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VASCULAR FLORA IN CEMETERIES OF THE ROZTOCZE REGION AND SURROUNDING AREAS (SOUTH-EAST POLAND)

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A b s t r a c t

The paper presents a systematic list of vascular plant species recorded at 78 cemeteries in the Roztocze region and surrounding areas. 543 species belonging to 75 families were recorded. Of these, 99 foreign and 43 native species were cultivated. 41 species introduced by humans to cemeteries can be regarded as the so-called established cemetery species. These species, once planted on graves, continue to grow or even spread after people stopped cultivating them.

Key words: vascular flora, cemetery, the Roztocze region, Poland

INTRODUCTION

Cemeteries constitute a material representation of history, traditions and beliefs of the local population. The diversity and exceptional character of cemeteries are determined first of all by architectural aspects, e.g. their location, shape, spatial arrangement and the type of gravestones. The unique character of a necropolis is also connected with the so-called cemetery green, which is affected not only by the original and planned arrangement, but also the inventiveness and aesthetic sense of individuals taking care of individual gravestones and the whole cemeteries. Cemeteries are important localities of plants in rural and urban floras (S u d n i k - W ó j c i k o w s k a , 1987; B r a n d e s and B r a n d e s , 1996; M a c i e j c z a k , 2008).

Cemeteries in the Roztocze region are the most beautiful not only on the national scale, but also throughout Europe; however, they are relatively unknown (K o l b u s z e w s k i , 1996). They are mostly old cemeteries, located amid fields and forests. A characteristic feature of the Roztocze cemeteries (particularly those from the Eastern Roztocze region) is the occurrence of folk art crosses and gravestones made from Tertiary sandstone (the so-called gravestone carving from the Bruśno stoneworking centre). They may be found in numerous cemeteries of different denominations: Greek Catholic and Roman Catholic (W ł a d and W i ś n i e w s k i , 2004). Many old cemeteries in that region of Poland have still retained rich old stands. They are also localities of plants grown in former times as well as of rare and interesting species.

This paper presents results of studies on vascular flora of 78 cemeteries from the Roztocze region and surrounding areas (Płaskowyż Tarnogrodzki, Równina Bełska) (Fig. 1, Table 1). 36 of the studied cemeteries are in active use, while 42 are currently closed and regarded as monuments. A smaller part of these temporary cemeteries (for example the ones located in Lubaczów and its vicinity, Podlesie) were used to bury German Evangelical settlers; the survivors among them left Poland during WW II. A greater part of these temporary cemeteries (for example the ones located in Łówcza, Gorajec, Chotylub, Huta Różaniecka) were used to bury the Ukrainian Greek Catholic population; its members were displaced from this region during the 1944-1947 period.

The aim of the study was to determine a list of vascular plant species in the analysed cemeteries, to conduct the analysis of the collected material and to establish a list of permanent cemetery species.

MATERIAL AND METHODS

Floristic inventories were conducted in the growing season of 2007. A total of 5004 floristic data were collected.

It included a list of families and species, with plant families presented using a system according to

the key proposed by Rutkowski (1998), while the species were presented alphabetically. Nomenclature of species was adopted after Mirek et al. (2002). Square brackets contain information on their geographic-historical status, life form and socio-ecological group. Parentheses with Roman numerals contain the degree of cover in a 5-point scale, provided that the degree of cover was at least II. Arabic numerals outside the parentheses denote the numbers assigned to the cemeteries in which a given species was recorded (the list of cemeteries is presented in Fig. 1, Table 1).

Geographic-historical groups were presented according to Chmiel (1993), with slight modifications: Sp – spontaneophytes; Ap – apophytes; Arch – archaeophytes; Ken –kenophytes; D – diaphytes.

Life forms sensu Raunkiaer were adopted after Zarzycki et al. (2002): M – megaphanerophytes; N – nanophanerophytes; Ch – chamaephytes; H – hemicryptophytes; G – geophytes; T – therophytes; Hel – helophytes.

Socio-ecological groups were presented according to Chmiel (1993): 1 – *Fagetalia*, *Prunetalia*; 2 – *Quercion robori-petraeae*, *Epilobion*, *Nardetalia*; 3 – *Sambuco-Salicion*, *Alliarion*; 4 – *Trifolio-Geranietea*, *Festuco-Brometea*; 5 – *Dicrano-Pinion*, *Sedo-Scleranthetea*, *Corynephoretea*; 6 – *Alnion*, *Magnocaricion*, *Caricetalia fuscae*, *Sphagnion fusci*; 7 – *Salicion*, *Phragmition*, *Glycerio-Sparganion*, *Potamogetonetea*, *Lemnetea*, *Utricularietea*; 8 – *Molinietalia*; 9 –*Arrenatheretalia*; 10 – *Plantaginetea*; 11 – *Thero-Salicornietea*, *Asteretea tripolium*, 12 – *Bidentetea*, *Nanocyperion*; 13 – *Arction*; 14 – *Onopordion*; 15 – *Sisymbrion*, *Eragrostion*; 16 – *Polygono-Chenopodietalia*; 17 – *Aperetalia*; 18 – *Asplenietea*; 19 – native species or naturalized antropophytes of undetermined phytosociological status and ephemerophytes.

A 5-point scale was adopted, indicating the area covered by a given species: I – the species growing on < 5 % of the cemetery area, II – 5-25 %, III – 25-50 %, IV – 50-75 %), and V – 75-100 %, respectively.

Native currently cultivated species are underlined with a double line, while foreign, formerly cultivated species are underlined with a single line.

The following scale was adopted in the determination of the frequency of species: very rare (1–2 localities), rare (3–5 localities), relatively frequent (6–10 localities), frequent (11–25 localities), very frequent (26–50 localities), and common (51–78 localities).

A list was prepared comprising species that were planted on graves and which, after being abandoned, have been growing in good condition until the present time, or even have been spreading. These species are referred to as constant cemetery plants. These species are good phytoindicators of cemetery locations.

Table 1.
A description of the investigated cemeteries in the Roztocze region. Cemeteries are denoted with numbers as in Fig. 1

No	Locality	Commune	Cemetery area (m)	Usage
1	Podlesie	Lubaczów	25 x 25	C
2	Basznia Dolna	Lubaczów	32 x 65	C
3	Bszania Dolna	Lubaczów	85 x 60	A
4	Karolówka	Lubaczów	20 x 35	A
5	Młodów	Lubaczów	20 x 30	C
6	Lubaczów	Lubaczów	50 x 100	A
7	Lubaczów	Lubaczów	30 x 35	C
8	Lubaczów	Lubaczów	25 x 40	C
9	Dachnów	Cieszanów	45 x 55	A
10	Załuże	Lubaczów	40 x 40	A
11	Cieszanów	Cieszanów	80 x 80	A
12	Kowalówka	Cieszanów	25 x 120	C
13	Ruda Różaniecka	Narol	25 x 120	A
14	Płazów	Narol	90 x 190	A
15	Łówcza	Narol	60 x 70	C
16	Gorajec	Cieszanów	40 x 100	C
17	Nowe Sioło	Cieszanów	35 x 70	A
18	Tansówka	Horyniec Zdrój	35 x 80	C
19	Podemszczyzna	Horyniec Zdrój	30 x 30	C
20	Podemszczyzna	Horyniec Zdrój	30 x 60	C
21	Nowe Brusno	Horyniec Zdrój	30 x 60	A
22	Polanka Horyniecka	Horyniec Zdrój	25 x 100	C
23	Stare Brusno	Horyniec Zdrój	25 x 75	C
24	Chotylub	Cieszanów	30 x 60	C

25	Horyniec Zdrój	Horyniec Zdrój	50 x 150	A
26	Radruż	Horyniec Zdrój	20 x 35	C
27	Radruż	Horyniec Zdrój	40 x 60	C
28	Moczary	Horyniec Zdrój	30 x 50	A
29	Werchrata	Horyniec Zdrój	45 x 110	A
30	Prusie	Horyniec Zdrój	50 x 50	A
31	Hrebenne	Lubycza Królewska	60 x 60	A
32	Siedliska	Lubycza Królewska	40 x 100	A
33	Kornie	Lubycza Królewska	35 x 150	C
34	Stary Machnów	Lubycza Królewska	35 x 40	C
35	Wierzbica	Lubycza Królewska	20 x 50	C
36	Nowosiółki Przednie	Lubycza Królewska	20 x 40	C
37	Nowosiółki Kardynalskie	Lubycza Królewska	30 x 30	C
38	Chodywańce	Jarczów	50 x 150	A
39	Jurów	Jarczów	20 x 30	C
40	Jarczów	Jarczów	50 x 60	A
41	Żurawce	Lubycza Królewska	30 x 120	A
42	Żurawce	Lubycza Królewska	60 x 70	A
43	Mosty Małe	Lubycza Królewska	30 x 70	A
44	Teniatyska	Lubycza Królewska	50 x 150	C
45	Lubycza Królewska	Lubycza Królewska	80 x 100	A
46	Lubycza Królewska	Lubycza Królewska	20 x 30	C
47	Lubycza Królewska	Lubycza Królewska	30 x 40	C
48	Kniazie	Lubycza Królewska	30 x 40	C
49	Kniazie	Lubycza Królewska	30 x 200	C
50	Chyże	Bełżec	50 x 60	A
51	Bełżec	Bełżec	150 x 200	A
52	Bełżec	Bełżec	20 x 40	C
53	Tomaszów Lubelski	Tomaszów Lubelski	60 x 150	C
54	Tomaszów Lubelski	Tomaszów Lubelski	200 x 200	A
55	Łaszczówka	Tomaszów Lubelski	100 x 100	A
56	Wierszczyca	Jarczów	20 x 30	C
57	Szlatyn	Jarczów	20 x 30	C
58	Hubinek	Ulhówek	30 x 50	A
59	Przeorsk	Tomaszów Lubelski	20 x 50	C
60	Dulne	Jarczów	25 x 30	C
61	Narol	Narol	20 x 20	C
62	Lipsko	Narol	100 x 150	A
63	Lipsko	Narol	100 x 100	A
64	Narol-Krupiec	Narol	60 x 150	A
65	Jędrzejówka	Narol	15 x 15	C
66	Stara Huta	Narol	30 x 50	C
67	Wola Wielka	Narol	3 x 30	C
68	Wola Wielka	Narol	25 x 30	C
69	Kijasówka	Narol	50 x 100	A
70	Bełżec	Bełżec	10 x 10	C
71	Łosiniec	Susiec	70 x 70	C
72	Łosiniec	Susiec	100 x 150	A
73	Majdan Sopocki Drugi	Susiec	150 x 200	A
74	Susiec	Susiec	50 x 50	A
75	Huta Różaniecka	Narol	30 x 40	C
76	Huta Różaniecka	Narol	40 x 40	A
77	Lisie Jamy	Lubaczów	15 x 60	A
78	Lisie Jamy	Lubaczów	25 x25	C

Explanations: A – active cemeteries, C – closed cemeteries.

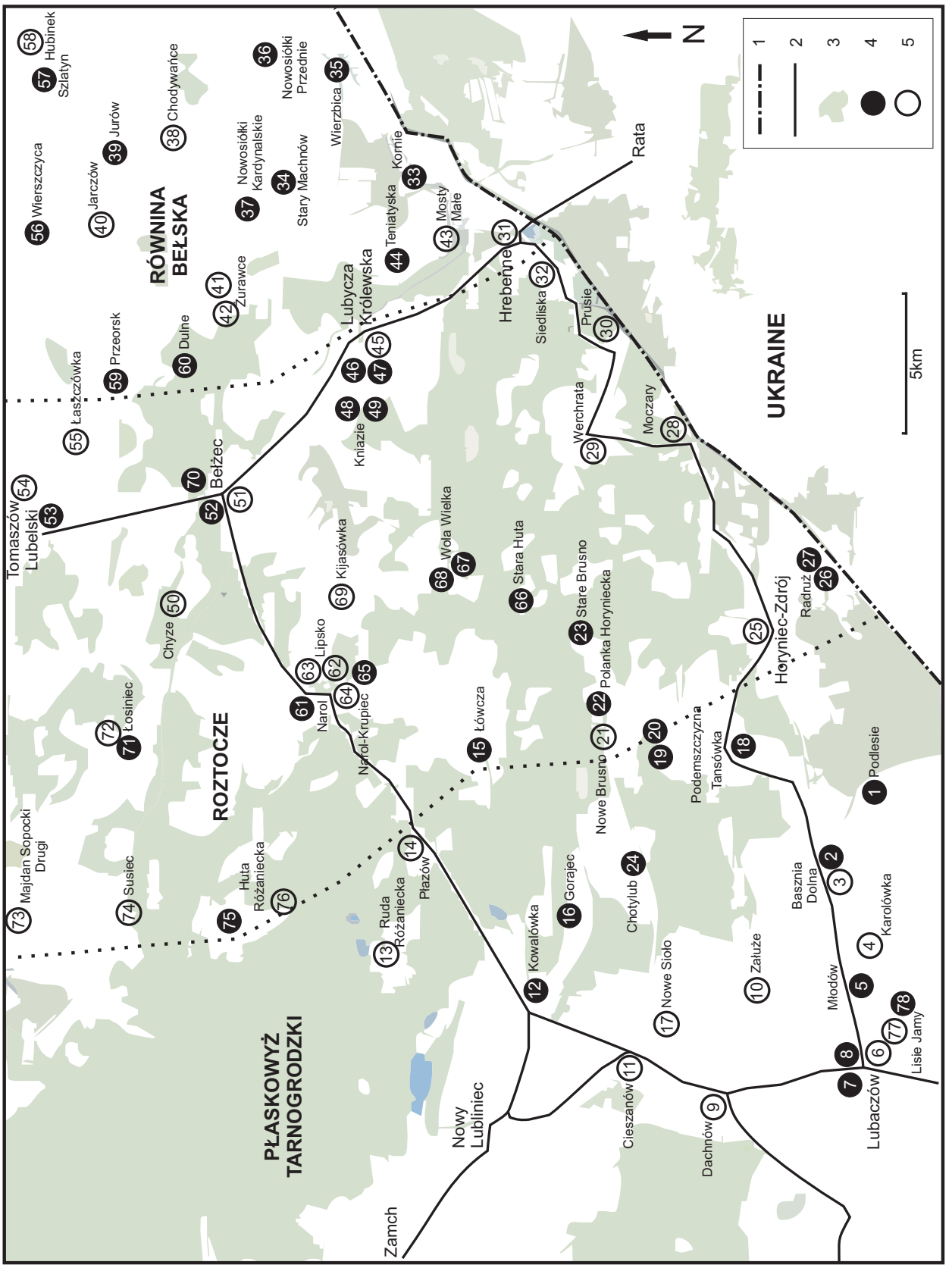

Fig. 1. Locations of the investigated cemeteries in the Roztocze region.
Explanations: 1 – state border; 2 – main roads; 3 – forest area; 4 – closed cemeteries; 5 – active cemeteries. Cemeteries are denoted with numbers as in Table 1.

RESULTS

A list of families and species

The explanation of the manner of presentation of information in the "Material and Methods" chapter.

Equisetaceae: ***Equisetum arvense*** L. [Ap G 6] 3(II), 4, 6, 7, 9, 10 (II), 11(II), 14, 15, 17, 19, 21, 23, 25, 29, 30, 32, 40, 41, 45, 46, 47, 49, 51, 53(III), 54(II), 60, 63, 64, 72, 73, 74, 77; ***Equisetum sylvaticum*** L. [Ap G 1] 60;

Hypolepidaceae: ***Pteridium aquilinum*** (L.) Kuhn [Sp G 2] 4, 12, 20, 64, 74;

Aspleniaceae: ***Asplenium ruta-muraria*** L. [Ap H 18] 25, 28; ***Asplenium trichomanes*** L. [Ap H 18] 66;

Athyriaceae: ***Athyrium filix-femina*** (L.) Roth [Sp H 1] 10, 18, 20, 49; ***Cystopteris fragilis*** (L.) Bernh. [Sp H 18] 11; ***Matteucia struthiopteris*** (L.) Tod. [Sp H 1] 3, 5, 6, 9, 10, 11, 14, 17, 25, 45, 49, 50, 54, 62, 63, 64, 68 (II), 73, 74, 77;

Aspidiaceae: ***Dryopteris carthusiana*** (Vill.) H. P. Fuchs [Sp H 8] 12 (II), 16, 18, 20, 24, 43, 44, 48, 60, 65, 66, 78; ***Dryopteris dilatata*** (Hoffm.) A. Gray [Sp H 1] 49, 66, ***Dryopteris filix-mas*** (L.) Schott [Sp H 2] 11, 12, 15, 16, 17, 18, 23, 25, 26, 27, 31, 48, 49, 54, 60, 67;

Polypodiaceae: ***Polypodium vulgare*** L. [Sp H 2] 24;

Pinaceae: ***Abies alba*** Mill. [Ap M 1] 28, 52, 70; ***Larix decidua*** Mill. [D M 2] 17, 25, 53, 78; ***Picea abies*** (L.) H. Karst. [Sp M 2] 20, 23, 29, 44 (II), 54, 61, 66 (II), 67, 77; ***Pinus sylvestris*** L. [Ap M 5] 8, 12, 13, 14, 15, 16 3, 17, 19 (II), 20, 21, 22, 23, 24, 28, 31, 42, 43 (II), 44 (II), 46, 47, 49, 51, 61 (II), 63, 64, 65 (II), 66 (II), 67 (II), 69, 70, 74, 78 (II); ***Tsuga canadensis*** (L.) Carričre [D M 19] 6;

Cupressaceae: ***Juniperus communis*** L. [Sp N 5] 19, 43, 44, 65, 66;

Salicaceae: ***Populus alba*** L. [Ap M 7] 15, 39; ***Populus nigra*** L. [Ap M 7] 49; ***Populus termula*** L. [Ap M 2] 7, 16, 23, 46, 47 (II), 60, 64, 74; ***Salix alba*** L. [Ap M 7] 43, 53; ***Salix alba*** L. f. ***viteliana pendula*** Rehd. [D M 19] 6, 8; ***Salix caprea*** L. [Ap N 3] 4, 7, 76, 25; ***Salix triandra*** L. [Sp N 7] 62;

Juglandaceae: ***Juglans regia*** L. [D M 19] 48, 53;

Betulaceae: ***Alnus glutinosa*** (L.) Gaertn. [Sp M 6] 21; ***Betula pendula*** Roth [Ap M 2] 8 (II), 11, 16, 18 (II), 19 (II), 21, 28, 42, 44, 45, 46, 47, 49, 51, 53, 54, 60, 66 (II), 67 (II), 69 (II), 72, 74, 75;

Corylaceae: ***Carpinus betulus*** L. [Sp M 1] 1, 12, 24 (III), 27 (III), 49 (II), 52, 66, 75; ***Corylus avellana*** L. [Sp N 1] 16, 23, 26, 28, 29, 31, 36, 48, 49, 51, 60;

Fagaceae: ***Fagus sylvatica*** L. [Sp M 1] 16, 23, 44, 66, 67, 70; ***Quercus robur*** L. [Sp M 1] 1, 2, 5, 8, 9, 12 (III), 15, 16 (II), 17, 19 (II), 20, 21, 22, 23 (II), 24 (II), 25, 26, 27, 28, 29, 30, 31, 32, 38, 43, 44 (II), 46 (II), 51 (III), 52, 60 (II), 61, 63, 65, 66, 70, 75, 78 (III); ***Quercus rubra*** L. [Ken M 2] 70;

Ulmaceae: ***Ulmus laevis*** Pall. [Sp M 1] 7, 11, 12, 13, 34, 36, 37, 53, 56, 58(II);

Cannabaceae: ***Humulus lupulus*** L. [Sp H 7] 11, 25, 31, 34, 36, 51, 59;

Urticaceae: ***Uritca dioica*** L. [Ap H 3] 1, 2, 5, 6, 7, 8, 10, 12 (II), 14, 16, 17, 18, 20, 23, 24, 25, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 39, 41, 42, 44, 46, 47, 48, 49, 51, 53, 54, 56, 57, 58, 59, 60, 62, 63, 64, 67, 69, 71, 73, 74, 75; ***Urtica urens*** L. [Arch T 16] 64;

Loranthaceae: ***Viscum album*** L. [Ap Ch 1] 25, 27, 59, 75;

Aristolochiaceae: ***Asarum europaeum*** L. [Sp H 1] 59;

Polygonaceae: ***Fallopia convolvulus*** (L.) Á. Löve [Arch T 16] 4, 6, 8, 11, 12, 14, 29, 33, 42, 43, 44, 49, 50, 51, 58, 60, 64, 76; ***Fallopia dumetorum*** (L.) Holub [Sp T 2] 2, 6, 7, 14, 15, 16, 25, 29, 30, 31, 33, 39, 42, 51, 54, 62, 63, 64, 68; ***Polygonum amphibium*** L. **f.** ***terrestre*** [Ap G 10] 45; ***Polygonum aviculare*** L. [Ap T 10] 4, 5, 6, 8, 9, 10, 11, 13, 17, 21, 25, 27, 29, 30, 31, 32, 35, 38, 40, 41, 42, 43, 46, 51, 54 (II), 55, 58, 62, 63, 68, 72, 74, 77; ***Polygonum bistorta*** L. [Sp G 8] 4; ***Polygonum hydropiper*** L. [Ap T 12] 77; ***Polygonum lapathifolium*** L. **ssp.** ***lapathifoium*** [Ap T 12] 6, ***Polygonum lapathifolium*** L. **ssp.** ***pallidum*** (With.) Fr. [Ap T 16] 3, 33; ***Polygonum minus*** Huds. [Ap T 12] 25, 51; ***Polygonum orientale*** L. [D T 19] 6, 10; ***Polygonum persicaria*** L. [Ap T 16] 41, 45, 51, 54, 72, 73, 74; ***Reynoutria japonica*** Houtt. [Ken G 16] 2, 11, 20, 25, 42, 45, 72; ***Rumex acetosa*** L. [Ap H 9] 2, 3, 4, 5, 7, 9; ***Rumex acetosella*** L. [Ap G 5] 4, 5, 16, 21, 22, 28, 30, 42, 43, 47, 61, 65, 66, 67, 69, 74, 76, 78; ***Rumex confertus*** Willd. [Ken H 14] 3, 6, 10, 32; ***Rumex crispus*** L. [Ap H 10] 29, 40, 54, 55, 64, 75; ***Rumex obtusifolius*** L. [Ap H 13] 9, 14, 23, 26, 27, 41, 49, 51, 53, 54, 58, 62, 68; ***Rumex thyrsiflorus*** Fingerh. [Ap H 14] 11, 13, 14, 17, 19, 21, 25, 28, 29, 30, 31, 32, 41, 42, 43, 44, 45, 46, 53, 55, 62, 63, 64, 66, 67, 68, 69, 72, 73, 74, 75, 76, 77, 78;

Chenopodiaceae: ***Atriplex hortensis*** L. [Ken T 16] 77; ***Atriplex nitens*** Schkuhr [Arch T 15] 54; ***Atriplex patula*** L. [Ap T 16] 7, 9, 14, 29, 34, 35, 38, 39, 40, 51, 54, 64; ***Chenopdodium album*** L. [Ap T 16] 3, 5, 6, 8, 9, 11, 13, 14, 17, 18, 21, 25, 28, 29, 30, 31, 32, 33 (II), 38, 40, 41, 42, 43, 45, 47, 50, 51, 54, 55, 58, 62, 63 (II), 64, 68, 71, 72, 73, 74, 76, 77; ***Chenopodium hybridum*** L. [Arch T 16] 33, 35, 58; ***Chenopodium polyspermum*** L. [Ap T 12] 31, 35; ***Chenopodium strictum*** Roth [Ken T 15] 73, 77; ***Fagopyrum esculentum*** Moench [D T 16] 54; ***Kochia scoparia*** (L.) Schrad. [Ken T 15] 3, 6, 9, 40;

Amaranthaceae: ***Amaranthus caudatus*** L. [Ken T 16] 73, 77; ***Amaranthus chlorostachys*** Willd. [Ken T 16] 38; ***Amaranthus cruentus*** L. [Ken T 16] 6, 9, 10, 11, 17, 25, 29, 38, 40, 51, 54, 68, 74, 77; ***Amaranthus retroflexus*** L. [Ken T 16] 9, 29, 33, 35, 40, 41, 58, 73; ***Celosia spicata*** L. [D T 19] 77;

Anacardiaceae: ***Rhus typhina*** L. [D M 16] 8, 50, 59, 64;

Portulaceae: ***Portulaca grandiflora*** Hook. [D T 19] 6; ***Portulaca oleracea*** L. [Ken T 16] 31; Caryophyllaceae: *Arenaria serpyllifolia* L. [Ap T 5] 31, 42, 47, 51, 72, 73, 76; ***Cerastium arvense*** L. s.s. [Ap H 9] 47, 53, 64; ***Cerastium biebersteinii*** DC. [D H 19] 5, 16, 25, 35; ***Cerastium holosteoides*** Fr. emend. Hyl. [Ap H 9] 3, 10, 14, 25, 26, 51, 53, 54, 69, 72, 73; ***Cucubalus baccifer*** L. [Sp H 3] 29, 39; ***Dianthus barbatus*** L. s.s. [Ken C 19] 1, 8, 14, 16, 21, 35, 47, 51; ***Dianthus deltoides*** L. [Ap H 2] 46; ***Gypsophila paniculata*** L. [Sp H 16] 50; ***Herniaria glabra*** L. [Ap H 5] 4, 42, 71, 76; ***Melandrium album*** (Mill.) Garcke [Ap H 14] 1, 2, 3, 5, 6, 7, 9, 10, 11, 14, 15 16, 17, 19, 21, 22, 24, 25, 27, 28, 30, 31, 32, 33 38, 39, 41, 44, 45, 46, 47, 49, 50, 51, 53, 54, 55, 58, 62, 66, 68, 69, 71, 72, 73, 74, 75; ***Moehringia trinervia*** (L.) Clairv. [Sp H 2] 8, 12, 14, 18, 20, 22, 23, 24, 25, 26, 27, 29, 47, 48, 66, 71; ***Myosoton aquaticum*** (L.) Moench [Ap H 7] 35; ***Saponaria officinalis*** L. [Arch G 14] 2, 3, 6, 7, 10, 11, 14, 15, 17, 21, 22, 25, 28, 30, 31, 32, 35, 36, 38, 40, 43, 44, 45, 46, 47, 49, 51, 54, 62, 63, 64, 69, 71, 73, 74, 76; ***Scleranthus annuus*** L. [Arch T 17] 25, 77; ***Scleranthus perennis*** L. [Ap H 5] 13, 21, 42, 43, 55, 69, 76; ***Silene armeria*** L. [D T 19] 3, 4, 25, 54; ***Silene vulgaris*** (Moench) Garcke [Ap H 14] 13, 14, 16, 19, 21, 25, 28, 38, 62, 63, 64 (II), 67 (II), 69, 72, 73, 74, 75, 76, 77; ***Spergula arvensis*** L. [Arch T 16] 3, 9, 10, 13, 25, 30, 50, 55 (II), 74, 77; ***Spergularia rubra*** (L.) J. Presl & C. Presl [Ap T 5] 3, 4, 25, 54, 77; ***Stellaria graminea*** L. [Ap H 2] 31, 47; ***Stellaria holostea*** L. [Sp H 1] 12, 52; ***Stellaria media*** (L.) Vill. [Ap T 16] 3, 4, 6, 9, 11, 14, 21, 25, 27, 31, 32, 33, 34, 35, 40, 44, 50, 51, 53, 58, 60, 62, 63, 64, 72, 73;

Ranunculaceae: ***Actea spicata*** L. [Sp H 1] 23; ***Aquilegia vulgaris*** L. [Sp H 1] 4, 9, 10, 15, 25, 32, 36, 38, 40, 44, 48, 49, 51, 68, 73, 74; ***Consolida ajacis*** (L.) Schur [D T 16] 11, 17, 35; ***Consolida regalis*** Gray [Arch T 17] 14, 38; ***Hepatica nobilis*** Schreb. [Sp H 1] 12, 35, 59; ***Ranunculus acris*** L. s.s. [Ap H 9] 3, 4, 5, 8, 9, 10, 11, 14, 21, 25, 26, 27, 28, 29, 30, 31, 32, 38, 40, 44, 45, 46, 47, 49, 51, 53, 54, 57, 58, 62, 63, 64 (II), 67, 68, 71, 72, 73, 74, 76; ***Ranunculus auricomus*** L. s.l. [Sp H 1] 22, 29; ***Ranunculus bulbosus*** L. [Ap H 4] 28, 45, 73; ***Ranunculus repens*** L. [Ap H 10] 14, 25, 26, 27, 51, 53, 54; ***Thalictrum minus*** L. [Sp H 4] 64; ***Trollius europaeus*** L. s.s. [Sp H 8] 51;

Berberidaceae: ***Berberis vulgaris*** L. [Ap N 4] 13; ***Mahonia aquifolium*** (Pursh) Nutt. [Ken N 19] 74;

Papaveraceae: ***Chelidonium majus*** L. [Ap H 3] 2, 8, 11, 12, 14, 15, 18, 20, 21, 22, 23, 24, 25, 27, 28, 30, 32, 33, 34, 35, 37, 42, 46, 47, 48, 49, 56, 58, 59, 60, 62, 63, 64, 66, 67, 69, 71, 73, 75, 76, 78; ***Eschscholtzia californica*** Cham. [D T 19] 6, 9; ***Papaver argemone*** L. [Arch T 17] 11; ***Papaver dubium*** L. [Arch T 17] 11, 14, 64, 76; ***Papaver rhoeas*** L. [Arch T 17] 11, 54, 64, 72;

Fumariaceae: ***Fumaria officinalis*** L. [Arch T 16] 51, 54; ***Fumaria vaillantii*** Loisel. [Arch T 14] 64;

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Cyperaceae: ***Carex brizoides*** L. [Sp H 1] 12; ***Carex caryophyllea*** Latourr. [Sp H 4] 78; ***Carex ericetorum*** Pollich [Ap H 2] 44, 50, 61, 65; ***Carex hirta*** L. [Ap G 10] 7, 8, 11, 15, 19, 21, 22, 28, 47, 53, 54, 68, 69, 72 73, 76; ***Carex ligerica*** J. Gay [Sp G 1] 16; ***Carex ovalis*** Gooden [Ap H 2] 53; ***Carex pallescens*** L. [Sp H 2] 16; ***Carex spicata*** Huds. [Ap H 2] 12, 13, 18, 22, 23, 26, 33, 35, 36, 40, 43, 52, 71.

Characteristics of flora and discussion

In the cemeteries of the analysed area, the occurrence of 523 species of vascular plants belonging to 75 families was recorded. The largest number of species belongs to the family Asteraceae (76), followed by those belonging to the families Poaceae (50) and Rosaceae

(40), as well as Fabaceae (25), Caryophyllaceae (22), and Lamiaceae (20). Six of the above mentioned families account for 45% of the flora in the analysed cemeteries. Similarly, Celka and Żywica (2005), when investigating 7 cemeteries in the Wielkopolska region, showed that the families Asteraceae and Poaceae are the most abundant in the number of species, followed by Caryophyllaceae. A considerable proportion of species from the family Poaceae in plant communities of the cemeteries in the city of Lublin was also indicated by Mosek and Miazga (2005). They are solely native, uncultivated species. They develop in abundance in unshaded or moderately shaded locations.

In the cemeteries of the Roztocze region, a total of 9 fern species were recorded. *Matteucia struthiopteris* is cultivated in cemeteries, but it tends to spread vegetatively. Among ferns, there are species found only in cracks of walls surrounding cemeteries and in cracks of gravestones (*Asplenium ruta-muraria, A. trichomanes, Cystopteris fragilis*). These species, due to the presence of stone walls, are frequent components of floras in urban cemeteries (Maciejczak 2008).

The frequency scale for species is extensive and ranges from 1 to 61 localities. "Very rare species" (present at 1-2 localities) predominate, comprising 194 taxa, which accounts for 37% of the flora (Fig. 2). The category of "common species" (occurring at 51-78 localities) consists of plants of the herbaceous layer, i.e. *Aegopodium podagraria*, *Conyza canadensis*, *Taraxacum officinale*, *Vinca minor*, *Galeopsis pubescens* and *Urtica dioica*, as well as two phanerophytes – *Tilia cordata* and *Robinia pseudoacacia* – forming the tree layer and regenerating in abundant numbers in the herbaceous layer. The group of common species is characterised by a higher mean value of cemetery area cover in comparison with the species representing the other frequency classes (Fig. 2).

In the analysed cemeteries, the richest layer was the herbaceous layer comprising 481 species, which accounts for 92% of recorded vascular plants. In the shrub layer, a total of 74 (14%) species were recorded, while the tree layer was formed by 34 species (6%). The plant division presented above corresponds to the percentage proportions of life forms (Fig. 3). The percentages of mega- and nanophanerophytes are very similar, with both groups comprising a total of 15% of the flora. Similar proportions of trees and shrubs were observed in the suburban cemeteries of the city of Warsaw (Galera et al. 1993). A study by Sudnik-Wójcikowska (1987) confirmed that in urbanised areas cemeteries (next to city parks) are important localities of the occurrence of phanerophytes. Native and alien trees and shrubs comprise an important element in the spatial composition of contemporary necropolises.

Among plants with non-woody shoots, hemicryptophytes (45%) and therophytes (32% of the flora) predominate. The presence of therophytes is distinctly marked in the presently used cemeteries, where tending measures are regularly applied. Hemicryptophytes are connected with both presently used and closed cemeteries. The dominance of hemicryptophytes and therophytes is typical of not only cemeteries (Celka and Żywica, 2005; Czarna et al. 2007), but of urban floras in general (Sudnik-Wójcikowska, 1987; Jackowiak, 1990).

Native species comprise almost 67% of the flora of the cemeteries, while the other 33% are composed of anthropophytes (Fig. 4). Such a distribution of proportions for native and alien species is typical of most necropolises (Celka and Żywica, 2004; Czarna, 2004). In Jewish cemeteries, where ornamental species are not introduced as a rule, the proportion of anthropophytes is small (Czarna, 2004; Czarna and Nowińska, 2010).

Among permanently naturalised alien species, kenophytes (16%) predominate over archeophytes (10%). A total of 39 species of alien origin do not show signs of permanent naturalisation, thus they were classified as diaphytes. Percentages of species representing 19 socio-ecological groups are presented in Fig. 5. A group of plants connected with weed communities of gardens and root crops, *Polygono-Chenopodietalia* (group 16), is represented in considerable numbers. The anthropogenic character of the cemeteries is also manifested in a high proportion of plants of unknown phytosociological affiliation (group 19). On the other hand, a still considerable and similar proportion was also recorded for these native species which are connected with fertile broad-leaved forests and shrub communities, i.e. *Fagetalia*, *Prunetalia* (group 1), as well as acidophilous or xerothermic oak forests, mixed coniferous forests and their substitute shrub, herb or grassland communities, i.e. *Quercion robori-petraeae*, *Epilobion* and *Nardetalia* (group 2).

Over 25% of vascular plants recorded in the analysed cemeteries are cultivated plants. In this group, geographically alien species predominate over native plants (99 vs. 43 species). According to Czarna (2001), cemeteries are testing grounds where previously cultivated species have a chance to survive. Such constant cemetery plants in the analysed cemeteries include 41 species: *Amaranthus caudatus, A. cruentus, Aquilegia vulgaris, Asparagus officinalis, Aster novi-belgii, Calendula officinalis*, *Convallaria majalis, Cosmos bipinnatus, Dianthus barbatus, Erigeron annuus, E. ramosus, Euphorbia marginata, Hemerocallis* sp., *Hesperis matronalis, Iris germanica, Kochia scoparia, Lamium album, Leonurus cardiaca, Leucanthemum vulgare, Lupinus polyphyllus, Matteucia struthiopteris, Oxalis corniculata, Phalaris arun-*

dinacea var. *picta, Polygonatum multiflorum, Reynoutria japonica, Rosa ×francofourtana, Rosa majalis, R. rugosa, Rudbeckia hirta, R. laciniata, Salvia verticillata, Saponaria officinalis, Sedum spurium, Solidago canadensis*, *S. gigantea, Sorbaria sorbifolia, Spiraea chamedrifolia Symphoricarpos albus, Syringa vulgaris, Vinca minor* and *Viola odorata.*

Some interesting and valuable species can be found in the investigated cemeteries. *Carex ligerica* is a new species for the investigated region. A closed cemetery in Gorajec (Cieszanów commune) is the farthest east area occupied by this species in Poland. *Geranium sibiricum* found in Tomaszów Lubelski is considered to be a very rare plant in Poland (Z a j ą c , Z a j ą c 2001). The necropolises of the investigated region are located in different habitats and differ in respect to anthropopression intensity. For this reason, they are notable as the mainstay of forest plants not very frequent in Poland (e.g. *Carex brizoides, Euonymus verrucosa, Lembotropis nigricans, Vicia dumetrum, Viola collina*), plants of forest edges (*Astragalu cicer*, *Geranium phaeum*, *Salvia verticillata*) and meadows (*Cirsium rivulare*), or ruderal plants (*Elsholtzia ciliata* and *Fumaria vaillantii*).

In the course of the study on the presently used cemetery in Ciechanów, *Eragrostis albensis* was found. It is a species described for the first time in science on the basis of herbarium specimens coming from the area of the middle Elbe River (S c h o l z , 1996). Previously, plants from the genus *Eragrostis* found on the Elbe were considered to be *E. pilosa*. In south-eastern Poland, the expansion of this species is observed in anthropogenic habitats (M i c h a l e w s k a and N o b i s z , 2005).

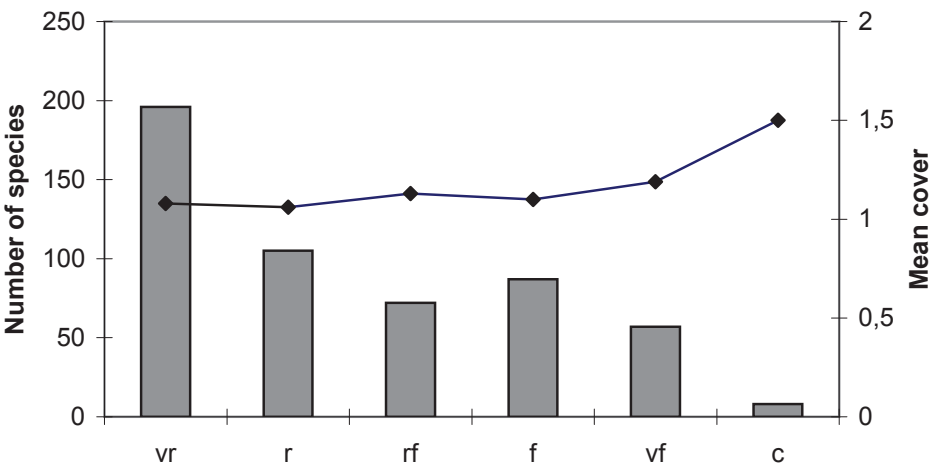

Fig. 2. The number of species and their average cover in particular frequency classes in the investigated cemeteries of the Roztocze region.
Explanations: vr – very rare; r – rare; rf – relatively frequent; f – frequent; vf – very frequent; c – common. Columns present the number of species, the line presents mean cover of species.

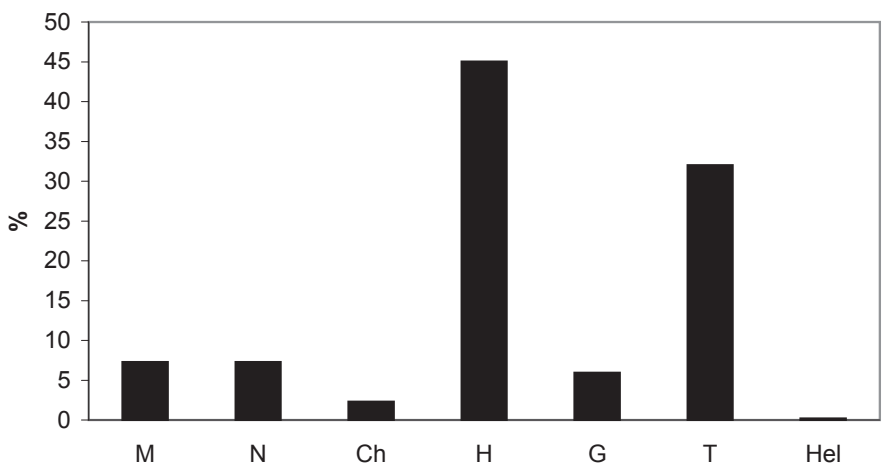

Fig. 3. The participation of life forms in the flora of the investigated cemeteries in the Roztocze region.
Explanations: M – megaphanerophytes; N – nanophanerophytes; Ch – chamaephytes; H –hemicryptophytes; G – geophytes; T – therophytes; Hel – helophytes.

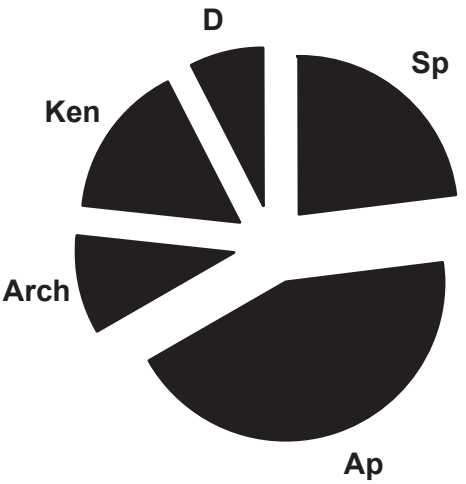

Fig. 4. Spectrum of geographical-historical groups in the flora of the cemeteries in the Roztocze region.
Explanations: Sp – spontaneophytes; Ap – apophytes; Arch – archaeophytes; Ken –kenophytes; D – diaphytes.

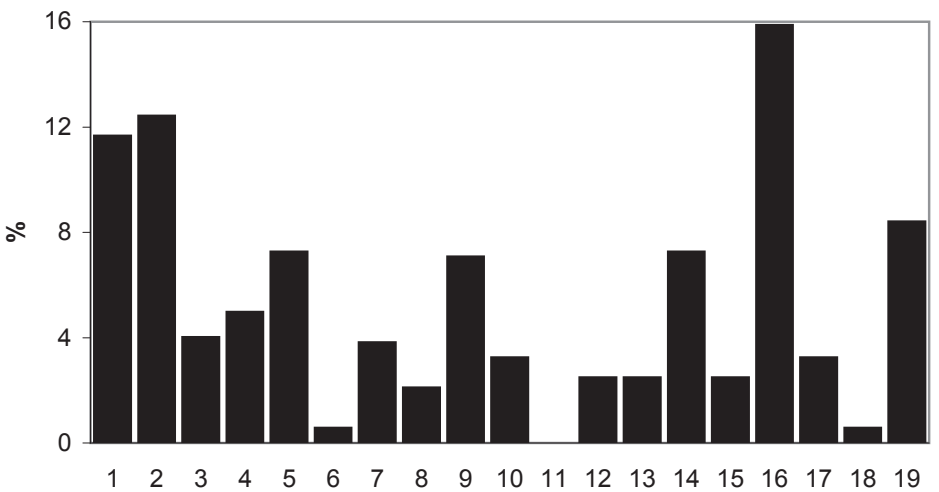

Fig. 5. The participation of socio-ecological groups in the flora of the cemeteries in the Roztocze region.
Explanations – see the "Material and Methods" chapter.

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Flora naczyniowa cmentarzy Roztocza i terenów przyległych

Streszczenie

Praca przedstawia wyniki badań florystycznych 78 cmentarzy Roztocza oraz granicznych terenów należących do sąsiednich mezoregionów: Płaskowyżu Tarnogrodzkiego i Równiny Bełskiej. Flora badanych nekropolii jest bogata, składają się na nią 523 gatunki roślin naczyniowych. 92% gatunków występuje w warstwie zielnej. Są to głównie hemikryptofity (45%) i terofity (32% flory), przy czym obecność terofitów zaznacza się wyraźniej na cmentarzach czynnych, gdzie prowadzone są systematyczne zabiegi pielęgnacyjne. Antropogeniczny charakter nekropolii wyraża się zwiększonym udziałem gatunków roślin związanych ze zbiorowiskami chwastów ogrodowych i polnych upraw okopowych (*Polygono-Chenopodietalia*) oraz roślin o nieokreślonej bliżej przynależności fitosocjologicznej.

Ponad 25% gatunków stwierdzonych na badanych cmentarzach to rośliny uprawiane. 41 taksonów zostało posadzonych na terenie nekropolii, a po zaniechaniu pielęgnacji rosną w dobrej kondycji do dnia dzisiejszego, czy wręcz rozprzestrzeniają się. Rośliny te należą do dobrych fitoindykatorów miejsc cmentarnych. Najczęściej występującymi reprezentantami tej grupy są: *Asparagus officinalis, Convallaria majalis, Cosmos bipinnatus, Erigeron annuus, Euphorbia marginata, Hedera helix, Kochia scoparia, Lupinus polyphyllus, Rudbeckia hirta, Saponaria officinalis, Solidago gigantea, Syringa vulgaris, Symphoricarpos albus, Vinca minor i Viola odorata.*