality in Ponidzie where the species occurs in xerothermic grasslands. Such communities are considered to be semi-natural. Szafer (1977), however, believed that natural xerothermic grasslands can occur on steep slopes with rock outcrops and shallow soil, where there is little possibility for a forest or dense brushwood to occur. Due to the landslide slope and the flora type, the locality in Ponidzie may be considered to be near-natural. Unlike the communities of *B. laevigata* near Olkusz and Bukowno, the field layer in the communities in Ponidzie is dominated by species typical of the class *Festuco-Brometea* (Table 1, Fig. 3).

Szafer (1930) accept that light-demanding species occurred in Lowland Poland in the period of woodless tundra and cold periglacial steppe, therefore the earliest probable time the species occurred here was the middle-Polish glaciation or the Baltic glaciation. Thus the species locality in Ponidzie may be classified as a glacial relict (early-Holocene). Szafer (l.c.) included the species into the group of oldest glacial relicts (a true relict) which descended into the lowland during the woodless postglacial period.

The newly-discovered locality is not only phytogeographically important but it opens new perspectives in research into plant adaptation to an increased content of heavy metals in the soil, which has been extensively researched and widely discussed (e.g. Godzik 1991,

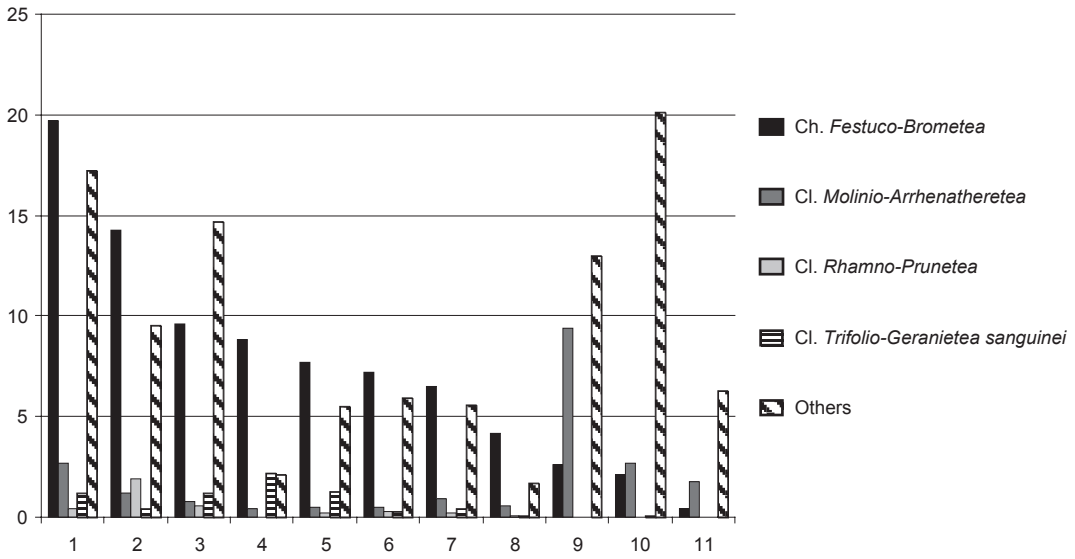

Fig. 3. Group quantity of species characteristic of the most numerous classes of associations in communities with *Biscutella laevigata* in the Polish Uplands (1-8: Zagórzyce, 9-10: Bukowno, 11: Olkusz)

Szarek-Łukaszewska and Niklińska 2002, Wierzbicka 2002, Pielichowska and Wierzbicka 2004, Wierzbicka and Pielichowska 2004).

The taxonomy of *B. laevigata* and its genetic relationship to other lowland and mountain populations are also extremely important. The taxon is characterised by a wide range of genetic and morphologic variability and a high potential for adaptation to different ecological conditions. Genetic data are often of limited relevance to taxonomic analyses (König 1994, 1998). König demonstrated that morphological changes within a subspecies were often greater than among subspecies.

The population of *B. laevigata* at the new locality is morphologically close to the calamine heaps populations. The specimens are also characterised by light-green, strongly tomentose leaves. Further research at the newly discovered locality will provide more detailed data on the morphology and ecology of the species.

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