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Vascular plants in the Cemetery of the Meritorious in Poznań (Poland)

SUMMARY

The Cemetery of the Meritorious is the oldest preserved burial site in the city of Poznań (western Poland). It was created in 1808, but after World War II it was subject to gradual devastation. In 1961, it was classified as a historic site, completely protected by law and cared for by the Cultural Heritage Officer. Field research shows that the vascular flora of the cemetery is composed of 140 taxa: 15 in the trees, 26 in the shrubs, and 99 in the herbaceous plants. The flora comprises 84 taxa (57.1%) that were planted there. Most of them are herbaceous: 45 species (30.6%), including 14 native (9.5%) and 31 alien ones (21.1%). Plants with symbolic meanings are represented by 13 taxa in the trees, 16 in the shrubs, and 30 in the herbaceous plants. Currently, however, the symbolism of cemetery plants is of little significance, as they are cultivated primarily because of their ornamental value. Special attention was paid to groundcover plants, represented by 37 species (25,2%), including 21 taxa introduced a long time ago and 16 recently (during the last 10 years or so).

Keywords: vascular flora, groundcover plants, Cemetery of the Meritorious, St. Adalbert's Hill, historic site, Poznań, Wielkopolska, Poland

STRESZCZENIE

Cmentarz Zasłużonych Wielkopolan jest najstarszym zachowanym miejscem pochówku w Poznaniu. Został utworzony w 1808 r. W latach powojennych uległ stopniowej dewastacji. W 1961 r. uznano go za obiekt zabytkowy, w całości podległy opiece konserwatora. Na omawianym cmentarzu stwierdzono 140 gatunków roślin naczyniowych. Wśród drzew wystąpiło 15 gatunków, krzewów 26, a wśród roślin zielnych 99. Wśród całej flory naczyniowej jest 84 taksonów (57,5%) wprowadzonych do uprawy. Najwięcej jest ich w warstwie zielnej: 45 gatunków

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(30,8%), wśród których 14 (9,6%) są to gatunki rodzime i 31 (21,2%) to gatunki obce. Wśród roślin o znaczeniu symbolicznym jest 13 drzew, 16 krzewów i 30 roślin zielnych. Obecnie symbolika związana z roślinnością cmentarną odgrywa niewielką rolę, a rośliny sadzone są głównie ze względu na walory dekoracyjne. Na szczególne podkreślenie zasługują gatunki okrywowe, wśród których stwierdzono 37 gatunków (24,6%), z czego 21 taksonów wprowadzono w dawnych czasach, a 16 współcześnie (w ciągu 10 lat).

Słowa kluczowe: flora naczyniowa, gatunki okrywowe, Cmentarz Zasłużonych, Wzgórze św. Wojciecha, obiekt zabytkowy, Poznań,Wielkopolska, Polska

INTRODUCTION

Thanatourism, i.e. travelling to places historically associated with death, such as cemeteries, is a more and more popular form of cultural tourism. Attention is paid to tombstones and monuments, but also to the introduced ornamental plants, which add a lot of charm and colour to old cemeteries. Thanatourism includes also visits to small abandoned cemeteries in villages, where cemetery phytoindicators (indicator plants) and noteworthy symbolic plants have survived. Thanatouristic trails can be designated in many regions, also in the city of Poznań.

Municipal cemeteries are some of the most valuable urban green areas, where trees play an important role. The selection of herbaceous plants is strongly affected by environmental conditions, e.g. light, water, microclimate, and soil type. It is recommended that in cemeteries low plants should be preferred, with small root systems, resistant to drought (9). In the past, necropoles were dependent on religious beliefs and were major sites in the city centre. In the course of time, various meanings were attributed to cemetery plants, usually linked with paradise imagery (17).

This study was aimed to analyse the taxonomic composition of vascular plants in the Cemetery of the Meritorious in Poznań, with particular reference to symbolic plants. It was tested whether a cemetery subject to continuous care is characterized by a richness of groundcover plants introduced to cultivation under trees and by a small contribution of apophytes (i.e. native plants found on sites disturbed by human activity).

STUDY SITE

The Cemetery of the Meritorious is located in the city of Poznań in western Poland, on St. Adalbert's Hill (Wzgórze św. Wojciecha), near St. Joseph's Church and a cloister of Barefoot Carmelites. It is the oldest necropolis in Poznań, as on 19 February 1810, the first burial took place on the new, then still disorganized cemetery. It is exceptionally picturesque, situated in an area with varied relief: a wooded slope of the hill, with north-eastern exposure, and a basin-like, slightly concave glade, which is a remnant of a former floodplain of a tributary of the stream Wierzbak. Part of the cemetery, with no graves and monuments, is a burial site of numerous victims of the cholera epidemics that swept Poznań in 1831–1873 (12).

The cemetery on St. Adalbert's Hill is also a burial site of many citizens of Poznań and of the Wielkopolska region who died in fights for Polish independence, but also of those who devoted their lives to helping others with their hard work. In 1948, the cemetery started to be supervised by the Municipal Council and since then only the most meritorious citizens of the Wielkopolska region can be buried there. After World War II, the cemetery was subject to gradual devastation until 1961, when it was classified as a historic site, completely protected by law and cared for by the Cultural Heritage Officer. In the 1960s, it was renovated: new lanes and paths were marked out, graves were cleared, while in the park-like part, several hundred rose bushes and other ornamental species were

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planted. In 1980, a social action took place, which resulted not only in renovation of the tombstones and clearance of rubbish, etc., but also initiation of continuous supervision of the cemetery, with a phone connection (12). Currently, new ornamental plants are still planted there and the monuments are being renovated.

MATERIALS AND METHODS

Field research on the vascular flora of the cemetery was conducted in 2011–2012. Herbarium specimens have been deposited at the Faculty of Forestry, Poznań University of Life Sciences (POZNB). Names of species follow (6, 7, 15). Frequency of each species was assessed on a 7-point scale: R – negligible (1–2 plants); + – several plants; 1 – very rare (covering 1–5% of cemetery area excluding graves); 2 – rare (5–25%); 3 – moderately frequent (25–50%); 4 – frequent (50–75%); and 5 – common (75–100%). Abbreviation "cul" indicates that the species was planted (long ago or recently, i.e. during the last 10 years or so).

Groundcover plants were classified as such on the basis of three sources (2, 5, 13). Raunkiaer's life-forms were presented primarily according to (6), but also (18, 19). The socioecological classification was based mostly on (12). Protected species were determined on the basis of the Regulation of the Minister of Environmental Protection of 16 October 2014, while plants with symbolic meanings, by (10, 11) and (20).

RESULTS

During the research in the Cemetery of the Meritorious on St. Adalbert's Hill in Poznań, 140 vascular plant taxa were recorded (Tab. 1). Some species were found simultaneously in the tree, shrub, and herb layers (*Hedera helix*) or in both tree and shrub layers (*Robinia pseudoacacia*) or in both shrub and herb layers (*Taxus baccata*) or in both tree and herb layers (*Acer platanoides*, *Aesculus hippocastanum*, *Ailanthus altissima*, and *Tilia cordata*). Among the recorded species, as many as 81 taxa (55.1%) were planted there.

Table 1. Vascular flora in the Cemetery of the Meritorious in Poznań: frequency classes (FC), life-forms (LF), geographic-historical status (GH), socioecological groups (SE), and symbolic meaning (Symb.)

Species	FC	LF	GH	SE	**Symb.**
Tree layer					
Abies concolor (Gordon & Glend.) Lindl. Ex Hildebr.	1 culA	F1	Er1	17	S
Acer platanoides L.	3 culA	F1	Ap2	1	S
Acer pseudoplatanus L.	1 culA	F1	Ap2	1	S
Aesculus hippocastanum L.	2 culA	F1	Kn	17	S
Ailanthus altissima (Mill.) Swingle	1 culA	F1	Kn	17	
Fraxinus excelsior L.	2 culA	F1	Ap2	1	S
Fraxinus excelsior L. 'Pendula'	1 culA	F1	Ap2	1	S
Hedera helix L.	1 culA	C1 li	Kn	1	S

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Tab. 1

Species	FC	LF	GH	SE	**Symb.**
Pseudotsuga menziesii (Mirb.) Franco	1 culA	F1	Kn	2	
Quercus robur L.	2 culA	F1	Ap2	1	S
Robinia pseudoacacia L.	1 culA	F1	Kn	12	S
Tilia cordata Mill.	2 culA	F1	Ap2	1	S
Tilia 'Euchlora'	1 culA	F1	Er1	17	S
Tilia platyphyllos Scop.	1 culA	F1	Ap2	1	S
Viscum album L.	+	C2ppep	Kn	6	S
Shrub layer					
Acer tataricum L.	+ culB	F1	Er1	17	
Buxus sempervirens L.	+ culA	F2	Er1	17	S
Carpinus betulus L.	+ culB	F2	Ap2	1	
Chamaecyparis pisifera (Siebold& Zucc.) Endl..	1 culB	F1	Er1	17	S
Cornus stolonifera Michx.	1 culB	F2	Er1	17	
×*Cupressocyparis leylandii* (A.B.Jacks. et Dallim.) Dallim.	+ culB	F1	Er1	17	S
Deutzia gracilis Siebold & Zucc.	+ culB	F2	Er1	17	
Forsythia ×*intermedia* Zabel	1 culB	F2	Er1	17	
Fraxinus pennsylvanica Marshall	+	F1	Kn	17	S
Hedera helix L.	+ culA	C1 li	Kn	1	S
Hamamelis mollis Oliv.	+ culB	F2	Er1	17	
Juniperus virginiana L.	+ culA	F1	Er1	17	S
Kerria japonica (L.) DC.	+ culB	F2	Er1	17	
Mahonia aquifolium (Pursh) Nutt.	+ culA	F2	Er1	17	S
Philadelphus coronarius L.	+ culA	F2	Er1	17	
Physocarpus opulifolius (L.) Maxim.	+ culB	F2	Er1	17	
Picea pungens Engelm.	+ culA	F2	Er1	17	S
Robinia pseudoacacia L.	+	F1	Kn	12	S
Rosa chinensis Jacq.	+ culB	F2	Er1	17	S
Sambucus nigra L.	+	F2	Ap1	3	S
Spiraea japonica L. f.	+ culB	F2	Er1	17	
Symphoricarpos albus (L.) S. F. Blanke	1 culA	F2	Er1	17	
Symphoricarpos ×*chenaultii* Rehd.	+ culB	F2	Er1	17	
Syringa ×*chinensis* Willd.	+ culA	F2	Er1	17	S
Syringa vulgaris L.	+ culA	F2	Er1	17	S
Taxus baccata L.	1 culA	F2	Ap2	1	S, Ccz
Thuja occidentalis L.	+ culA	F1	Er1	17	S
Tsuga canadensis (L.) Carričre	+ culB	F1	Er1	17	
Viburnum rhytidophyllum Hemsl.	+ culB	F2	Er1	17	S

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Tab. 1

Species	FC	LF	GH	SE	Symb.
Herb layer					
Acer platanoides L.	1	F1	Ap2	1	S
Aegopodium podagraria L.	1 culA	H1	Ap2	1	
Aesculus hippocastanum L.	+	F1	Kn	17	S
Alchemilla mollis (Buser) Rothm.	+ culB	H1	Er1	17	S
Ailanthus altissima (Mill.) Swingle	R	F1	Kn	17	
Alliaria petiolata (M. Bieb) Cavara & Grande	R	T1	Ap1	3	
Allium scorodoprasum L.	1 culA	G1	Kn	4	S
Allium vineale L.	+	G1	Ap1	4	S
Anemone ranunculoides L.	1 culA	G1	Sp1	1	S
Anthriscus sylvestris (L.) Hoffm.	+	H1	Ap1	3	
Aquilegia vulgaris L.	R culA	H1	Sp1	3	S, Ccz
Bellis perennis L.	1	H1	Ap1	8	S
Bergenia cordifolia (Haw.) Sternb.	+ culA	H1	Er1	17	
Bromus hordaceus L.	+	T1	Ap1	12	
Campanula rapunculoides L.	+ culA	H1	Ap2	14	
Capsella bursa-pastoris (L.) Medik.	R	T1	Ach	14	
Cardamine hirsuta L.	+	T1	Ap2	14	
Cerastium glomeratum Thuill.	R	T1	Ap1	17	
Cerastium holosteoides Fr. Emend. Hyl.	+	H1	Ap1	8	
Cerastium semidecandrum L.	+	T1	Ap1	4	
Chelidonium majus L.	+	H1	Ap1	3	S
Convallaria majalis L.	1 culA	G1	Sp2	3	S
Conyza canadensis (L.) Cronquist	+	T1	Kn	13	
Cotoneaster horizontalis Dence.	+ culA	F2	Er1	17	
Cotoneaster suecicus G. Klotz	1 culA	F2	Er1	17	
Crocus vernus (L.) Hill	r culB	G1	Er1	3	S
Dactylis glomerata L.	+	H1	Ap1	8	
Digitaria sanguinalis (L.) Scop.	+	T1	Ar	11	
Dryopteris filix-mas (L.) Schott	2 culB	H1	Ap1	2	
Echinochloa crus-galli (L.) P.Beauv.	+	T1	Ar	14	
Eranthis hyemalis (L.) Salisb.	+ culB	G1	Er1	17	
Erophila verna (L.) Chevell.	1	T1	Ap1	5	
Euphorbia helioscopia L.	+	T1	Ar	14	
Fallopia convolvulus (L.) Á. Löve	+	T1	Ar	14	
Ficaria verna Huds.	2 culA	G1	Ap2	14	
Fragaria indica Andr.	+ culB	H1	Er1	17	S
Gagea arvensis (Pers.) Dumort.	+ culA	G1	Ar	3	

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Tab. 1

Species	FC	LF	GH	SE	**Symb.**
Gagea lutea (L.) Ker Gawl.	2 culA	G1	Ap2	1	
Gagea pratensis (Pers.) Dumort.	1	G1	Ap2	3	
Galanthus nivalis L.	+ culA	G1	Ap1	1	S, CCz
Galeobdolon argentatum Snejkal	1 culA	H1	Er1	17	
Galium mollugo L. s.s.	+	H1	Ap1	8	
Geranium macrorrhizum L.	1 culB	H1	Er1	17	
Geranium platypetalum Fisch. & C. A. Mey	+ culB	H1	Er1	17	
Geranium molle L.	+	H1	Kn	12	
Geranium pratense L.	+	H1	Ap1	8	
Geranium pusillum Burm. F. ex L.	+	T1	Ar	14	
Geum urbanum L.	R	H1	Ap1	3	S
Glechoma hederacea L.	+	H1	Ap1	1	
Hedera helix L.	3 culA	C1 li	Kn	1	S
Hemerocallis fulva L.	1 culA	H1	Er1	17	
Heracleum sibiricum L.	+	H1	Ap1	7	
Hyacinthus orientalis L.	RculB	G1	Er1	17	
Lactuca serriola L.	R	T2	Ar	15	
Lamium purpureum L.	+	T1	Ar	14	
Leontodon autumnalis L.	R	H1	Ap1	9	
Ligularia dentata (A. Gray) H. Hara	+ culB	H1	Er1	17	
Lolium perenne L.	2	H1	Ap1	9	
Lysimachia nummularia L.	+ culA	H1	Ap2	1	
Matteucia struthiopteris (L.) Tod.	1 culA	H1	Er1	17	CCz
Muscari botryoides (L.) Mill.	R culA	G1	Er1	17	
Myosotis sparsiflora Pohl	+	H1	Ap1	6	S
Ornithogalum nutans L.	+ culA	G1	Er2	17	
Ornithogalum umbellatum L.	2 culA	G1	Kn	17	
Oxalis dillenii Jacq.	+	T1	Kn	15	
Oxalis fontana Bunge	+	T1	Kn	13	
Pachysandra terminalis Siebold & Zucc.	1 culB	C1	Er1	17	
Paeonia officinalis L.	R culA	H1	Er1	17	S
Picris hieraciodes L.	R	H1	Ap1	12	
Poa annua L.	+	T1	Ap1	9	
Poa nemoralis L.	1	H1	Ap1	2	
Poa pratensis L. s.s.	2	H1	Ap1	8	
Polygonum aviculare L.	+	T1	Ap1	9	
Potentilla reptans L.	R	H1	Ap1	9	
Prunella vulgaris L.	1	H1	Ap1	8	

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Tab. 1

Species	FC	LF	GH	SE	Symb.
Ranunculus bulbosus L.	R	H1	Ap1	3	
Reynoutria japonica Houtt	+ culA	G1	Er1	17	
Rumex obtusifolius L.	R	H1	Ap1	11	
Rumex thyrsiflorus Fingerh.	+	H1	Ap1	12	
Sagina procumbens L.	+	H1	Ap1	10	
Scilla sibirica Haw.	2 culA	G1	Er2	17	
Sedum spectabile Boreau	1 culA	H1	Er1	17	
Senecio vulgaris L.	R	T1	Ar	14	
Setaria viridis (L.) P. Beauv.	+	T1	Ar	14	
Sonchus oleraceus L.	R	T1	Ar	14	
Spergularia rubra (L.) J. Presl & C. Presl	+	T1	Ap1	5	
Stellaria media (L.) Vill.	+	T1	Ap1	14	
Stellaria pallida (Dumort.) Piré	+	T2	Ap1	14	
Taraxacum officinale Web.	2	H1	Ap1	8	S
Taxus baccata L.	1 culA	F2	Ap2	17	S, CCz
Tilia cordata Mill.	+	F1	Ap1	4	S
Tradescantia ×andersoniana W. Ludw. & Rohweder	+ culB	H1	Er1	17	
Trifolium pratense L.	+	H1	Ap1	8	S
Tulipa gesneriana L.	r culA	G1	Er1	17	S
Tulipa sylvestris L.	2 culA	G1	Er2	17	S
Urtica dioica L.	R	H1	Ap1	3	S
Veronica arvensis L.	+	T1	Ap1	15	S
Veronica sublobata M. A. Fisch.	1	T1	Ap1	15	S
Vinca minor L.	1 culA	C1	Er2	17	S
Viola cyanea Čelak.	+ culA	H1	Kn	3	S
Viola odorata L.	+ culA	H1	Kn	3	S
Viola ×wittrockiana Hort.	+ culB	T0	Er2	14	S
Waldsteinia ternata (Stephan) Fritsch	1 culB	H1	Er1	17	

Explanations:
Groundcover plants: old and recent.

FC (Frequency classes): R – 1–2 plants; + – several plants; 1 – very rare (covering 1–5% of cemetery area excluding graves); 2 – rare (5–25%); 3 – moderately frequent (25–50%); 4 – common (50–75%); 5 – very frequent (75–100%); cul – cultivated, introduced long ago (A) or recently (B), i.e. in the last 10 years or so.

LF (Life-forms): F1 – megaphanerophytes; F2 – nanophanerophytes; C1 – woody chamaephytes; C2 – non-woody chamaephytes; G1 – wintering geophytes; G0 – non-wintering geophytes; H1 – wintering hemicryptophytes; H0 – non-wintering hemicryptophytes; T1 – annual

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therophytes; T2 – biennial therophytes; T0 – non-wintering therophytes; li – lianas; pp – parasites; ppep – hemiparasites.

GH (Geographic-historical status): Sp1 – spontaneous spontaneophytes; Sp2 – planted spontaneophytes; Ap1 – spontaneous apophytes; Ap2 – planted apophytes; Arch – archaeophytes; Ken – kenophytes; Er1 – non-spreading ergasiophytes; Er2 – ergasiophytes spreading within the cemetery.

SE (socioecological groups): 1 – fertile broad-leaved forests and shrub communities (*Fagetalia*, *Prunetalia*); 2 – acidophilous or xerothermic oak forests, mixed coniferous forests and their substitute shrub, herb or grassland communities (*Quercion robori-petraeae*, *Quercion petraeae*, *Epilobion*, *Nardetalia*); 3 – nitrophilous shrub or herb communities (*Sambuco-Salicion*, *Alliarion*); 4 – xerothermic herb or grassland communities (*Trifolio-Geranietea*, *Festuco-Brometea*); 5 – pine forests or sandy grasslands (*Dicrano-Pinion*, *Sedo-Scleranthetea*, *Corynephoretea*); 6 – swamp alder forests, woodless fens, bogs and intermediate mires, and riparian forests and thickets, reeds and aquatic vegetation (*Alnion*, *Magnocaricion*, *Caricetalia fuscae*, *Sphagnion fusci, Salicion*, *Phragmition*, *Glycerio-Sparganion*, *Potamogetonetea*, *Lemnetea*, *Utricularietea*); 7 – humid meadows and tall herb communities (*Molinietalia*); 8 – fresh and moderately humid meadows (*Arrhenatheretalia*); 9 – nitrophilous floodplains and treaded communities (*Plantaginetea*); 10 – therophyte communities on wet and humid sites (*Bidentetea*, *Nanocyperion*); 11 – mesophilous communities of tall perennials (*Arction*); 12 – xerothermic, perennial ruderal communities (*Onopordon*); 13 – short-term, pioneer ruderal communities (*Sisymbrion*, *Eragrostion*); 14 – weed communities of gardens and root crop fields (*Polygono-Chenopodietalia, Poo-Oxalidetum*); 15 – weed communities of cereal fields (*Aperetalia*); 16 – epilithic communities (*Asplenietea*); 19 – species with undefined phytosociological affiliation.

S – species with a symbolic meaning.
C Cz – species with a partial protection.

The tree layer consisted of 15 taxa, the shrub layer of 26, and the herb layer of 99 taxa. It must be emphasized that the tree layer included *Fraxinus excelsior* 'Pendula', which symbolizes the hair of a girl weeping at her friend's grave. In the shrub layer, only three species occurred spontaneously: *Fraxinus pennsylvanica*, *R. pseudoacacia*, and *Sambucus nigra*. Abundantly fruiting *Buxus sempervirens* reached 2 m in height. In the herb layer, 51 species were native to the study area, but 13 of them were planted, e.g. *Aegopodium podagraria*, *Allium vineale*, *Anemone ranunculoides*, *Aquilegia vulgaris*, *Campanula rapunculoides*, *Convallaria majalis*, *Dryopteris filix-mas*, *Ficaria verna*, *Gagea lutea*, *G. pratensis*, *Galanthus nivalis*, *Lysimachia nummularia*, *and Taxus baccata*. Among alien herbaceous species, 31 were planted: *Alchemilla mollis*, *Allium scorodoprasum*, *Bergenia cordifolia*, *Cotoneaster horizontalis*, *C. suecicus*, *Eranthis hyemalis*, *Fragaria indica*, *Gagea arvensis*, *Galeobdolon argentatum*, *Geranium macrorrhizum*, *G. platypetalum*, *Hedera helix*, *Hemerocallis fulva*, *Ligularia dentata*, *Matteucia struthiopteris*, *Muscari botryoides*, *Ornithogalum nutans*, *O. umbellatum*, *Pachysandra terminalis*, *Reynoutria japonica*, *Scilla sibirica*, *Sedum specta-*

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bile, *Tradescantia ×andersoniana*, *Tulipa gesneriana*, *T. sylvestris*, *Vinca minor*, *Viola cyanea*, *V. odorata*, *V. ×wittrockiana*, and *Waldsteinia ternata.*

In the tree layer, the major species (with the highest degree of cover) were: *A. platanoides, A. hippocastanum*, *F. excelsior*, *Quercus robur*, and *T. cordata* (Tab. 1). The shrub layer was poorly developed. Shrubs were the most numerous in the meadow part, with no monuments, where the highest degree of cover was recorded for *Cornus stolonifera*. In the part with graves, the most abundant shrub species was *Symphoricarpos albus*. In the herb layer, the major species were *D. filix-mas*, *F. verna*, *Gagea lutea*, *H. helix*, *Lolium perenne*, *Poa pratensis*, *S. sibirica*, *Taraxacum officinale*, and *T. sylvestris*. All the major herb species except *T. officinale* were planted in the part with graves or sown in the meadow.

In the flora of the Cemetery of the Meritorious, species in the second frequency class (+) were the most numerous (over 52% of the total number of species). Species in the third frequency class (1) were less numerous (over 23%). Species in the first class (R) and fourth class (2) accounted for about 10% each. The fifth frequency class (3) was represented by only two species: *A. platanoides* in the tree layer and *H. helix* in the herb layer (Tab. 2).

Table 2. Percentage contributions of species of individual frequency classes to the total flora in the Cemetery of the Meritorious in Poznań

Frequency class (FC)		Number of species	% of total flora
R	1–2 specimens	20	13.6
+	several specimens	76	51.7
1	very rare species (covering 1–5% of cemetery area excluding graves)	36	24.5
2	rare (5–25%)	13	8.8
3	moderately frequent (25–50%)	2	1.4
4	frequent (50–75%)	0	0
5	very frequent (75–100%)	0	0

Among geographical-historical groups, native species (apophytes) account for over 43% of the flora of the study area (Tab. 3). Alien species include archaeophytes (more than 8% of the flora), kenophytes (14.3%), and ergasiophytes (35.4%). The most noteworthy archaeophyte is *Gagea arvensis.* Kenophytes are represented by e.g. *A. hippocastanum*, *Ailanthus altissima*, *A. scorodoprasum*, *Conyza canadensis*, *Geranium molle*, *H. helix*, *O. umbellatum*, *Oxalis dillenii*, *O. fontana*, *V. cyanea*, *and V. odorata*. Ergasiophytes are an important group in old cemeteries, here comprising e.g. *A. mollis*, *B. cordifolia*, *E. hyemalis*, *Fragaria indica*, *G. argentatum*, *G. macrorrhizum*, *G. platypetalum*, *H. fulva*, *M. struthiopteris*, *O. nutans*, *P. terminalis*, *R. japonica*, *S. sibirica*, *S. spectabile*, *T. ×andersoniana*, *T. gesneriana*, *T. sylvestris*, *V. minor*, and *V. ×wittrockiana*.

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Table 3. Percentage contributions of geographical-historical groups to the total flora in the Cemetery of the Meritorious in Poznań

Geographic-historical status (GH)		Number of species	% of total flora
Sp1	spontaneous spontaneophytes	2	1.4
Sp2	planted spontaneophytes	3	2.0
Ap1	spontaneous apophytes	39	26.5
Ap2	planted apophytes	18	12.2
Ar	archaeophytes	12	8.2
Kn	kenophytes	21	14.3
Er1	non-spreading ergasiophytes	47	32.0
Er2	ergasiophytes spreading within cemetery	5	3.4

Among socioecological groups (Tab. 4), the major group are the taxa with undefined phytosociological affiliation (group 17=39.5%). Among the species attributed to a defined group, a major role is played by species of fertile deciduous forests and shrub communities (group 1=13%), weeds of gardens and root crop fields (group 14=10.3%), plants of nitrophilous shrub communities and forest edges (group 3=9.5%), and of fresh and moderately moist meadows (group 8=6.1%). Contributions of other groups vary from 1.4% to 4.8%.

Table 4. Percentage contributions of socioecological groups to the total flora in the Cemetery of the Meritorious in Poznań

Socioecological groups (SE)		Number of species	% of total flora
1	Fertile broad-leaved forests and shrub communities (*Fagetalia, Prunetalia*)	19	12.9
2	Acidophilous or xerothermic oak forests, mixed coniferous forests, and their substitute shrub, herb or grassland communities (*Quercion robori-petraeae*, *Quercion petraeae, Epilobion, Nardetalia*)	3	2.0
3	Nitrophilous shrub or herb communities (*Sambuco-Salicion, Alliarion*)	14	9.5
4	Xerothermic herb or grassland communities (*Trifolio-Geranietea, Festuco-Brometea*)	4	2.7
5	Pine forests or sandy grasslands (*Dicrano-Pinion, Sedo-Scleranthetea, Corynephoretea*)	3	2.0
6	Swamp alder forests, woodless fens, bogs, and intermediate mires and riparian forests and thickets, reeds, and aquatic vegetation (*Alnion, Magnocaricion, Caricetalia fuscae, Sphagnion fusci, Salicion, Phragmition, Glycerio-Sparganion, Potamogetonetea, Lemnetea, Utricularietea*)	2	1.4

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Tab. 4

Socioecological groups (SE)		Number of species	% of total flora
7	Humid meadows and tall herb communities (*Molinietalia*)	1	0.7
8	Fresh and moderately humid meadows (*Arrhenatheretalia*)	9	6.1
9	Nitrophilous floodplains and treaded communities (*Plantaginetea*)	5	3.4
10	Therophyte communities on wet and humid sites (*Bidentetea, Nanocyperion*)	1	0.7
11	Mesophilous communities of tall perennials (*Arction*)	2	1.4
12	Xerothermic, perennial ruderal communities (*Onopordion*)	5	3.4
13	Short-term, pioneer ruderal communities (*Sisymbrion, Eragrostion*)	3	2.0
14	Weed communities of gardens and root crop fields (*Polygono-Chenopodietalia, Poo-Oxalidetum*)	15	10.3
15	Weed communities of cereal fields (*Aperetalia*)	3	2.0
16	Epilithic communities (*Asplenietea*)	0	0.0
17	Species with undefined phytosociological affiliation	58	39.5

Among Raunkiaer's life forms (Tab. 5) in the study area, hemicryptophytes are the most diverse, represented by 45 species (30.6%). Contributions of megaphanerophytes, nanophanerophytes, and annual therophytes exceed 15% each, while geophytes account for more than 12%.

Table 5. Percentage contributions of plant life forms to the total flora in the Cemetery of the Meritorious in Poznań

Life forms (LF)		Number of species	% of total flora
F1	megaphanerophytes	25	17.0
F2	nanophanerophytes	22	15.0
C1	woody chamaephytes	5	3.4
C2	non-woody chamaephytes	1	0.7
H1	wintering hemicryptophytes	46	31.2
G1	wintering geophytes	19	12.9
T0	non-wintering therophytes	1	0.7
T1	annual therophytes	26	17.7
T2	biennial therophytes	2	1.4

Special attention was paid to groundcover plants, which decorate graves and their vicinity. These include perennial herbs, dwarf shrubs or low shrubs, forming dense patches, either natural or introduced intentionally, protecting the soil from expansion of weeds, erosion or degradation (14). Among them, 21 taxa were introduced long ago (*A. podagraria, A. scorodoprasum*, *A. ranunculoides*, *C. ma-*

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jalis, *F. verna*, *G. lutea*, *G. pratensis*, *H. helix*, *H. fulva*, *Lysimachia nummularia*, *M. struthiopteris*, *O. nutans*, *O. umbellatum*, *S. sibirica*, *V. minor*, *V. cyanea*, and *V. odorata*) and 15 recently (*A. mollis*, *C. horyzontalis*, *C. suecicus*, *D. filix-mas*, *E. hyemalis*, *F. indica*, *G. argentatum*, *G. macrorrhizum*, *G. platypetalum*, *P. terminalis*, *R. japonica*, *S. spectabile*, *T. baccata*, *T. ×andersoniana*, and *V. ternata*).

The genus *Gagea* was represented by three species: *G. arvensis, G. lutea*, and *G. pratensis*. The first two species were certainly introduced intentionally, while *Gagea pratensis* probably accidentally, accompanying other plant species introduced into this cemetery when it was created.

Plants in cemeteries were attributed symbolic meanings related to religion already in the Middle Ages. First of all, they were supposed to be associated with concepts of the future paradise. Many of the plants cultivated in cemeteries were worshipped according to folk beliefs in the given region. Among the plants with symbolic meanings, 13 species are in the trees, 16 in the shrubs, and 30 in the herbaceous plants (Tab. 1). Particularly noteworthy are *V. minor* and *H. helix*, which symbolize immortality and paradise, but also friendship and faithfulness. Trifoliate leaves, like those of *F. indica* (symbol of noble modesty and humility) and clovers (*Trifolium* spp.), symbolized the Holy Trinity. The species flowering in spring included: 1. *A. ranunculoides*, withering quickly and associated with disease and death, also symbolizing the shed blood of saints; 2. *C. majalis*, symbolizing youth, chastity, and salvation; 3. *Galanthus nivalis*, a symbol of spring and Christian hope; 4. *Viola odorata*, because of its subtle scent and dark purple flowers regarded as a symbol of modesty and humility; 5. *Myosotis* sp., a sign of eternal sleep and memory of the dead; 6. pansy *V. ×wittrockiana*, planted every year, reminding about the deceased, being also a sign of the Holy Trinity. In the meadow part of the cemetery, *Bellis perennis* is very common. It grows there spontaneously and symbolizes modesty, innocence, immorality, and eternal life. Spontaneous species with symbolic meanings include also *Veronica sublobata*, *Geum urbanum*, and *Chelidonium majus*; their symbolism is similar, denoting salvation and redemption from spiritual blindness. Particular power, symbolizing resurrection and restoration of vitality, was attributed to trees, which "restore life" every year. They are represented in the study area by 10 species. *Buxus sempervirens* was believed to deter evil spirits and regarded as a tree of life and death, as well as constancy and power. The presence of *R. pseudoacacia* was linked with old beliefs and fear of penetration of the dead from the cemetery to the living world. The space under *Sambucus nigra* was magical, people believed that evil spirits found shelter there. After washing the dead body, the water was poured under this bush, to protect other members of the family against early death. Roses (*Rosa* spp.) have many symbolic meanings, depending on flower colour and the presence/absence of prickles. Generally, however, roses are associated with Mary

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and Christ's blood, transition, love, and death. The most common species in the cemetery is *A. platanoides*, which was believed to deter devils waiting for the souls of the dead. *Q. robur*, according to many beliefs, was created as the first tree. In the imagery, the oak was gigantic, a sign of immortality, power, and might. *Tilia* sp. guaranteed peaceful eternal sleep. The currently very common cemetery species *Thuja occidentalis* is a sign of sorrow, death, and mourning.

Currently the symbolism of cemetery plants is of little significance, as they are cultivated primarily because of their ornamental value. Recently introduced species include *A. mollis* (decorative habit and leaves), *Cotoneaster horizontalis* and *C. suecicus* (decorative habit and fruits), *E. hyemalis* (decorative habit and flowers), *F. indica* (decorative flowers, leaves, and habit), *D. filix-mas* (decorative habit), *Geranium macrorrhizum* (decorative habit and flowers), *G. platypetalum* (decorative habit and flowers), *P. terminalis* (decorative habit and leaves), *R. japonica* (decorative habit and leaves), *S. spectabile* (decorative habit and flowers), *T.* ×*andersoniana* (decorative habit), and *W. ternata* (decorative habit and leaves).

DISCUSSION

In the Cemetery of the Meritorious in Poznań, 140 taxa of vascular plants were recorded. The trees consisted of 15 taxa, the shrubs of 26, and the herbaceous plants of 99. As many as 84 of them were planted, mostly in the herb layer: 14 native species and 31 alien species.

Comparable numbers of plant species were found in some other old cemeteries, both in Poland, e.g. 144 in the New Cemetery in Zakopane (4) and in other countries, e.g. recently 143 in Timişoara in Bulgaria (16) and nearly 30 years ago in Australia: 136 in Rossmore and 148 in an Anglican cemetery in Campbelltown (14). However, in many other cemeteries the numbers of recorded plant species were much lower or higher, e.g. 51 in Greendale and 164 in Liverpool in Australia (14) and 363 wild-growing plant species in the Jewish cemetery in Berlin (1).

The assumption that apophytes are not numerous was not confirmed. They ranked first among geographic-historical groups (41% of total flora). Their high contribution resulted from introduction of over 15% species to cultivation, as well as from the forest-like vegetation and magnificent, about 200-year-old trees in a large part of the cemetery.

140 species of vascular plants were found in the Meritorious Cemetery, and 255 species of vascular flora were found in cemeteries in Poznań (3). On the other hand, the dendropflora of the selected Lubelszczyzna cemeteries has 114 species (8). Among the plants with symbolic meanings, 13 species were in the trees, 16 in the shrubs, and 30 in the herbaceous plants. The presented results show that 62.5% of the shrubs found in the Cemetery of the Meritorious in Poznań have symbolic meanings. In contrast, in cemeteries of the Lublin region, symbolic shrubs

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account for 50% (8), while in the Citadel of Poznań, only 28.1% (3). Contributions of symbolic plants were higher also in the other layers of vegetation: 86% of trees in the Cemetery of the Meritorious, compared to 41.4% in the Citadel (3) and 30.2% of herbs in the study area, compared to 17.9% in the Citadel (3). Similarly, groundcover plants accounted for 24% in the Cemetery of the Meritorious, while in the Citadel of Poznań, for 9.5% (3).

In total, groundcover plants were represented by 35 species (24%), 21 of them introduced long ago, and 15 recently (during the last 10 years or so). Ground – cover plants are also popular in other cemeteries.

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