

VASCULAR PLANTS OF CERTAIN OLD JEWISH CEMETERIES
IN WESTERN CARPATHIANS

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(Received: February 26, 2010. Accepted: March 18, 2010)

ABSTRACT. The work contains a list of all vascular plants found in the four Jewish cemeteries subjected to research in Western Carpathians. The research confirms that no ornamentals were planted in Jewish cemeteries.

KEY WORDS: vascular plants, Krościenko, Mszana Dolna, Nowy Sącz and Nowy Targ, Carpathians

INTRODUCTION

Old cemeteries constitute a material document of the past. In the past, cemeteries were characterised by the religious tradition. Catholic, Jewish, Lutheran and East Orthodox cemeteries differed in location, grave decoration or intensity of introducing ornamentals to the necropolis. At the beginnings of the 20th century every tenth Polish citizen was Jewish. For this reason Jewish cemeteries – called *kirkut* or *kierkow* (from German *Kirchof*, meaning a *churchyard*) – hold a special place among Polish necropoleis. It is estimated that of the 1200 old Jewish cemeteries in Poland only less than 400 have preserved tombstones. Many Jewish necropolis were destroyed during WW II. They were also disrespected after the war: the tombstones were taken away as building material and cemetery areas were allotted for different purposes (OLEJ-KOBUS et AL. 2009). It is worth remembering that a *kirkut* is often the oldest monument of material culture in a given place or region (www.kirkuty.xip.pl). Presently, the existing Jewish cemeteries are usually located off the beaten track, remaining lonely and neglected places.

MATERIAL AND METHODS

Floristic research of Jewish cemeteries located in Western Carpathians was conducted in the vegetative season of 2009. Cemeteries in four loci were examined: in Krościenko, Mszana Dolna, Nowy Sącz and Nowy Targ (Fig. 1).

In order to determine the density of individual species, a five degree scale was used: r – a species represented by 1-3 individuals, + – a species represented by several individuals, covering less than 1% of the cemetery area, 1 – a species covering 15% of the cemetery



FIG. 1. Distribution of the described Jewish cemeteries

area, 2 – a species covering 5-25% of the cemetery area, 3 – a species covering 25-50% of the cemetery area, 4 – a species covering 50-75% of the cemetery area, 5 – a species covering 75-100% of the cemetery area. Geographic-historical and socioecological groups were presented according to CHMIEL'S concept (1993) with only few modifications, whereas Raunkiaer life forms were presented according to ZARZYCKI et AL. (2002). Binomial nomenclature follows MIREK et AL. (2002).

Characteristics of the cemeteries

① Town commune Krościenko, nowotarski district

A cemetery area of 25 m × 30 m, located on a high, steep escarpment with a north facing slope. The cemetery neighbourhood consists of a lawn and gardens. The cemetery, surrounded with a cast-iron fence, used to be locked, but presently the rusty gate with a corroded padlock testifies to the place not being watched. A hardly trodden path shows that the place gets little interest. Among the thicket grave foundations and a few overturned *matzevahs* with blurred inscriptions can be found.

② Town commune Mszana Dolna, limanowski district

A cemetery area of 15 m × 30 m, open, surrounded with a cast-iron fence. The site is adjacent to lawns and, on one side, to a forest. It is located near home buildings. There are about 25 *matzevahs* preserved, standing and with readable inscriptions. Front mowed.

③ District town Nowy Sącz

The Jewish community of Nowy Sącz maintained two cemeteries. The older one was located on the so-called "town escarpment" next to a synagogue built in 1746. Not a trace of it remains today. The new Jewish cemetery that was examined by the research authors was founded in the second half of the 19th century. It is located in the city centre, in the Rybacka Street. The cemetery is surrounded with a wall, about 1 m high and a cast-iron fence. The forest part of the cemetery covers an area of about 25 m × 50 m and is much shaded by two rows of *Tilia platyphyllos* and one row of *Acer saccharinum*. Ground plants are scarce. The non-forest part with an area of about 30 m × 100 m is characterised by a scattering of (mainly fruit) trees. This plot was bought for

the cemetery probably in 1926 by the local *kahal*. At the fence there is a row of *Larix decidua*. Numerous *matzevahs* are scattered on nearly the whole cemetery area.

④ District town Nowy Targ

The cemetery was founded in about 1875. Its area is trapezoid in shape, with sides of roughly 30 m × 100 m. Surrounded with a low wall and a low cast-iron fence. Adjacent to houses on one side, and to streets with houses on two other sides. Much shaded and mowed. Presently there are about 40 *matzevahs*, most of which are overturned.

RESULTS

160 species of vascular plants were recorded growing in the area of the examined Jewish cemeteries of Western Carpathians (Table 1). The most species (90) were recorded in the Nowy Sącz cemetery, other cemeteries hold about 50 species each.

TABLE 1. Register of vascular plants recorded in the four Jewish cemeteries of the Western Carpathians

| Species | Cover-abundance class in four cemeteries | | | | Species characteristics | | |
|---|--|---|---|---|-------------------------|-----|-----|
| | ① | ② | ③ | ④ | LF | GHs | SEg |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Tree layer | | | | | | | |
| <i>Acer negundo</i> L. | . | . | . | + | M | Ken | 3 |
| <i>Acer pseudoplatanus</i> L. | 2 | 1 | . | . | M | Ap | 1 |
| <i>Acer saccharinum</i> L. | . | . | 2 | . | M | D | 19 |
| <i>Betula pendula</i> Roth | . | . | 1 | 2 | M | Ap | 2 |
| <i>Cerasus avium</i> (L.) Moench | 1 | . | 2 | . | M | Ken | 2 |
| <i>Crataegus monogyna</i> Jacq. | . | . | r | . | N | Ap | 1 |
| <i>Euonymus europaea</i> L. | . | . | + | . | N | Ap | 1 |
| <i>Fraxinus excelsior</i> L. | 2 | 1 | . | . | M | Ap | 1 |
| <i>Juglans regia</i> L. | . | . | r | . | M | D | 19 |
| <i>Larix decidua</i> Mill. | . | . | r | 3 | M | Sp | 2 |
| <i>Malus domestica</i> Borkh. | . | . | 1 | . | M | Ken | 19 |
| <i>Picea abies</i> (L.) H. Karst. | 1 | . | + | 2 | M | Sp | 2 |
| <i>Pinus cembra</i> L. | . | . | r | . | M | Sp | 19 |
| <i>Populus nigra</i> L. | . | . | . | 1 | M | Ap | 7 |
| <i>Populus tremula</i> L. | . | 2 | . | . | M | Ap | 2 |
| <i>Prunus cerasifera</i> Ehrh. | . | . | r | . | M | Ken | 3 |
| <i>Prunus domestica</i> L. | . | . | + | . | M | D | 19 |
| <i>Pyrus communis</i> L. | . | . | r | . | M | D | 19 |
| <i>Pyrus pyraster</i> (L.) Burgsd. | + | . | + | . | M | Ap | 1 |
| <i>Robinia pseudoacacia</i> L. | . | . | 1 | . | N | Ken | 14 |
| <i>Salix alba</i> L. | . | . | r | . | M | Ap | 7 |
| <i>Salix fragilis</i> L. | . | + | r | . | M | Ap | 7 |
| <i>Sorbus aucuparia</i> L. emend. Hedl. | . | . | . | + | M | Sp | 2 |
| <i>Tilia cordata</i> Mill. | . | 1 | 1 | . | M | Ap | 1 |

TABLE 1 – cont.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|----|-----|----|
| <i>Tilia platyphyllos</i> Scop. | . | . | 2 | . | M | Ap | 1 |
| <i>Ulmus laevis</i> Pall. | . | . | + | . | M | Ap | 1 |
| Shrub layer | | | | | | | |
| <i>Acer negundo</i> L. | . | . | . | r | M | Ken | 3 |
| <i>Acer pseudoplatanus</i> L. | l | + | . | . | M | Ap | 1 |
| <i>Caragana arborescens</i> Lam. | . | . | . | r | N | D | 19 |
| <i>Cerasus avium</i> (L.) Moench | + | . | . | . | M | Ken | 2 |
| <i>Cornus sanguinea</i> L. | + | r | . | . | N | Sp | 1 |
| <i>Corylus avellana</i> L. | l | . | + | . | N | Sp | 1 |
| <i>Crataegus monogyna</i> Jacq. | . | r | . | . | N | Ap | 1 |
| <i>Crataegus laevigata</i> × <i>C. monogyna</i> × <i>C. rhipidophylla</i> | + | . | . | . | N | Ap | 1 |
| <i>Euonymus europaea</i> L. | l | . | . | . | N | Ap | 1 |
| <i>Juglans regia</i> L. | . | . | r | . | M | D | 19 |
| <i>Ligustrum vulgare</i> L. | . | . | r | . | N | Ken | 19 |
| <i>Lonicera xylosteum</i> L. | + | . | . | . | N | Ap | 1 |
| <i>Malus domestica</i> Borkh | r | . | . | . | M | Ken | 19 |
| <i>Padus avium</i> Mill. | . | r | . | . | M | Sp | 1 |
| <i>Partenocissus quinquefolia</i> (L.) Planch. in A. & C. DC. | . | . | r | . | N | D | 19 |
| <i>Picea abies</i> (L.) H. Karst. | r | . | . | . | M | Sp | 2 |
| <i>Pinus sylvestris</i> L. | . | . | . | + | M | Ap | 5 |
| <i>Populus termula</i> L. | . | r | . | . | M | Ap | 2 |
| <i>Prunus cerasifera</i> Ehrh. | . | r | . | . | M | Ken | 3 |
| <i>Prunus spinosa</i> L. | l | . | . | . | N | Ap | 4 |
| <i>Quercus robur</i> L. | . | . | . | r | M | Sp | 1 |
| <i>Rosa canina</i> L. | + | . | . | . | N | Ap | 4 |
| <i>Rosa sherardii</i> Davies | . | . | r | . | N | Ap | 4 |
| <i>Rubus caesius</i> L. | l | . | l | . | Ch | Ap | 13 |
| <i>Rubus idaeus</i> L. | . | r | . | . | N | Sp | 2 |
| <i>Salix caprea</i> L. | + | . | . | . | N | Ap | 3 |
| <i>Sambucus nigra</i> L. | + | . | + | . | N | Ap | 3 |
| <i>Sambucus racemosa</i> L. | . | . | . | r | N | Ap | 3 |
| <i>Syringa vulgaris</i> L. | . | . | r | . | N | Ken | 19 |
| <i>Thuja occidentalis</i> L. | . | . | r | . | M | D | 19 |
| Herbaceous layer | | | | | | | |
| <i>Abies alba</i> Mill. | r | . | . | . | M | Ap | 1 |
| <i>Acer saccharinum</i> L. | . | . | r | . | M | D | 19 |
| <i>Achillea millefolium</i> L. s.s. | . | . | l | + | G | Ap | 9 |
| <i>Aegopodium podagraria</i> L. | . | 3 | 2 | 3 | H | Sp | 1 |
| <i>Agrostis capillaris</i> L. | . | l | . | + | H | Ap | 5 |
| <i>Ajuga reptans</i> L. | + | + | + | . | H | Sp | 1 |
| <i>Alchemilla monticola</i> Opiz | . | r | r | 2 | H | Ap | 8 |
| <i>Anthoxanthum odortum</i> L. s.s. | . | . | . | + | H | Ap | 2 |
| <i>Arrhenatherum elatius</i> (L.) P. Beauv. ex J. Presl & C. Presl | l | . | 4 | 1 | H | Ap | 9 |
| <i>Asarum europaeum</i> L. | + | r | . | . | H | Sp | 1 |
| <i>Astrantia major</i> L. | + | . | . | . | H | Sp | 1 |
| <i>Athyrium filix-femina</i> (L.) Roth | r | . | . | . | H | Sp | 1 |

TABLE 1 – cont.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--|---|---|---|---|---|------|----|
| <i>Bellis perennis</i> L. | . | . | + | + | H | Sp | 9 |
| <i>Betula pendula</i> Roth | . | . | r | . | M | Ap | 2 |
| <i>Brachypodium pinnatum</i> (L.) P. Beauv. | + | . | . | . | G | Sp | 4 |
| <i>Brachypodium sylvaticum</i> (Huds.) P. Beauv. | + | . | . | . | H | Sp | 1 |
| <i>Bromus sterilis</i> L. | . | . | + | . | T | Arch | 3 |
| <i>Calamagrostis epigeios</i> (L.) Roth | . | . | l | . | G | Ap | 2 |
| <i>Campanula patula</i> L. s.s. | . | . | + | + | H | Ap | 9 |
| <i>Campanula trachelium</i> L. | r | + | . | . | H | Sp | 1 |
| <i>Carex sylvatica</i> Huds. | . | + | + | . | H | Sp | 1 |
| <i>Cerastium holosteoides</i> Fr. emend. Hyl. | . | . | + | + | H | Ap | 9 |
| <i>Chaerophyllum aromaticum</i> L. | 3 | 3 | l | . | H | Sp | 3 |
| <i>Chelidonium majus</i> L. | + | . | l | . | H | Ap | 3 |
| <i>Cirsium arvense</i> (L.) Scop. | + | + | + | . | G | Ap | 13 |
| <i>Cirsium oleraceum</i> (L.) Scop. | r | . | . | . | H | Sp | 8 |
| <i>Cirsium palustre</i> (L.) Scop. | . | . | . | r | H | Sp | 8 |
| <i>Convolvulus arvensis</i> L. | . | . | + | . | G | Ap | 14 |
| <i>Conyza canadensis</i> (L.) Cronquist | . | . | + | . | T | Ken | 15 |
| <i>Crepis biennis</i> L. | . | . | + | . | T | Ap | 14 |
| <i>Cruciata gabra</i> (L.) Ehrend. | . | + | . | + | H | Sp | 1 |
| <i>Dactylis glomerata</i> L. | + | 2 | l | l | H | Ap | 9 |
| <i>Deschampsia caespitosa</i> (L.) P. Beauv. | . | 2 | + | r | H | Sp | 8 |
| <i>Elymus repens</i> (L.) Gould | . | . | . | + | G | Ap | 10 |
| <i>Epilobium montanum</i> L. | . | . | . | r | H | Ap | 1 |
| <i>Equisetum arvense</i> L. | + | . | . | + | G | Ap | 6 |
| <i>Euonymus europaea</i> L. | . | . | + | . | N | Ap | 1 |
| <i>Festuca gigantea</i> (L.) Vill. | . | + | + | . | H | Sp | 1 |
| <i>Festuca rubra</i> L. s.s. | . | + | . | + | H | Ap | 9 |
| <i>Fragaria xananassa</i> Deuchesne | . | . | r | . | H | D | 19 |
| <i>Fragaria vesca</i> L. | + | + | . | + | H | Sp | 2 |
| <i>Fragaria viridis</i> Deuchesne | . | . | r | . | H | Ap | 4 |
| <i>Galeopsis pubescens</i> Besser | . | . | . | + | T | Ap | 2 |
| <i>Galeopsis tetrahit</i> L. | . | . | + | . | T | Ap | 2 |
| <i>Galium mollugo</i> L. s.s. | + | + | l | + | H | Ap | 9 |
| <i>Geranium palustre</i> L. | 3 | . | . | . | H | Sp | 8 |
| <i>Geranium phaeum</i> L. | . | + | . | . | H | Sp | 2 |
| <i>Geranium pratense</i> L. | . | . | 3 | . | H | Ap | 9 |
| <i>Geranium pusillum</i> Burm. F. ex L. | . | . | + | . | T | Arch | 16 |
| <i>Geranium robertianum</i> L. | . | . | + | . | T | Sp | 3 |
| <i>Geum urbanum</i> L. | . | . | + | . | H | Ap | 3 |
| <i>Glechoma hederacea</i> L. | . | . | l | l | H | Ap | 3 |
| <i>Heracleum sphondylium</i> L. s.s | . | + | + | + | H | Ap | 9 |
| <i>Holcus lanatus</i> L. | . | 2 | l | . | H | Ap | 8 |
| <i>Hordeum murinum</i> Huds. | . | . | r | . | T | Arch | 15 |
| <i>Hypericum maculatum</i> Crantz | r | + | . | + | H | Sp | 2 |
| <i>Hypochoeris radicata</i> L. | . | + | . | . | H | Ap | 5 |
| <i>Impatiens parviflora</i> DC. | . | . | + | . | T | Ken | 3 |
| <i>Lamium album</i> L. | . | . | + | . | H | Arch | 3 |

TABLE 1 – cont.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--|---|---|---|---|---|------|----|
| <i>Lamium maculatum</i> L. | . | . | + | . | H | Sp | 1 |
| <i>Lathyrus pratensis</i> L. | . | + | . | . | H | Ap | 9 |
| <i>Leontodon hispidus</i> L. | . | 2 | + | . | H | Sp | 9 |
| <i>Lolium perenne</i> L. | . | . | + | . | H | Ap | 10 |
| <i>Lotus corniculatus</i> L. | . | + | . | . | H | Ap | 9 |
| <i>Lychnis flos-cuculi</i> L. | . | + | . | . | H | Sp | 8 |
| <i>Lysimachia nummularia</i> L. | . | 2 | 1 | 2 | H | Sp | 1 |
| <i>Medicago falcata</i> L. | + | . | . | . | H | Ap | 4 |
| <i>Medicago lupulina</i> L. | . | . | . | r | H | Ap | 9 |
| <i>Moehringia trinervia</i> (L.) Clairv. | . | . | + | + | H | Sp | 2 |
| <i>Myosotis sylvatica</i> Ehrh. ex Hoffm. | . | . | . | + | T | Sp | 1 |
| <i>Origanum vulgare</i> L. | r | . | . | . | H | Ap | 2 |
| <i>Oxalis acetosella</i> L. | . | + | . | . | H | Sp | 2 |
| <i>Papaver rhoeas</i> L. | . | . | r | . | T | Arch | 17 |
| <i>Paris quadrifolia</i> L. | r | . | . | . | G | Sp | 1 |
| <i>Pastinaca sativa</i> L. s.s. | . | . | r | . | H | Ap | 9 |
| <i>Pimpinella major</i> (L.) Huds. | . | + | . | . | H | Sp | 8 |
| <i>Plantago lanceolata</i> L. | . | . | 1 | . | H | Ap | 10 |
| <i>Plantago major</i> L. s.s. | . | . | + | . | H | Ap | 10 |
| <i>Plantago media</i> L. | . | . | r | . | H | Ap | 10 |
| <i>Poa annua</i> L. | . | . | + | 1 | T | Ap | 10 |
| <i>Poa compressa</i> L. | . | . | . | + | H | Ap | 14 |
| <i>Poa pratensis</i> L. | . | 1 | . | 1 | H | Sp | 7 |
| <i>Polygonatum multiflorum</i> (L.) All. | r | . | . | . | G | Sp | 1 |
| <i>Potentilla reptans</i> L. | . | . | + | . | H | Ap | 10 |
| <i>Primula elatior</i> (L.) Hill. | r | . | . | . | H | Sp | 1 |
| <i>Prunella vulgaris</i> L. | . | + | . | . | H | Sp | 9 |
| <i>Ranunculus acris</i> L. s.s. | + | + | 1 | . | H | Ap | 9 |
| <i>Ranunculus repens</i> L. | . | + | . | + | H | Ap | 10 |
| <i>Rumex alpestris</i> Jacq. | . | . | . | 2 | H | Sp | 9 |
| <i>Rumex obtusifolius</i> L. | . | . | r | + | H | Ap | 13 |
| <i>Sagina procumbens</i> L. | . | . | . | r | H | Ap | 12 |
| <i>Salvia glutinosa</i> L. | r | r | . | . | H | Sp | 4 |
| <i>Sambucus nigra</i> L. | . | r | . | . | N | Ap | 3 |
| <i>Scrophularia scopolii</i> Hoppe | . | . | r | . | H | Ap | 1 |
| <i>Senecio ovatus</i> (P. Gaertn., B. Mey. & Scherb.) Willd. | r | . | . | . | H | Sp | 2 |
| <i>Sorbus aucuparia</i> L. | . | . | r | r | M | Sp | 2 |
| <i>Stellaria graminea</i> L. | + | + | + | . | H | Ap | 2 |
| <i>Stellaria media</i> (L.) Vill. | . | . | 1 | . | T | Ap | 16 |
| <i>Symphytum officinale</i> L. | . | r | r | . | H | Sp | 7 |
| <i>Taraxacum officinale</i> F.H. Wigg. | . | 2 | 2 | 1 | H | Ap | 9 |
| <i>Trifolium medium</i> L. | + | . | . | . | H | Ap | 2 |
| <i>Trifolium pratense</i> L. | . | . | 1 | . | H | Ap | 9 |
| <i>Trifolium repens</i> L. | . | + | 1 | + | H | Ap | 10 |
| <i>Tussilago farfara</i> L. | . | . | . | r | G | Ap | 10 |
| <i>Urtica dioica</i> L. | 1 | . | 1 | 1 | H | Ap | 3 |
| <i>Valeriana officinalis</i> L. | r | . | . | . | H | Sp | 8 |

TABLE 1 – cont.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--|---|---|---|---|---|----|-----|----|
| <i>Verbascum nigrum</i> L. | | r | . | . | . | T | Ap | 2 |
| <i>Veronica chamaedrys</i> L. s.s. | | . | + | + | + | H | Ap | 9 |
| <i>Veronica officinalis</i> L. | | . | . | . | r | H | Ap | 2 |
| <i>Veronica serpyllifolia</i> L. | | . | . | . | r | H | Ap | 10 |
| <i>Viburnum opulus</i> L. | | r | . | . | . | N | Sp | 7 |
| <i>Vicia cracca</i> L. | | 1 | + | + | . | G | Ap | 8 |
| <i>Vicia sepium</i> L. | | . | + | + | . | G | Sp | 1 |
| <i>Vinca minor</i> L. | | . | . | . | + | Ch | Sp | 1 |
| <i>Viola odorata</i> L. | | . | . | 1 | + | H | Ken | 3 |
| <i>Viola reichenbachiana</i> Jord. ex Boreau | | . | r | . | . | H | Sp | 1 |

Cover-abundance classes: r – species represented by 1-3 individuals, no measurable cover; + – several individuals, but less than 1% cover; 1 – 1-5% cover; 2 – 5-25% cover; 3 – 25-50% cover; 4 – 50-75% cover; 5 – 75-100% cover.

LF (Life forms): M – megaphanerophytes, N – nanophanerophytes, C – non-woody chamaephytes, Ch – woody chamaephytes, G – geophytes, H – hemicryptophytes, T – therophytes.

GHs (Geographic-historical status): Sp – spontaneophytes, Ap – apophytes, Arch – archaeophytes, Ken – kenophytes, Dia – diaphytes.

SEg (Socio-ecological 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 robur-petraeae*, *Quercion petraeae*, *Epilobion*, *Nardetalia*); 3 – nitrophilous shrub or herb communities (*Sambuco-Salicion*, *Alliarion*); 4 – xerothermic herb or grassland communities (*Trifolio-Geranietaea*, *Festuco-Brometea*); 5 – pine forests or sandy grassland (*Dicrano-Pinion*, *Sedo-Scleranthetea*, *Corynephoretea*); 6 – swamp alder forests, woodless fens, bogs and intermediate mires (*Alnion*, *Magnocaricion*, *Caricetalia fuscae*, *Sphagnion fuscii*); 7 – riparian forests and thickets, reeds and aquatic vegetation (*Salicion*, *Phragmition*, *Glycerio-Sparganion*, *Potamogetonetea*, *Lemnetea*, *Utricularietaea*); 8 – humid meadows and tall herb communities (*Molinietalia*); 9 – fresh and moderately humid meadows (*Arrhenatheretalia*); 10 – nitrophilous floodplains and treaded communities (*Plantaginetea*); 11 – salt marshes and halophilous grasslands (*Thero-Salicornietea*, *Asteretea trifolium*); 12 – therophyte communities on wet and humid sites (*Bidentetea*, *Nanocyperion*); 13 – mesophilous communities of tall perennials (*Arction*); 14 – xerothermic, perennial ruderal communities (*Onopordon*); 15 – short-term, pioneer ruderal communities (*Sisymbriion*, *Eragrostion*); 16 – weed communities of gardens and root crop fields (*Polygono-Chenopodietalia*); 17 – weed communities of cereal fields (*Aperetalia*); 18 – epilithic communities (*Asplenetia*); 19 – species of another phytosociological affiliation or unknown affiliation.

In all cemeteries species of the two lowest cover classes comprise the most numerous group (Table 2). In the herbaceous layer, *Aegopodium podagraria* (2,4), *Arrhenatherum elatius* (3), *Chaerophyllum aromaticum* (1,2), *Geranium palustre* (1) and *Geranium pratense* (3) display especially high cover values. In the cemetery in Nowy Targ *Larix decidua* is very common in the tree layer.

Species recorded in the four examined Jewish cemeteries of Western Carpathians form a full spectrum of Raunkiaer life forms (Table 3). The most numerous

group in all the examined cemeteries are hemicryptophytes, which results from the places being (nearly) out of use. A high percentage of mega- and nanophanerophytes was observed, too, especially in the cemetery of Nowy Sącz. The least numerous are non-woody chamaephytes and therophytes. *Polygonatum multiflorum* and *Paris quadrifolia* ought to be noted as interesting geophyte species.

A percentage analysis of given vascular plant species in the flora of the examined Jewish cemeteries according

TABLE 2. Number of species in particular frequency classes in the four Jewish cemeteries of the Western Carpathians

| Cover-abundance class | Number of species on cemeteries | | | |
|-----------------------|---------------------------------|----|----|----|
| | 1 | 2 | 3 | 4 |
| r | 15 | 11 | 24 | 12 |
| + | 22 | 27 | 38 | 27 |
| 1 | 9 | 5 | 21 | 8 |
| 2 | 2 | 7 | 5 | 5 |
| 3 | 2 | 2 | 1 | 2 |
| 4 | 0 | 0 | 1 | 0 |
| Total | 50 | 52 | 90 | 54 |

Frequency class explanations – see Table 1.

TABLE 3. Number of species represent different life forms in the four Jewish cemeteries of the Western Carpathians

| Life forms | Number of species on cemeteries | | | |
|------------------------|---------------------------------|----|----|----|
| | 1 | 2 | 3 | 4 |
| Megaphanerophytes | 7 | 7 | 19 | 9 |
| Nanophanerophytes | 10 | 4 | 10 | 2 |
| Non-woody chamaephytes | 1 | 0 | 1 | 1 |
| Geophytes | 6 | 3 | 6 | 4 |
| Hemicryptophytes | 25 | 38 | 43 | 35 |
| Therophytes | 1 | 0 | 11 | 3 |
| Total | 50 | 52 | 90 | 54 |

to the geographic-historical criteria (Table 4) shows that indigenous species – apophytes nad spontaneophytes – form the most numerous group, collectively comprising nearly 100% of all flora in three of the examined cemeteries, with alien species amounting to about 20% of the flora only in the cemetery of Nowy Sącz. Anthropophytes are represented by species like *Cerasus avium*, *Fragaria xananassa*, *Juglans regia*, *Lamium album*, *Malus domestica*, *Prunus cerasifera*, *Prunus domestica*, *Pyrus communis*, *Syringa vulgaris* and *Viola odorata*.

TABLE 4. Number of species according to geographic-historical status in the four Jewish cemeteries of the Western Carpathians

| Geographic-historical groups | Number of species on cemeteries | | | |
|------------------------------|---------------------------------|----|----|----|
| | ① | ② | ③ | ④ |
| Spontaneophytes | 22 | 26 | 19 | 18 |
| Apophytes | 26 | 25 | 50 | 33 |
| Archaeophytes | 0 | 0 | 5 | 0 |
| Kenophytes | 2 | 1 | 9 | 2 |
| Diaphytes | 0 | 0 | 7 | 1 |
| Total | 50 | 52 | 90 | 54 |

The plant life of the examined entities originates from 17 groups of syngenic plant communities (Table 5). Species preferring fertile broad-leaved forests and shrub communities form the majority. There is also a significant percentage of species from semi-natural and anthropogenic meadow and pasture communities, especially of the order Arrhenatheretalia. In the cemetery of Nowy Sącz a numerous group is comprised of species characteristic to nitrophilous shrub or herb communities and species with no specifically defined phytosociological affiliation.

SUMMARY

Of the 160 species of vascular plants recorded in the examined cemeteries, the majority was found in the cemetery of Nowy Sącz. It is also the biggest of the examined cemeteries. However, as previous studies have shown, the size of a cemetery does not have much importance for the richness of vascular flora, but it is the intensity of cemetery use and of introducing ornamentals that counts (CZARNA 2001).

Contrary to cemeteries of other religions, ornamentals are not planted in Jewish cemeteries, nor are graves adorned with flowers (PALACZ 1996). Due to this tradition, alien species constitute a small fraction in the

TABLE 5. Number of species in socio-ecological groups in the four Jewish cemeteries of the Western Carpathians

| No | Socio-ecological groups | Number of species on cemeteries | | | |
|-------|--|---------------------------------|----|----|----|
| | | ① | ② | ③ | ④ |
| 1 | <i>Fagetalia, Prunetalia</i> | 18 | 16 | 16 | 7 |
| 2 | <i>Quercion robori-peraeae, Quercion petraeae, Epilobion, Nardetalia</i> | 9 | 7 | 10 | 11 |
| 3 | <i>Sambuco-Salicion, Alliarion</i> | 5 | 3 | 12 | 5 |
| 4 | <i>Trifolio-Geranieta, Festuco-Brometea</i> | 5 | 1 | 2 | 0 |
| 5 | <i>Dicrano-Pinion, Sedo-Scleranthetea, Coryneporetea</i> | 0 | 2 | 0 | 2 |
| 6 | <i>Alnion, Magnocaricion, Caricetalia fuscae, Sphagnion fusci</i> | 1 | 0 | 0 | 1 |
| 7 | <i>Salicion, Phragmition, Glycerio-Sparganion, Potamogetonetea, Lemneta, Utricularietea</i> | 1 | 3 | 3 | 2 |
| 8 | <i>Molinieta</i> | 4 | 6 | 4 | 3 |
| 9 | <i>Arrhenatheretalia</i> | 4 | 11 | 15 | 13 |
| 10 | <i>Plantaginetea</i> | 0 | 2 | 7 | 6 |
| 11 | <i>Thero-Salicornietea, Asteretea tripolium</i> | 0 | 0 | 0 | 0 |
| 12 | <i>Bidentetea, Nanocyperion</i> | 0 | 0 | 0 | 1 |
| 13 | <i>Arction</i> | 2 | 1 | 3 | 1 |
| 14 | <i>Onopordion</i> | 0 | 0 | 3 | 1 |
| 15 | <i>Sisymbriion, Eragrostion</i> | 0 | 0 | 2 | 0 |
| 16 | <i>Polygono-Chenopodietalia</i> | 0 | 0 | 2 | 0 |
| 17 | <i>Aperetalia</i> | 0 | 0 | 1 | 0 |
| 18 | <i>Asplenieta</i> | 0 | 0 | 0 | 0 |
| 19 | Native species or naturalised antropophytes of undetermined phytosociological status and ephemeroxytes | 1 | 0 | 10 | 1 |
| Total | | 50 | 52 | 90 | 54 |

examined entities. This correlation has been already found in the authors' previous studies of cemeteries in Jarocin (CZARNA 2004) and in Olkusz (CZARNA and NOWIŃSKA 2010).

Among the recorded alien species introduced into cultivation are: *Acer negundo*, *A. saccharinum*, *Caragana arborescens*, *Cerasus avium*, *Fragaria xananassa*, *Juglans regia*, *Lamium album*, *Ligustrum vulgare*, *Malus domestica*, *Partenocissus quinquefolia*, *Prunus cerasifera*, *P. domestica*, *Pyrus communis*, *Robinia pseudoacacia*, *Syringa vulgaris*, *Thuja occidentalis* and *Viola odorata*, and among spontaneously appearing alien species: *Bromus sterilis*, *Conyza canadensis*, *Geranium pusillum*, *Hordeum murinum*, *Impatiens parviflora*, *Malus domestica*, *Papaver rhoeas* and *Prunus cerasifera*. Many of the above mentioned alien species come from the cemetery of Nowy Sącz, which was expanded by adding a lot that had probably been functioning as a garden before. This can be deduced from the presence of species such as *Cerasus avium*, *Fragaria xananassa*, *Juglans regia*, *Lamium album*, *Malus domestica*, *Prunus cerasifera*, *P. domestica*, *Pyrus communis*, *Syringa vulgaris* and *Viola odorata*. For that reason the statistical analysis of this cemetery's flora differs from the results obtained in three other loci.

Cemeteries can play an important role as indigenous species reserves. In the examined cemeteries these are: *Alchemilla monticola*, *Asarum europaeum*, *Astrantia major*, *Brachypodium pinnatum*, *Campanula trachelium*, *Chaerophyllum aromaticum*, *Cruciata gabra*, *Epilobium montanum*, *Geranium phaeum*, *G. pratense*, *Hypericum maculatum*, *Lamium maculatum*, *Myosotis sylvatica*, *Origanum vulgare*, *Paris quadrifolia*, *Pinus cembra*, *Polygonatum multiflorum*, *Primula elatior*, *Rumex alpestris*, *Salvia glutinosa*, *Scrophularia scopoli*, *Senecio ovatus*, *Viburnum opulus* and *Vinca minor*.

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For citation: Czarna A., Nowińska R. (2010): Vascular plants of certain old Jewish cemeteries in Western Carpathians. Roczn. AR Pozn. 389, Bot.-Stec. 14: 45-52.