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Plant associations and communities of the Kazimierz Landscape Park. V. Xerothermic grasslands and shrubs associations

Zespoły i zbiorowiska Kazimierskiego Parku Krajobrazowego.
V. Murawy kserotermiczne i zespoły zarośli

INTRODUCTION AND RESEARCH METHODS

The paper presents a phytosociological characteristics of associations and communities of grasslands and xerothermic shrubs belonging to the *Sedo-Scleranthetea, Festuco-Brometea, Trifolio-Geranietea* and *Rhamno-Prunetea* classes in the Kazimierz Landscape Park. Field research was conducted in the years 1982-1989 and then supplemented in 1994-1996. Phytosociological research was carried out using Braun-Blanquet's method (Braun-Blanquet 1964, Pawłowski 1977). The recorded area covered from several up to 150 m² depending on the type and the area of a given phytocenosis. The systematic membership of the communities in question as well as the classification of characteristic and differential species follows the classification made by Matuszkiewicz (1981). The terminology for vascular plant species is based on Mirek et al. (1995), for bryophytes on Ochyra and Szmajda (1978) and for liverworts on Grolle (1976). The natural environment of the Kazimierz Landscape Park is presented in the first part of the paper together with the characteristics of meadow and pasture associations (Kucharczyk 1996).

SURVEY OF ASSOCIATIONS AND COMMUNITIES

In the Kazimierz Landscape Park 12 associations and communities of xerothermic grasslands and shrubs have been reported. Their syntaxonomic position can be presented as follows:

Cl.: *Sedo-Scleranthetea* Br.-Bl. 1955 em. Müll. 1961,
O.: *Corynephoretalia canescentis* R. Tx. 1937 em. Krausch 1962,
All.: *Corynephorion canescentis* Klika 1931,
Ass.: *Spergulo vernalis-Corynephoretum* (R. Tx. 1928) Libb. 1933,

Subass.: *Spergulo vernalis-Corynephoretum thymetosum serpylli* K. Czyżewska 1992,
O.: *Festuco-Sedetalia* R. Tx. 1951 em. Krausch 1962,
All.: *Koelerion glaucae* (Volk 1931) Klika 1935,
Ass.: *Festuco psammophilae-Koelerietum glaucae* Klika 1931,
Cl.: *Festuco-Brometea* Br.-Bl. et R. Tx. 1943,
O.: *Festucetalia valesiacae* Br.-Bl. et R. Tx. 1943,
All.: *Festuco-Stipion* (Klika 1931) Krausch 1961,
Ass.: *Koelerio-Festucetum sulcatae* Kornaś 1952,
Subass.: *K.-F. typicum*,
Subass.: *K.-F. odontitetosum luteae* Głazek 1968,
Ass.: *Sisymbrio-Stipetum capillatae* (Dziub. 1925) Medw.-Korn. 1959,
All.: *Cirsio-Brachypodion pinnati* Hadač et Klika 1944 em. Krausch 1961,
Ass.: *Inuletum ensifoliae* Kozł. 1925,
Ass.: *Thalictro-Salvietum pratensis* Medw.-Korn. 1959,
Ass.: *Origano-Brachypodietum* Medw.-Korn. et Kornaś 1963,
Cl.: *Trifolio-Geranietea sanguinei* Müll. 1962,
O.: *Origanetalia* Müll. 1962,
All.: *Geranion sanguinei* R. Tx. 1961,
Ass.: *Geranio-Peucedanetum cervariae* (Kuhn 1937) Müll. 1961,
Ass.: *Geranio-Trifolietum alpestris* Müll. 1961,
Cl.: *Rhamno-Prunetea* Rivas Goday et Carb. 1961,
O.: *Prunetalia spinosae* R. Tx. 1952,
All.: *Berberidion* Br.-Bl. (1947) 1950,
Ass.: *Prunetum fruticosae* Dziub. 1925
Ass.: *Ligustro-Prunetum* R. Tx. 1952,
Comm. with *Ulmus minor* var. *suberosa*.

Spergulo vernalis-Corynephoretum (R. Tx. 1928) Libb. 1933
Table 1

Localities of phytosociological records:

1 (194). Polanówka near Rogów, sand mine near the village. Area of phytocenosis: 40 m². Contact phytocoenoses: pine plantings. 1983-08-06.

2 (798). Janowiec, near a road. Area of phytocoenosis: 90 m². Contact phytocoenoses: *Lolio-Plantaginetum*, cereal and root plants. 1986-07-02.

3 (799). See record no 2.

Table 1. Composition and structure of phytocoenoses *Spergulo vernalis-Corynephoretum* (R. Tx. 1928) Libb. 1933

Succesive number of record	1	2	3	4	5	6	7	8	9	10	11	12	
Number of record	194	798	799	1052	357	371	363	359	670	692	699	797	
Cover of herb layer c [%]	20	40	60	60	50	30	40	30	50	60	70	60	PRESENCE
Cover of moss layer d [%]	20	70	50	30	10	60	20	20	60	50	50	20	
Area of sample plot [m^2]	40	20	30	15	40	25	45	50	20	15	15	15	
Number of species	20	20	17	19	19	17	17	17	20	21	23	19	
Ch. °D. *Spergulo-Corynephoretum*													
Spergula morisonii	1.1	1.1	2.1	.	+	+	+	+	+	+	+	+	V
°*Veronica dillenii*	+	+	+	+	+	+	.	+	.	.	.	.	III
D. Subass. *S. v.-C. thymetosum*													
Rhaconitrium canescens	2.2	3.2	3.2	2.2	2.2	4.3	2.2	2.2	3.2	3.2	+	+	V
Thymus serpyllum	1.2	1.2	1.2	+	1.2	+	1.1	1.2	+	1.2	1.2	1.2	V
Ch. *Corynephoretalia*													
Corynephorus canescens	1.2	2.2	3.3	3.3	3.2	2.2	3.2	2.2	3.3	3.2	4.3	4.3	V
Agrostis canina	.	.	.	1.2	.	.	+	+	.	+	+	+	III
Filago minima	+	+	+	.	.	.	.	+	.	.	.	.	II
Ch. *Sedo-Scleranthetea*, °*Festuco-Sedetalia*													
Hieracium pilosella	+	1.1	2.2	2.2	1.1	+	+	+	1.2	1.2	+	+	V
Rumex acetosella	1.1	1.1	1.1	1.2	+	+	+	+	1.1	+	1.1	+	V
Potentilla argentea	+	+	+	.	+	+	+	+	+	2.2	+	1.1	V
Scleranthus perennis	+	+	+	.	1.1	+	+	+	+	+	+	1.2	V
Trifolium arvense	.	.	.	.	+	+	.	+	+	1.2	1.2	+	III
°*Festuca psammophila*	.	.	.	.	+	.	.	.	1.2	+	+	1.2	III
Sedum sexangulare	+	.	.	+	+	.	.	.	.	+	.	.	II
°*Koeleria glauca*	.	1.2	+	+	.	.	.	.	.	.	.	.	II
Jasione montana	.	.	.	1.1	+	.	.	+	.	.	.	.	II
Veronica verna	+	+	+	.	.	.	.	.	.	.	.	.	II
Sedum acre	.	.	.	.	+	.	.	.	+	.	+	.	II
Alyssum alyssoides	.	.	.	.	.	1.1	.	.	.	.	+	.	I
°*Sedum maximum*	+	.	.	+	.	.	.	.	.	.	.	.	I
Ceratodon purpureus	.	2.2	1.2	2.2	.	1.2	1.2	+	1.2	1.2	3.2	3.2	V
Polytrichum piliferum	+	1.2	.	.	.	2.2	.	.	.	.	.	+	II
Ch. *Festuca-Brometea*													
Artemisia campestris	.	.	.	.	+	1.1	+	+	1.1	+	1.1	1.1	IV
Euphorbia cyparissias	+	1.1	1.1	1.1	+	+	+	+	.	.	.	.	IV
Achillea pannonica	.	.	.	+	.	.	+	+	+	+	+	1.1	III
Potentilla arenaria	.	1.1	+	.	.	.	.	.	.	+	.	.	II
Centaurea rhenana	.	.	.	.	.	+	+	.	.	.	+	.	II
Allium oleraceum	.	+	+	.	.	.	.	.	.	.	.	.	I
Other accompanying:													
Carex hirta	r	.	.	+	+	.	+	.	.	.	+	1.1	III
Conyza canadensis	.	.	1.1	.	+	.	+	.	.	.	.	1.1	II
Oenothera biennis	+	.	.	1.1	.	+	+	.	.	.	.	.	II
Equisetum arvense	.	.	.	.	+	.	.	.	+	.	+	1.1	II
Verbascum phlomoides	.	.	.	.	.	.	.	.	.	+	+	+	II
Erigeron acris	.	.	.	.	.	.	.	.	+	.	2.1	.	I
Salsola kali subsp. ruthenica	1.1	.	.	.	.	.	.	.	.	+	.	.	I
Linaria vulgaris	+	+	.	.	.	.	.	.	.	.	.	.	I
Medicago lupulina	.	.	.	.	.	.	.	.	.	+	+	.	I
Cladonia chlorophea	.	2.2	.	.	.	.	.	.	2.2	.	.	.	I

Sporadic species:
Ch. *Festuco-Sedetalia*: *Plantago arenaria* 1.
Ch. *Festuco-Brometea*: *Agropyron intermedium subsp. intermedium* 2, *Dianthus carthusianorum* 4/1.1, *Veronica spicata* 4/1.1, *Anthemis tinctoria* 9, *Scabiosa ochroleuca* 9.
Other accompanying: *Hypericum perforatum* 4, *Silene nutans* 7, *Pimpinella saxifraga* 9, *Plantago lanceolata* 10, *Bromus hordaceus* 10, *Cladonia subulata* 11/1.2.

4 (1052). Nasiłów, slope foot. Area of phytocoenosis: 15 m². Contact phytocoenoses: *Peucedano-Pinetum* partially developed, *Lolio-Plantaginetum*. 1986-08-07.

5 (357). Oblasy near Janowiec, slope foot. Area of phytocoenosis: 60 m². Contact phytocoenoses: pine plantings, *Plantaginetea* comm. 1984-07-21.

6 (371). Janowiec, sand hill. Area of phytocoenosis: 25 m². Contact phytocoenoses: *Festuco-Koelerietum*, pine plantings. 1984-07-21.

7 (363). Oblasy near Janowiec, edge of a road. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Plantaginetea*, *Peucedano-Pinetum* comm. partially developed. 1984-07-21.

8 (359). Oblasy near Janowiec, edge of a road. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Plantaginetea*, *Querco-Pinetum* comm. 1984-07-21.

9 (670). Męćmierz, edge of a ravine south of the village. Area of phytocoenosis: 20 m². Contact phytocoenoses: cereal and root plants, *Festuco-Koelerietum* partially developed. 1985-08-12, 1994-06-15.

10 (692). Janowiec, side of a road. Area of phytocoenosis: 15 m². Contact phytocoenoses: *Artemisietea* comm. 1985-08-21.

11 (699). See record no 10.

12 (797) Janowiec, small sand mine near the road to Janowice. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Artemisietea* and *Plantaginetea* comm. 1986-07-02.

In *Spergulo vernalis-Corynephoretum* phytocoenoses dominates the growing in tufts *Corynephorus canescens* (V^{3396}), where one can find *Hieracium pilosella* (V^{463}), *Thymus serpyllum* (V^{378}), *Rumex acetosella* (V^{255}), *Scleranthus perennis* (V^{91}) and others. The layer of bryophytes is usually well developed (up to 70% of the area) and consists mainly of *Rhacomitrium canescens* (V^{2501}) and *Ceratodon purpureus* (V^{1125}). The characteristic and differential species for this association are *Spergula morissonii* (V^{235}), *Veronica dillenii* (III^{6}) and *Teesdalia nudicaulis* (not present in the analysed phytocoenoses). It is worth noting that from the species of the *Sedo-Scleranthetea* class, some of the *Festuco-Sedetalia* order (among others *Festuca psammophila* and *Koeleria glauca*) are well represented, while those of the *Corynephoretalia* order are barely visible here (3 species). The *Festuco-Brometea* class species (11), particularly *Artemisia campestris* (IV^{170}), *Euphorbia cyparissias* (IV^{129}) and *Achillea pannonica* (III^{47}) are quite numerous.

When compared with the syntaxonomic variability of the association in the area of Poland (Czyżewska 1997), the *Spergulo-Corynephoretum* phytocoenoses of the Kazimierz Landscape Park should be classified as belonging to *S. v.-C. thymetosum serpylli*, among which records 1-4 are a typical variant, while records 5-12 are a variant with *Artemisia campestris*.

Spergulo-Corynephoretum phytocoenoses occur in the Kazimierz Landscape Park only in the vicinity of Janowiec and in Męćmierz. They grow on regosol with a poorly developed profile that was formed from loose sands or on not too clayey soils covering chalk deposits. Small phytocoenoses of the association in question (up to 90 m²) border on one side with coniferous forests (*Pino-Quercetum*, partially developed patches of *Peucedano-Pinetum*, pine young growths) and associations of the *Artemisietea* and *Plantaginetea* classes on the other side. As the sand layer gets thinner, *Spergulo-Corynephoretum* gradually pass into *Festuco-Koelerietum glaucae*.

Festuco psammophilae-Koelerietum glaucae K l i k a 1931
Table 2

Localities of phytosociological records:

1 (808). Oblasy near Janowiec, scarp foot. Area of phytocoenosis: 10 m². Contact phytocoenoses: *Peucedano-Pinetum* partially developed, *Plantaginetea* comm. 1986-07-06.

2 (694). Janowiec, near the road to Janowice. Area of phytocoenosis: 10 m². Contact phytocoenoses: pine monoculture. 1985-08-21.

3 (693). See record no 2.

4 (358). Oblasy near Janowiec, scarp foot. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Peucedano-Pinetum* partially developed, *Plantaginetea* comm. 1984-07-21.

5 (1032). Męćmierz, slope of a sandy ravine near the village. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Inuletum ensifoliae*. 1986-07-31.

6 (1215). Męćmierz, slope of a sandy ravine near the road to Kazimierz. Area of phytocoenosis: 35 m². Contact phytocoenoses: *Potentillo albae-Quercetum* partially developed, *Artemisietea* and *Plantaginetea* comm. 1995-07-12.

7 (640). See record no 5. 1985-08-05.

8 (638). See record no 5. 1985-08-05.

9 (636). Męćmierz, slope of a sandy ravine near the village. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Inuletum ensifoliae, Spergulo-Corynephoretum* partially developed. 1985-08--05, 1994-06-15.

10 (637). See record no 9.

11 (373) Janowiec, near the ruins of the castle, upper part of a slope. Area of phytocoenosis: 12 m². Contact phytocoenoses: *Spergulo-Corynephoretum*. 1984-07-21.

12 (372). Janowiec, near the ruins of the castle, sandy hillock on a plateau. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Spergulo-Corynephoretum, Plantaginetea* comm. 1984-07-21.

The *Festuco-Koelerietum glaucae* have the character of a loose grassland, where the upper layer consists of *Festuca psammophila* (V^{2459}), *Koeleria glauca* (V^{648}) and *Artemisia campestris* (V^{523}), and the lower of *Thymus serpyllum* (V^{730}), *Euphorbia cyparissias* (V^{504}), *Sedum sexangulare* (V^{237}), *Rumex acetosella* (V^{131}), *Potentilla cinerea* (V^{131}) and *Sedum acre* (V^{9}). The moss layer which covers up to 50% of the area of some phytocoenoses is well developed. From the species characteristic of this association the most abundant is *Festuca psammophila* (V^{2459}), while *Silene chlorantha* (III^{46}) and *Dianthus arenarius* (I^{2}) are found less frequently. Beside 22 species of the *Sedo-Scleranthetea* class, quite numerous are plants representing the *Festuco-Brometea* class (19 species). The most frequently occurring species of this class are *Artemisia campestris* (V^{523}), *Euphorbia cyparissias* (V^{504}), *Potentilla cinerea* (V^{31}) and *Achillea pannonica* (V^{10}).

Festuco-Koelerietum grows in Męćmierz and in the vicinity of Janowiec on soils that developed from loose and clayey sands covering chalk deposits. Phytocoenoses of the association border with *Spergulo-Corynephoretum* and pine forests or xerothermic grasslands, mainly *Inuletum ensifoliae*; phytocoenoses where records 1-4 have been taken border with *Plantaginetea majoris*.

Table 2. Composition and structure of phytocoenoses *Festuco psammophilae-Koelerietum glaucae* Klika 1931

Succesive number of record	1	2	3	4	5	6	7	8	9	10	11	12	
Number of record	808	694	693	358	1032	1215	640	638	636	637	373	372	
Exposure	-	-	-	E	-	SE	SE	S	S	S	SE	-	
Slope inclination [°]	-	-	-	10	-	30	20	15	25	30	35	-	
Cover of shrub layer b [%]	-	-	-	-	10	<5	<5	-	-	-	-	-	
Cover of herb layer c [%]	60	50	60	50	50	50	60	60	50	50	40	40	
Cover of moss layer d [%]	20	30	20	40	10	30	20	30	40	30	+	50	
Area of sample plot [m²]	10	10	10	25	10	30	20	15	25	15	10	20	
Number of species	19	24	25	21	23	27	27	25	25	24	20	26	
Ch. *Festuco-Koelerietum*													
Festuca psammophila	1.1	3.3	3.3	2.2	3.2	3.2	3.3	3.2	3.2	1.2	1.2	+	V
Silene chlorantha	.	.	.	1.1	+	+	+	+	+	.	.	.	III
Dianthus arenarius	.	.	+	+	.	.	.	.	.	.	.	.	I
Ch. *Koelerion glaucae*													
Koeleria glauca	3.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	+	+	+	V
Silene otites	.	.	.	+	.	+	.	.	.	.	.	1.2	II
Ch. C6B°D. *Festuco-Sedetalia*													
Thymus serpyllum	1.2	1.2	2.2	1.2	1.2	1.2	1.2	1.2	2.2	2.2	+	.	V
°*Petrorhagia prolifera*	.	.	.	.	.	.	.	+	+	2.1	2.1	1.1	III
Tortula muralis	+	1.2	1.2	.	.	.	1.2	1.2	1.2	1.2	+	2.2	IV
Ch. *Sedo-Scleranthetea*													
Sedum sexangulare	+	+	2.2	+	+	+	+	1.2	1.1	+	+	+	V
Sedum acre	+	+	+	+	.	+	+	+	+	+	+	+	V
Rumex acetosella	.	.	+	+	+	+	+	1.1	1.1	1.1	+	+	V
Alyssum alyssoides	.	.	.	.	1.1	+	1.2	.	+	+	+	1.1	III
Corynephorus canescens	.	1.2	+	+	1.1	.	.	.	+	.	.	+	III
Trifolium arvense	.	.	.	.	.	.	.	+	+	+	1.1	+	III
Hieracium pilosella	.	+	.	+	.	.	.	.	+	.	+	+	III
Acinos arvensis	+	+	+	.	.	.	.	.	.	.	.	.	II
Scleranthus perennis	.	.	.	+	.	+	+	.	.	.	.	.	II
Jasione montana	.	.	+	+	.	.	.	.	.	.	.	.	I
Festuca ovina	.	.	.	.	.	.	+	.	+	.	.	.	I
Rhaconitrium canescens	2.2	+	.	3.2	1.2	1.2	2.2	+	3.2	3.2	.	2.2	V
Ceratodon purpureus	+	1.1	1.2	+	1.2	2.2	.	2.2	.	+	.	+	IV
Ch. *Festuca-Brometea*													
Artemisia campestris	1.1	1.1	+	+	1.2	1.1	1.2	2.2	1.2	1.1	1.2	1.1	V
Euphorbia cyparissias	1.2	+	+	+	+	1.1	2.1	1.1	1.1	1.1	+	2.2	V
Achillea pannonica	+	+	+	+	+	+	+	+	+	+	+	+	V
Potentilla arenaria	1.1	.	+	+	1.2	+	+	+	1.2	+	+	.	V
Centaurea rhenana	+	.	.	.	.	1.1	+	1.2	+	1.1	+	+	IV
Carex caryophyllea	.	+	+	+	+	.	+	.	.	.	+	.	III
Scabiosa ochroleuca	.	.	.	.	1.1	+	+	.	.	.	.	.	II
Sanguisorba minor	+	.	.	.	+	+	.	.	.	.	.	.	II
Anthemis tinctoria	+	.	.	.	2.2	.	.	.	.	.	.	.	I
Teucrium chamaedrys	.	.	.	.	+	.	.	.	.	+	.	.	I
Other accompanying:													
Plantago lanceolata	.	+	+	.	1.1	.	+	+	+	+	.	+	IV
Medicago lupulina	.	+	1.2	.	.	.	+	.	+	.	+	+	III
Arenaria serpyllifolia	.	+	+	.	.	.	+	.	.	+	+	+	III
Medicago falcata	+	.	.	.	.	.	.	.	+	.	+	+	II
Berteroa incana	.	.	.	.	.	.	.	+	+	+	.	+	II
Juniperus communis b	.	.	.	.	2.1	+	+	.	.	.	.	.	II
Agrostis capillaris	.	.	.	+	.	.	.	+	.	+	.	.	II
Elymus repens	.	.	.	.	.	.	.	.	+	+	.	+	II
Chenopodium album	.	+	+	.	.	.	.	.	.	.	.	.	I
Lolium perenne	.	+	+	.	.	.	.	.	.	.	.	.	I
Daucus carota	.	.	+	.	.	+	.	.	.	.	.	.	I
Bryum argenteum	.	2.2	2.2	.	.	.	1.2	.	.	.	.	2.2	II
Abietinella abietina	.	.	.	.	1.2	.	+	+	.	.	.	.	II
Hypnum cupressiforae	.	.	.	.	.	.	+	+	.	.	.	.	I

PRESENCE

Sporadic species:
Ch. *Sedo-Scleranthetea*: *Polytrichum piliferum* 8/1.2.
Ch. *Festuco-Brometea*: *Salvia pratensis* 1, *Centaurea scabiosa* 5, *Anthyllis vulneraria subsp. polyphylla* b, *Dianthus carthusianorum* b, *Salvia verticillata* 7, *Veronica spicata* 8, *Plantago media* 10.
Other accompanying: *Origanum vulgare* 1/1.2, *Trifolium arvense* 2/1.2, *Conyza canadensis* 2, *Taraxacum officinale s. l.* 2, *Trifolium repens* 3, *Chaenorhinum minus* 6, *Echium vulgare* 6, *Lembotropis nigricans* 6, *Pinus sylvestris* b 6, *Trifolium campestre* 8, *Silene vulgaris* 12.

Koelerio-Festucetum sulcatae Kornaś 1952
Table 3

Localities of phytosociological records:

1 (431). Podgórz, upper part of a slope, loess cap. Area of phytocoenosis: 35 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Plantaginetea majoris* comm., cereal and root plants. 1984-08-18.

2 (430). See record no 1. Area of phytocoenosis: 35 m².

3 (578). Dobre, lower part of a loess cap. Area of phytocoenosis: 25 m². Contact phytocoenoses: *Sisymbrio-Stipetum capillatae, Thalictro-Salvietum pratensis.* 1985-06-19.

4 (429). Podgórz, upper part of a slope, loess cap. Area of phytocoenosis: 20 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Plantaginetea majoris* comm. 1984-08-18.

5 (434). Podgórz, upper part of a slope, loess cap. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Origano-Brachypodietum* partially developed, cereal and root plants. 1984-08-18, 1994-06-15.

6 (571). Podgórz, upper part of a slope, loess cap. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Origano-Brachypodietum,* shrubs of the *Rhamno-Prunetea* class, *Plantaginetea majoris* comm. 1985-06-19, 1994-06-15.

7 (411). Podgórz, upper part of a slope, loess cap. Area of phytocoenosis: 25 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Plantaginetea majoris* comm. 1984-08-04.

8 (433). See record no 5.

9 (562). Dobre, near the road to Kazimierz, lower part of the scarp of a ravine. Area of phytocoenosis: 20 m². Among *Origano-Brachypodietum.* 1985-06-13, 1995-07-15.

10 (568). Kazimierz Dolny, Góra III Krzyży, loess scarp. Area of phytocoenosis: 15 m². Contact phytocoenoses: *Sisymbrio-Stipetum capillatae, Thalictro-Salvietum pratensis.* 1985-06-19.

Koelerio-Festucetum sulcatae has the form of a loose grassland, where grasses predominate – species characteristic of the association: *Festuca rupicola* (V^{1726}) and *Koeleria macrantha* (V^{1925}); occasionally *Phleum phleoides* (I^{550}) occurs here, too. Other species of the *Festuco-Brometea* class, like *Artemisia campestris* (V^{554}), *Euphorbia cyparissias* (V^{504}), *Achillea pannonica* (V^{378}) and *Centaurea rhenana* (V^{232}) occur here permanently, however, they do not attain a high degree of cover. It should be noted that among the accompanying species there are few representatives of the *Trifolio-Geranietea* class (7 species), very few shrubs, and some plants of the *Sedo-Scleranthetea* class (7 species). These are usually *Silene otites* (V^{183}), *Helichrysum arenarium* (IV^{182}), *Hieracium pilosella* (IV^{105}) and *Festuca trachyphylla* (III^{229}). The presence of the species makes *Koelerio-Festucetum sulcatae* closer to communities of the *Festuco-Sedetalia* order, in particular to *Sileno otitis-Festucetum* and *Festuco-Koelerietum glaucae.*

Achillea pannonica, Agropyron intermedium, Campanula sibirica and *Festuca trachyphylla* occur only in records 1-8, which makes them closer to the *K.-F. s. odontitetosum luteae* sub-association distinguished by Głazek from the Sandomierz Upland (Głazek 1968). However, *Odontites lutea, Digitaria ischaemum* and *Pulsatilla pratensis* are absent here. Records 9 and 10 should be classified as a typical sub-association.

Table 3. Composition and structure of phytocoenoses *Koelerio-Festucetum sulcatae* Kornaś 1952

Succesive number of record	1	2	3	4	5	6	7	8	9	10	
Number of record	431	430	578	429	434	571	411	433	562	568	
Exposure	SSW	SW	SW	S	S	SW	SW	SW	SW	SW	
Slope inclination [°]	40	40	25	40	35	25	35	35	40	35	PRESENCE
Cover of shrub layer b [%]	-	5	5	-	-	5	<5	<5	<5	<5	
Cover of herb layer c [%]	50	70	60	40	60	70	60	60	70	80	
Cover of moss layer d [%]	30	40	30	50	10	30	10	20	30	<5	
Area of sample plot [m²]	35	25	20	20	30	20	25	25	20	15	
Number of species	25	30	31	28	30	30	25	29	26	24	
Ch. °D. *Koelerio-Festucetum*											
Festuca rupicola	1.2	+	2.2	2.2	2.2	1.2	2.2	2.2	3.2	3.3	V
°*Koeleria macrantha*	3.2	3.3	2.2	1.2	2.2	2.2	2.2	3.2	1.1	.	V
°*Phleum phleoides*	.	.	.	.	.	.	.	.	2.1	3.2	I
Ch. °*Festuco-Stipion*, *Cl Festucetalia valesiacae*											
Achillea pannonica	+	+	+	1.1	1.1	1.1	2.2	1.1	.	.	IV
Aropyron intermedium subsp. *intermedium*	+	+	1.2	+	+	+	+	+	.	.	IV
Potentilla arenaria	1.1	1.1	+	+	1.1	+	.	.	.	.	III
Campanula sibirica	.	.	+	+	+	+	.	+	.	.	III
Scabiosa ochroleuca	+	+	.	+	+	.	.	.	.	.	II
°*Alyssum montanum*	+	+	+	.	.	.	.	.	+	.	II
Anthemis tinctoria	.	+	+	.	.	.	.	+	.	.	II
°*Stipa capillata*	.	.	+	.	.	.	.	.	.	1.2	I
Bromus inermis	.	+	.	.	.	.	.	.	+	.	I
Ch. *Festuco-Brometea*											
Artemisia campestris	1.2	2.2	+	1.2	1.2	1.1	+	2.2	+	+	V
Euphorbia cyparissias	+	1.2	2.2	+	+	1.1	1.1	+	2.1	.	V
Centaurea rhenana	+	+	+	+	2.2	1.1	+	+	+	.	V
Salvia pratensis	+	+	+	.	+	.	+	+	.	1.1	IV
Acinos arvensis	+	.	+	+	+	+	.	+	.	.	III
Dianthus carthusianorum	+	.	.	.	.	+	+	+	.	+	III
Teucrium chamaedrys	.	.	.	.	+	+	.	.	1.2	+	II
Galium album	.	.	.	.	+	.	1.2	+	.	.	II
Carex humilis	+	.	+	.	.	.	.	.	+	.	II
Plantago media	.	+	.	+	.	+	.	.	.	.	II
Anthyllis vulneraria subsp. *polyphylla*	+	.	.	+	.	.	.	.	.	.	I
Ch. *Trifolio-Geranietea*											
Medicago falcata	+	1.1	2.2	+	1.1	1.2	+	+	+	+	V
Galium verum	1.2	+	+	+	.	1.1	.	+	.	2.2	IV
Origanum vulgare	.	+	+	+	+	.	+	+	.	.	III
Verbascum lychnitis	.	.	.	.	+	+	.	.	.	+	II
Ch. *Sedo-Scleranthetea*											
Silene otites	2.2	+	+	.	+	+	+	+	+	+	V
Helichrysum arenarium	+	.	.	+	2.1	+	+	+	+	+	IV
Hieracium pilosella	.	.	.	+	+	1.2	+	+	1.2	+	IV
Festuca trachyphylla	+	1.2	+	+	+	2.2	.	.	.	.	III
Arenaria serpyllifolia	+	+	+	.	+	.	+	.	.	.	II
Other accompanying:											
Erophila verna	.	+	+	+	.	+	.	+	+	+	IV
Melilotus officinalis	+	+	.	+	.	.	+	+	.	.	III
Berberis vulgaris	.	.	+	.	.	1.1	+	+	.	.	II
Pimpinella saxifraga	.	.	.	1.1	+	.	+	.	.	.	II
Rosa canina b	.	.	+	.	.	1.1	+	.	.	.	II
Poa angustifolia	.	.	.	.	.	+	.	.	+	1.2	II
Pastinaca sativa	.	+	.	+	.	.	.	.	.	.	I
Hypericum perforatum	.	+	.	.	.	.	.	+	.	.	I
Thymus pulegioides	.	+	.	.	.	.	.	.	.	+	I
Hieracium umbellatum	.	.	.	+	.	.	.	+	.	.	I
Eryngium planum	.	.	.	.	+	.	+	.	.	.	I
Plantago lanceolata	.	.	.	.	+	+	.	.	.	.	I
Chamaecytisus ratisbonensis	.	.	.	.	.	+	.	.	.	+	I

Tab. 3 – continued

Camptothecium lutescens	2.2	2.2	2.2	.	.	.	.	2.2	2.2	.		III
Abietinella abietina	2.2	2.2	1.2	.	.	.	.	.	1.2	.		II
Pottia intermedia	.	.	.	3.2	2.2	1.2	.	+	.	.		II
Streblotrichum convolutum	.	.	+	.	.	2.2	.	.	+	+		II
Phascum floerkeanum	.	.	.	2.2	+	.	.	.	.	.		I
Bryum caespiticium	.	.	.	.	.	.	1.2	.	.	+		I

Sporadic species:
Ch. *Festuco-Brometea*: *Brachypodium pinnatum* 5, *Pterygoneurum ovatum* 7, *Hiellanthemum nummularium subsp. obscurum* 9/1.1, *Carex caryophyllea* 9, *Sanguisorba minor* 9, *Filipendula vulgaris* 10.
Ch. *Trifolio-Geranietea*: *Peucedanum cervaria* 7, *Coronilla varia* 9, *Anthericum ramosum* 10.
Ch. *Sedo-Scleranthetea*: *Rumex acetosella* 9, *Sedum sexangulare* 9.
Other accompanying: *Nigella arvensis* 1, *Berteroa incana* 2, *Erigeron annuus* 2, *Prunus fruticosa* b 2, *Bromus sterilis* 3, *Cichorium intybus* 3, *Festuca macrantha* 3, *Lappula squarrosa* 3/r, *Rhamnus catharticus* b 3, *Daucus carota* 4/1.1, *Barbula bornschuchiana* 4/1.2, *Echium vulgare* 5, *Euphrasia stricta* 5, *Bryum capillare* b, *Lithospermum officinale* 6, *Adonis vernalis* 7, *Juniperus communis* b 8, *Catapyrenium lachneum* 8, *Collema tenax* 8, *Equisetum arvense* 9, *Arabis glabra* 10, *Orobanche lutea* 10, *Prunus spinosa* b 10.

In the Kazimierz Landscape Park *Koelerio-Festucetum sulcatae* phytocoenoses occur in Dobre, Podgórz and Kazimierz Dolny on loess slopes of southern and south-western exposure and inclination of up to 40°. They have the form of small patches (up to 50 m²), long in shape. On one side they border with communities of the *Plantaginetea majoris* class (mainly *Lolio-Plantaginetum*) and communities of cereal and root plants, and on the other with xerothermic grasslands (*Sisymbrio-Stipetum*, *Thalictro-Salvietum* and *Origano-Brachypodietum*) or shrubs of the *Rhamno-Prunetea* class.

Sisymbrio-Stipetum capillatae (Dziub. 1925) Medw.-Korn. 1959
Table 4

Localities of phytosociological records:

1 (412). Dobre, loess cap. Area of phytocoenosis: 40 m². Contact phytocoenoses: *Thalictro-Salvietum pratensis*, *Origano-Brachypodietum* partially developed. 1984-08-04.

2 (428). Dobre, loess cap. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Thalictro-Salvietum pratensis*, *Origano-Brachypodietum* partially developed. 1984-08-13.

3 (445). Dobre, loess cap. Area of phytocoenosis: 60 m². Contact phytocoenoses: *Thalictro-Salvietum pratensis*. 1984-08-18, 1986-06-31.

4 (566). Kazimierz Dolny, Góra III Krzyży, upper part of a slope. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Koelerio-Festucetum sulcatae*, *Thalictro-Salvietum pratensis*, shrubs of the *Rhamno-Prunetea* class. 1985-06-19, 1995-07-20.

5 (444). See record no 3.

6 (441). Dobre, loess cap. Area of phytocoenosis: 100 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Origano-Brachypodietum* partially developed, *Koelerio-Festucetum sulcatae* partially developed. 1984-08-18, 1986-06-10.

7 (442). See record no 6.

8 (443). Dobre, lower part of a loess cap. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Origano-Brachypodietum* partially developed. 1984-08-18, 1994-06-15.

9 (572). Dobre, loess cap. Area of phytocoenosis: 50 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Koelerio-Festucetum sulcatae* partially developed. 1985-06-19, 1994-06-15.

10 (1079). Dobre, loess cap. Area of phytocoenosis: 40 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Koelerio-Festucetum sulcatae* partially developed. 1986-07-31, 1994-06-15.

Table 4. Composition and structure of phytocoenoses *Sisymbrio-Stipetum capillatae* (Dziub. 1925) Medw.-Korn. 1959

Succesive number of record	1	2	3	4	5	6	7	8	9	10	
Number of record	412	428	445	566	444	441	442	443	572	1079	
Exposure	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
Slope inclination [°]	40	35	30	25	35	35	35	30	30	30	
Cover of shrub layer b [%]	<5	<5	<5	<5	<5	-	-	5	<5	<5	
Cover of herb layer c [%]	90	90	90	100	90	90	80	90	100	90	
Cover of moss layer d [%]	<5	10	10	5	<5	<5	<5	<5	<5	<5	
Area of sample plot [m²]	30	25	30	20	30	25	25	25	25	25	
Number of species	21	23	24	33	24	27	28	33	39	27	
Ch. *Sisymbrio-Stipetum*											
Carex supina	+	+	1.2	+	1.2	+	+	+	+	+	V
Festuca valesiaca	.	.	.	.	.	.	+	+	.	.	I
Ch. °*Festuco-Stipion*											
Festucelia valesiacae											
°*Stipa capillata*	4.3	4.3	4.3	4.3	4.4	5.5	5.4	4.4	5.5	5.4	V
Campanula sibirica	+	+	+	+	.	.	+	+	+	+	IV
Achillea pannonica	.	.	.	2.1	2.2	2.2	1.1	2.2	2.1	1.1	IV
Potentilla cinerea	+	1.2	1.2	+	.	+	.	+	.	+	IV
°*Alyssum montanum*	.	.	+	.	+	+	+	.	+	.	III
Agropyron intermedium											
subsp. intermedium	1.2	2.2	2.1	2.2	.	.	.	.	.	.	II
°*Scabiosa ochroleuca*	.	.	.	+	.	.	.	.	+	+	II
Ch. *Festuco-Brometea*											
Centaurea rhenana	1.1	1.1	2.1	1.1	1.2	+	+	+	+	+	V
Euphorbia cyparissias	+	+	+	1.1	1.1	+	+	1.1	+	+	V
Veronica spicata	+	+	+	+	+	1.1	+	+	+	+	V
Galium album	1.2	+	+	2.1	2.1	+	+	+	.	1.1	V
Salvia pratensis	1.1	+	+	+	+	.	+	1.2	+	+	V
Artemisia campestris	+	+	+	+	+	+	+	+	.	.	IV
Phleum phleoides	.	.	.	1.2	+	+	1.1	.	+	1.2	III
Koeleria macrantha	.	+	+	r	.	.	+	.	+	r	III
Stachys recta	.	.	+	+	+	+	.	.	+	+	III
Dianthus carthusianorum	.	.	.	.	.	+	+	+	+	+	III
Brachypodium pinnatum	.	.	.	+	.	.	+	+	.	+	II
Acinos arvensis	.	.	.	.	.	.	+	+	+	+	II
Carex humilis	2.2	.	.	.	.	.	+	.	1.2	.	II
Linosyris vulgaris	+	+	.	.	+	.	.	.	.	.	II
Teucrium chamaedrys	.	.	.	.	.	.	.	+	+	+	II
Allium oleraceum	.	.	+	+	.	.	.	.	.	.	I
Pterygoneurum ovatum	.	2.2	1.2	1.2	+	+	.	+	.	.	III
Ch. *Trifolio-Geranietea*											
Medicago falcata	1.1	2.2	1.2	2.1	2.1	2.1	1.1	2.1	2.1	1.1	V
Origanum vulgare	+	.	.	+	+	+	+	1.1	.	.	III
Verbascum lychnitis	.	.	.	+	.	+	+	.	+	+	III
Agrimonia eupatoria	.	.	.	+	.	+	.	.	.	+	II
Thalictrum minus	.	+	.	r	+	.	.	.	.	.	II
Galium verum	.	.	.	.	.	.	+	.	1.1	.	I
Clinopodium vulgare	.	.	.	+	.	.	.	.	.	+	I
Other accompanying:											
Poa angustifolia	.	.	+	2.2	+	+	+	.	+	1.2	IV
Berberis vulgaris b	+	+	+	.	+	.	.	+	+	+	Iv
Silene otites	.	1.1	+	.	.	+	+	+	+	.	III
Hypericum perforatum	+	+	+	.	.	+	+	+	.	.	III
Pimpinella saxifraga	+	.	.	.	+	+	+	+	.	.	III
Festuca trachyphylla	.	1.2	.	+	+	.	.	2.2	.	.	II
Senecio jacobaea	.	+	+	.	+	.	.	.	+	.	II
Helichrysum arenarium	.	.	.	.	.	+	+	+	+	.	II
Thymus serpyllus	+	.	.	+	.	.	.	+	.	.	II
Pinus sylvestris b	.	.	+	.	+	.	.	.	.	+	II
Crepis rhoaedifolia	.	.	.	.	.	+	.	.	+	+	II
Lappula squarrosa	.	.	.	.	+	.	.	.	+	.	I
Hieracium pilosella	.	.	.	.	.	+	.	.	+	.	I
Medicago lupulina	.	.	.	.	.	+	.	.	+	.	I
Rosa canina b	.	.	.	.	.	.	.	+	+	.	I
Encalyptra vulgaris	+	.	.	+	.	+	.	.	+	+	III

Sporadic species:
Ch. *Festucelia valesiacae*: *Asparagus officinalis* 9, *Hieracium piloselloides* 9.
Ch. *Festuco-Brometea*: *Centaurea scabiosa* 2, *Carex caryophyllea* 4, *Festuca rupicola* 9.
Ch. *Trifolio-Geranietea*: *Peucedanum cervaria* 1, *Coronilla varia* 4.
Other accompanying: *Alyssum alyssoides* 2, *Bryum caespiticium* 3/1.2, *Festuca macutrensis* 4, *Ulmus minor* b 4, *Camptothecium lutescens* 7, *Bryum argentea* 8, *Cornus sanguinea* b 8/1.1, *Daucus carota* 8, *Euphrasia stricta* 8, *Leontodon autumnalis* 8, *Ligustrum vulgare* b 8, *Echium vulgare* 9, *Poa compressa* 9, *Populus alba* b 9, *Rumex acetosella* 9, *Viola arvensis* 9.

Sisymbrio-Stipetum capillatae phytocoenoses have the character of a dense grassland, where the upper layer consists mainly of *Stipa capillata* (V^{7250}) and *Medicago falcata* (V^{1250}), *Achillea pannonica* (V^{975}), *Galium album* (V^{455}), *Centaurea rhenana* (V^{380}), *Salvia pratensis* (V^{107}) and *Veronica spicata* (V^{59}). The lower layer of herbaceous plants is made up of *Euphorbia cyparissias* (V^{157}), *Carex supina* (V^{108}) and *Potentilla cinerea* (V^{105}) as well as *Festuca trachyphylla* (II^{227}), *Carex humilis* (II^{226}) and others. The proportion of shrubs and bryophytes is rather low and does not exceed 5% and 10% respectively. From the species characteristic of the association only two are present here, namely *Carex supina* (V^{108}) and *Festuca valesiaca* (I^{2}). The *Festuco-Brometea* class is represented by 31 species; apart from *Stipa capillata* also *Galium album* (V^{455}), *Centaurea rhenana* (V^{380}), *Euphorbia cyparissias* (V^{157}), *Salvia pratensis* (V^{107}), *Veronica spicata* (V^{59}), *Achillea pannonica* (IV^{975}), *Potentilla cinerea* (IV^{105}), *Artemisia campestris* (IV^{8}) and *Campanula sibirica* (IV^{8}) are often found here. Among the accompanying species the most frequent and abundant is *Medicago falcata* (V^{1250}), less frequent and numerous are *Poa angustifolia* (IV^{230}) and *Berberis vulgaris* (IV^{7}).

Sisymbrio-Stipetum capillatae phytocoenoses in the Kazimierz Landscape Park have various facies: records 1-4 (Table 4) present a facies with *Agropyron intermedium*, while records 4-10 one with *Achillea pannonica*, in record no 4 the above mentioned species occur equally numerously. In the Kazimierz Landscape Park *Sisymbrio-Stipetum capillatae* can be found only in Kazimierz Dolny and Dobre. It prefers extremely dry and warm habitats on slopes and loess caps of south-western exposure, well dried by furrows. The shape of the phytocoenoses depends on the shape of the cap, usually they are long and narrow, coming in contact with other phytocoenoses (*Thalictro-Salvietum pratensis* (records 1-4) and other xerothermic grasslands as well as partly developed shrubs of the *Rhamno-Prunetea* class) at the very ends only.

Inuletum ensifoliae Kozł. 1925
Table 5

Localities of phytosociological records:

1 (1030). Męćmierz, south of the village, upper part of a slope. Area of phytocoenosis: 40 m^2. Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1986-07-31.

2 (672). Męćmierz, slope south of the village. Area of phytocoenosis: 120 m^2. Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1985-08-12.

3 (420). Dobre, lower part of a slope. Area of phytocoenosis: 250 m^2. Contact phytocoenoses: *Ligustro-Prunetum*, pine plantings, *Origano-Brachypodietum* partially developed. 1984-08-13.

4 (402). Dobre, lower part of a slope. Area of phytocoenosis: 150 m^2. Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1984-08-04.

Table 5. Composition and structure of phytocoenoses *Inuletum ensifoliae* K o z ł. 1925

Succesive number of record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Number of record	1030	672	420	402	755	414	642	643	629	574	669	582	456	1023	458	457	1021	646	872	756	
Exposure	W	W	S	SSW	SSW	SW	SSW	SSW	SSW	S	SSW	-	SW	-	S	SW	-	SW	W	S	
Slope inclination [°]	30	10	20	25	25	30	15	10	5	20	5	-	30	-	30	30	-	15	25	15	
Cover of shrub layer b [%]	30	20	20	20	30	<5	10	<5	20	10	20	30	20	20	10	20	30	20	20	10	
Cover of herb layer c [%]	80	80	80	70	90	60	90	90	90	80	60	70	60	80	50	60	80	90	80	100	
Cover of moss layer d [%]	30	60	20	20	20	20	10	30	30	30	20	50	<5	30	<5	<5	20	20	30	<5	
Area of sample plot [m²]	40	50	50	50	20	50	50	50	50	50	50	50	50	50	50	50	50	50	50	30	
Number of species	39	41	31	33	31	31	33	35	47	31	35	44	38	37	37	34	35	44	36	35	
Ch. *Inuletum ensifoliae*																					
Inula ensifolia	5.5	4.4	4.4	4.4	4.4	4.4	5.5	5.5	5.5	4.4	4.4	4.3	4.3	4.4	3.3	3.3	4.4	4.4	4.4	3.3	V
Aster amellus	1.1	1.1	+	+	+	+	1.1	1.1	+	1.1	1.1	+	+	2.2	+	1.1	1.1	+	1.1	1.1	V
Ch. **Cirsio-Brachypodion, Festucetalia valesiacae*																					
Salvia verticillata	+	+	+	+	+	+	+	+	+	1.1	+	+	1.1	1.1	1.2	1.1	1.1	+	.	.	V
Achillea pannonica	+	+	+	+	+	+	+	+	+	+	+	.	+	.	+	+	+	+	.	1.1	V
Campanula sibirica	+	+	.	.	.	.	+	+	.	+	+	+	+	+	+	+	+	+	+	+	IV
Scabiosa ochroleuca	1.1	.	.	.	.	+	+	.	+	.	.	+	+	+	+	+	+	+	.	.	III
Hieracium praealtum	+	.	.	.	.	.	.	.	+	+	+	+	+	+	+	+	+	.	.	.	III
Petentilla arenaria	.	.	+	.	.	+	+	+	+	+	+	r	.	.	.	.	.	+	.	.	III
Anthemis tinctoria	.	.	.	+	.	.	.	.	.	+	.	1.1	+	.	+	.	.	.	+	.	II
**Carex michelli*	.	.	.	.	+	.	.	.	+	.	+	.	.	.	.	.	.	.	.	2.2	I
**Campanula bononiensis*	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Adonis vernalis	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	I
Ch. Festuco-Brometea																					
Teucrium chaemedrys	1.1	1.1	1.2	1.1	+	+	+	+	1.2	+	+	+	1.2	1.2	1.2	2.2	1.2	+	1.2	1.2	V
Anthyllis vulneraria subsp. polyphylla	2.1	+	+	+	+	+	+	+	+	+	+	+	+	1.1	+	+	1.1	+	1.1	.	V
Euphorbia cyparissias	+	+	+	1.1	1.1	1.1	+	+	+	+	+	+	+	+	+	+	+	+	.	.	V
Sanguisorba minor	+	.	+	+	+	+	.	+	+	+	+	+	+	+	+	+	+	+	+	+	V
Galium album	.	.	+	+	+	+	.	+	+	1.1	+	1.1	1.1	1.2	1.2	1.2	1.2	+	1.1	+	V
Brachypodium pinnatum	.	.	.	.	+	+	+	+	+	+	+	+	+	+	+	+	2.2	2.2	1.2	2.2	IV
Salvia pratensis	+	+	+	+	1.1	+	+	1.1	1.1	.	.	.	.	.	.	.	.	+	1.1	1.1	III
Carex humilis	2.2	2.2	2.2	2.2	3.2	2.2	2.2	1.2	+	+	.	.	.	.	.	.	.	.	.	.	III
Stachys recta	.	+	.	.	.	.	.	.	.	.	.	+	+	1.1	+	+	.	+	+	+	III
Carlina vulgaris	.	.	.	.	+	.	.	+	+	+	+	r	.	1.1	.	.	+	+	.	.	III
Centaurea rhenana	.	.	+	.	.	+	.	.	1.1	.	.	.	+	.	.	.	.	.	1.1	+	II
Plantago media	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	+	.	+	+	II
Polygala comosa	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	I
Ch. Trifolio-Geranietea																					
Medicago falcata	+	1.1	+	1.1	1.1	+	1.1	1.1	+	+	+	+	+	1.2	+	+	1.1	1.1	1.1	1.1	V
Origanum vulgare	1.1	+	+	+	+	+	1.1	+	1.1	+	+	1.1	+	+	+	+	2.1	1.1	1.1	1.1	V
Anthericum ramosum	+	+	+	2.2	+	+	1.1	+	+	1.1	+	.	+	1.1	+	+	+	1.1	1.1	.	V
Coronilla varia	.	+	+	+	+	+	+	.	+	+	+	+	+	+	+	+	.	.	.	.	IV
Melampyrum cristatum	+	2.1	.	.	.	.	.	.	.	.	1.1	+	.	+	.	.	.	.	1.2	.	II
Galium verum	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	+	.	.	+	1.1	II
Agrimonia eupatoria	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	+	.	+	II
Anemone sylvestris	.	.	.	.	+	.	.	.	+	.	.	.	.	+	.	.	.	.	+	2.1	II
Ch. Rhamno-Prunetea																					
Berberis vulgaris b/c	1.1	+	.	+	+	+	1.1	.	1.1	+	r	.	+	.	+	.	.	1.1	1.1	2.1	IV
Cornus sanguinea b/c	.	.	+	+	2.1	+	+	.	+	.	.	+	2.1	.	+	2.2	.	+	+	.	III
Ligustrum vulgare b/c	.	.	+	.	1.1	.	+	+	+	.	.	.	+	.	.	+	+	+	1.1	.	III
Rosa canina b	+	.	2.1	1.1	.	.	.	.	.	.	.	.	.	.	+	1.1	1.1	.	+	+	II
Rosa tomentosa b/c	.	1.1	.	.	.	.	1.1	+	+	.	+	+	.	.	.	.	.	1.1	.	.	II
Prunus spinosa b/c	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	1.1	.	+	I
Rosa rubiginosa b/c	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	I
Rhamnus catharticus b	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	1.1	.	.	.	I
Other accompanying:																					
Juniperus communis b	3.2	2.1	+	+	1.1	.	1.1	+	+	+	2.1	2.1	.	2.1	+	+	1.2	1.1	2.1	+	V
Pimpinella saxifraga	2.1	1.1	+	+	.	1.1	1.1	1.1	+	+	1.1	+	+	2.1	1.1	+	+	1.1	.	.	V
Linum catharticum	+	+	+	.	.	+	+	+	+	.	+	+	+	.	+	+	.	+	+	.	IV
Pinus sylvestris	1.1	.	+	+	.	.	+	.	+	+	.	2.1	+	1.1	+	+	2.2	+	.	.	III
Leontodon hispidus	.	.	.	.	.	.	+	.	+	+	.	1.1	+	1.1	+	+	2.1	.	.	1.1	III
Echium vulgare	.	.	+	r	.	+	+	.	.	+	+	r	.	.	+	+	.	.	.	.	III

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Thymus pulegioides	+	+					+	+	+			+		1.2					+	+		III
Dactylis glomerata		+							+			+		+			1.2		+			II
Genista tinctoria		1.1					+		+			1.1					1.1	2.1	+			II
Stachys officinalis		+										+	+	1.2			+		+			II
Knautia arvensis	+	+								+		+					+	+				II
Daucus carota	+			+				+	+				+		+							II
Cichorium intybus				+		+			+				+		+		+					II
Poa angustifolia		+						+			+		+							2.2		II
Campanula trachelium	1.1		+	+												+		+				II
Ononis spinosa	+	+							1.2		+											II
Lembotropis nigricans			+		+				+									+				I
Carex tomentosa	1.1												1.2							1.1		I
Medicago lupulina	+							+							+							I
Vincentoxicum hirundinaria	+													+				+				I
Cuscuta epithymus			+										+			+						I
Chamaecytisus ruthenicus				+								+								+		I
Campylium chrysophyllum	1.2	2.2	2.2	2.2	1.2					1.2				2.2	+	+	2.2	2.2	2.2	+		IV
Abietinella abietina	1.2	1.2		+	2.2	2.2	2.2	1.2		2.2		1.2		2.2	+		+					III
Camptothecium lutescens	2.2	3.2		+		1.2	1.2	2.2				3.2		+		+			2.2	+		III
Tortella tortuosa	+	+						+						+			+	1.2				II
Bryum caespiticium					+							+	+			+						I
Amblystegium serpens								+			2.2	1.2										I

Sporadic species:
Ch. *Festucetalia valesiacae*: *Thesium linophyllon* 2/1.1.
Ch. *Festuco-Brometea*: *Centaurea scabiosa* 1/1.1, *Campanula glomerata* 1, 2, *Carex caryophyllea* 8/1.1, 19, *Gentiana cruciata* 11, 12, *Poa compressa* 11, 18, *Ranunculus bulbosus* 11, 20/1.1, *Artemisia campestris* 7, *Linosyris vulgaris* 11, *Phleum phleoides* 18.
Ch. *Trifolio-Geranietea*: *Verbascum lychnitis* 5, 12/1.1, *Clematis recta* 14, 18, *Fragaria viridis* 15, 20/1.1, *Astragalus glycyphyllos* 2, *Veronica teucrium* 12, *Campanula rapunculoides* 13, *Clinopodium vulgare* 14, *Peucedanum cervaria* 19/1.1.
Ch *Rhamno-Prunetea*: *Ulmus minor* b 1, 4, *Viburnum opulus* b 1.
Other accompanying: *Fraxinus excelsior* b 2, 18, *Quercus robur* b 4, 10/1.1, *Hieracium pilosella* 6, 7, *Euphrasia stricta* 7, 8, *Lotus corniculatus* 9, 11, *Hypericum perforatum* 13, 15, *Thymus serpyllum* 17, 18, *Carex flacca* 10, *Cerinthe minor* 11, *Eryngium planum* 14, *Melilotus officinalis* 15, *Lonicera xylosteum* b 20, *Carex montana* 20, *Orobanche lutea* 20.

5 (755). Bochotnica, slope near the quarry. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Ligustro-Prunetum* and other shrubs of the *Rhamno-Prunetea* class. 1986-05-28, 1994-07-02.

6 (414). See record no 3.

7 (642). Męćmierz, slope near the village. Area of phytocoenosis: 350 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea, Koelerio-Festucetum sulcatae* partially developed. 1985-08-05.

8 (643). Męćmierz, slope near the village. Area of phytocoenosis: 350 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea, Origano-Brachypodietum* partially developed, *Plantaginetea* comm. 1985-08-05.

9 (629). Bochotnica, slope near the village. Area of phytocoenosis: 250 m². Contact phytocoenoses: *Ligustro-Prunetum*, pine plantings, *Origano-Brachypodietum* partially developed. 1985-07-31, 1994-07-02.

10 (574). Dobre, near the road leading to the fields, lower part of a slope. Area of phytocoenosis: 120 m². Contact phytocoenoses: *Origano-Brachypodietum*, plantings of *Quercus robur*. 1985-07-12.

11 (669). Męćmierz, slope south of the village. Area of phytocoenosis: 80 m². Contact phytocoenoses: bushes of of the *Rhamno-Prunetea* class, pine plantings, *Origano-Brachypodietum* partially developed. 1985-07-12.

12 (582). Męćmierz, south of the village, edge of a plateau. Area of phytocoenosis: 150 m². Contact phytocoenoses: pine plantings, shrubs of the *Rhamno-Prunetea* class partially developed, *Origano-Brachypodietum*. 1985-07-12.

13 (456). Dobre, strongly eroded slope. Area of phytocoenosis: 80 m². Contact phytocoenoses: shrubs of the *Cornus sanguinea, Origano-Brachypodietum* partially developed. 1984-08-27.

14 (1023). Męćmierz, south of the village, edge of a plateau. Area of phytocoenosis: 70 m². Contact phytocoenoses: pine plantings, shrubs of the *Rhamno-Prunetea* class. 1986-07-31.

15 (456). Dobre, middle part of a slope. Area of phytocoenosis: 200 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1984-08-27.

16 (457). Dobre, lower part of a slope. Area of phytocoenosis: 180 m². Contact phytocoenoses: pine plantings, shrubs of the *Rhamno-Prunetea* class. 1984-08-27.

17 (1021). Męćmierz, south of the village, edge of a plateau. Area of phytocoenosis: 60 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, pine plantings. 1986-07-31.

18 (646). Męćmierz, upper part of a slope near the village. Area of phytocoenosis: 300 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Potentillo albae-Quercetum* partially developed. 1985-08-05.

19 (872). Męćmierz, slope near the village. Area of phytocoenosis: 50 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1986-07-12.

20 (756). Bochotnica, upper part of a slope near the quarry. Area of phytocoenosis: 30 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1986-05-19, 1994-07-02.

Inuletum ensifoliae phytocoenoses have the character of a loose grassland with a mosaic-like shrub layer as a permanent element (up to 30%). The following species of the *Rhamno-Prunetea* class usually occur here: *Berberis vulgaris* (IV^{217}), *Cornus sanguinea* (III^{267}) and *Ligustrum vulgare* (III^{54}) as well as *Juniperus communis* (V^{704}) and man-planted *Pinus sylvestris* (III^{230}). In the layer of herbaceous plants the dominant species is *Inula ensifolia* (V^{5750}), and the following appear permanently, though less abundantly: *Aster amellus* (V^{342}), *Teucrium chamaedrys* (V^{367}), *Medicago falcata* (V^{255}), *Origanum vulgare* (V^{269}), *Anthericum ramosum* (V^{269}), *Anthyllis vulneraria* subsp. *polyphylla* (V^{170}) and *Euphorbia cyparissias* (V^{83}). Due to the strong erosion of soil, the layer of bryophytes and lichens is developed almost exclusively in the neighbourhood of shrubs. The syntaxonomic composition is the following: from the species characteristic of the association only *Inula ensifolia* and *Aster amellus* (V^{342}) occur here. The *Festuco-Brometea* class is represented by 33 species, 11 of which are characteristic of *Festucetalia valesiacae*. The highest degree of permanence with a low degree of cover (+ — 2) at the same time is attained by *Teucrium chamaedrys* (V^{367}), *Galium album* (V^{205}), *Anthyllis vulneraria* subsp. *polyphylla* (V^{170}), *Salvia verticillata* (V^{156}), *Euphorbia cyparissias* (V^{83}) and *Sanguisorba minor* (V^{9}). Among the accompanying species two groups are worth noting: 18 species of the *Trifolio-Geranietea* class and 10 of *Rhamno-Prunetea*. They constitute a part of the mosaic-like shrub layer and are often found in the herbaceous plants layer of the phytocoenoses.

Among the *Inuletum ensifoliae* phytocoenoses reported from the Kazimierz Landscape Park a facies with *Carex humilis* (records 1-8) can be distinguished. Other phytocoenoses (records 17-20), in which the proportion of *Brachypodium pinnatum* is higher, represent an intermediate stage to *Origano-Brachypodietum* or shrub communities. In the area in question *Inuletum ensifoliae* phytocoenoses occur in Dobre, Męćmierz and Bochotnica. They grow on strongly eroded

rendzinas formed of marls on slopes of southern, south-western and western exposure, rarely on fragments of plateaux. They usually have the form of large patches on slopes or small "islands" in shrubs of the *Rhamno-Prunetea* class (most often *Ligustro-Prunetum spinosae*). The border between *Inuletum* and the shrubs has the form of a narrow belt of *Origano-Brachypodietum*, rarely – *Geranio-Peucedanetum cervariae*.

Thalictro-Salvietum pratensis Medw.-Korn. 1959
Table 6

Localities of phytosociological records:

1 (447). Dobre, upper part of a slope covered with loess. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Ligustro-Prunetum*, *Inuletum ensifoliae* partially developed. 1984-07-22, 1994-06-15.

2 (398). Dobre, ravine near the road to Kazimierz. Area of phytocoenosis: 60 m². Contact phytocoenoses: *Origano-Brachypodietum*, cereal and root plants. 1984-08-04.

3 (401). Dobre, near the road to a plateau, eroded chalk slope. Area of phytocoenosis: 60 m². Contact phytocoenoses: *Inuletum ensifoliae*, *Geranio-Peucedanum*. 1984-08-04, 1994-06-15.

4 (448). Dobre, upper part of a slope covered with loess. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Koelerio-Festucetum sulcatae*, *Plantaginetea* comm. 1984-07-22.

5 (464). Dobre, slope formed of marls covered with loess. Area of phytocoenosis: 150 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Origano-Brachypodietum* partially developed. 1984-07-27.

6 (438). Dobre, upper part of a slope formed of marls. Area of phytocoenosis: 100 m². Contact phytocoenoses: *Inuletum ensifoliae*, shrubs of the *Rhamno-Prunetea* class. 1984-08-18.

7 (467). See record no 5.

8 (465). See record no 5.

9 (575). Dobre, slope foot, alluvial rendzina. Area of phytocoenosis: 80 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Origano-Brachypodietum*. 1985-06-19.

10 (589). Dobre, slope formed of marls covered with loess. Area of phytocoenosis: 120 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Origano-Brachypodietum* partially developed. 1985-07-12.

11 (576). Dobre, upper part of a slope formed of marls. Area of phytocoenosis: 150 m². Contact phytocoenoses: *Ligustro-Prunetum* partially developed, *Koelerio-Festucetum sulcatae* partially developed. 1985-06-19.

12 (561). Dobre, slope of a ravine near the road to Kazimierz, shallow rendzina formed of marls. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Origano-Brachypodietum*, shrubs of the *Rhamno-Prunetea* class. 1985-06-13, 1994-06-15.

13 (567). Kazimierz Dolny, Góra III Krzyży, slope covered with loess. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Koelerio-Festucetum sulcatae*, *Sisymbrio-Stipetum*, shrubs of the *Rhamno-Prunetea* class. 1985-07-31.

14 (618). See record no 13. Area of phytocoenosis: 50 m².

15 (651). Kazimierz Dolny, Góra III Krzyży, slope covered with loess. Area of phytocoenosis: 30 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Lolio-Cynosuretum* partially developed. 1985-08-09.

16 (619). Kazimierz Dolny, Góra III Krzyży, lower part of a slope, alluvial rendzina. Area of phytocoenosis: 50 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1985-07-31.

Table 6. Composition and structure of phytocoenoses *Thalictro-Salvietum pratensis* Medw.-Korn. 1959

Succesive number of record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Number of record	447	398	401	448	464	438	467	465	575	589	576	561	567	618	651	619	615	353	
Exposure	SSE	SSE	S	SSW	SW	SW	SW	SW	SW	SW	SW	SW	S	S	SSW	S	S	S	
Slope inclination [°]	35	20	25	40	40	30	30	40	35	20	35	30	30	35	25	25	20	20	
Cover of shrub layer b [%]	5	<5	5	-	<5	10	5	5	10	<5	5	10	-	5	<5	<5	<5	5	PRESENCE
Cover of herb layer c [%]	90	90	90	90	100	100	90	90	90	90	100	90	90	80	80	90	90	90	
Cover of moss layer d [%]	<5	20	10	<5	<5	<5	5	<5	<5	10	10	20	<5	20	5	10	30	<5	
Area of sample plot [m²]	50	50	50	50	50	50	50	50	50	50	50	30	25	50	30	50	30	50	
Number of species	33	34	33	40	36	39	43	40	44	39	38	39	34	33	32	32	34	33	
Ch. *Thalictro-Salvietum*																			
Agropyron intermedium subsp. *intermedium*	3.3	2.2	2.2	3.2	3.3	3.3	3.2	2.2	3.3	3.3	4.4	3.2	3.3	3.3	3.2	3.2	3.2	3.2	V
**Campanula bononiensis*	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	II
Carex praecox	.	.	.	.	+	.	.	+	.	.	.	.	+	.	+	.	.	.	II
Ch. **Cirsio-Brachypodion*																			
Aster amellus	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	II
Seseli annuum	.	.	.	.	.	.	+	+	.	.	.	.	+	+	.	.	.	.	II
Veronica austriaca	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	I
Ch. *Festucelia valesiacea*																			
Achillea pannonica	+	1.1	1.1	+	2.2	2.2	1.1	2.1	2.1	2.1	1.1	1.1	2.1	2.1	1.1	1.1	2.2	1.1	V
Scabiosa ochroleuca	+	+	+	+	+	+	+	+	.	+	+	+	+	+	+	+	.	+	V
Salvia verticillata	+	+	+	+	+	+	+	.	+	+	+	.	.	.	+	2.2	+	2.1	IV
Potentilla arenaria	+	.	.	.	.	.	.	.	+	+	+	1.1	+	+	+	+	+	+	IV
Anthemis tinctoria	+	+	+	.	.	.	.	+	.	.	.	+	+	+	+	1.1	.	+	III
Alyssum montanum	.	.	+	+	.	.	.	.	+	+	+	+	+	+	.	.	.	.	III
Asparagus officinalis	.	.	.	.	+	+	.	+	.	r	.	+	+	.	.	.	.	.	II
Bromus inermis	.	.	.	+	.	.	.	.	.	.	.	+	1.2	+	.	.	.	.	II
Adonis vernalis	+	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	II
Campanula sibirica	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	I
Ch. *Festuco-Brometea*																			
Salvia pratensis	1.1	1.1	1.1	1.1	2.1	2.2	2.1	2.2	2.1	2.2	1.1	2.1	+	+	+	+	1.1	1.1	V
Artemisia campestris	+	+	+	+	+	+	+	+	+	+	+	1.1	+	1.1	+	1.1	+	+	V
Euphorbia cyparissias	+	+	+	+	.	+	+	1.2	1.1	1.1	+	1.1	+	+	+	1.1	+	1.1	V
Galium album	.	+	.	+	2.2	2.1	2.2	1.1	2.1	1.1	1.1	1.1	1.1	+	+	+	+	1.1	V
Teucrium chamaedrys	+	2.2	2.2	1.1	+	+	+	+	1.2	+	+	1.1	1.2	+	.	+	.	1.2	V
Centaurea rhenana	+	.	+	+	+	1.1	+	+	+	1.1	+	+	+	+	1.1	+	1.1	.	V
Veronica spicata	+	1.1	+	1.1	+	+	+	+	+	r	+	.	.	.	.	.	.	.	IV
Carex humilis	3.3	3.3	3.3	2.3	2.2	1.2	1.2	1.2	1.2	1.2	.	.	.	.	.	.	.	.	III
Acinos arvensis	+	.	.	.	.	.	.	.	+	1.1	+	+	+	+	.	.	+	+	III
Koeleria macrantha	.	.	.	1.1	+	.	+	+	+	+	1.2	+	.	.	.	.	.	.	III
Phleum phleoides	.	.	.	+	+	.	.	+	+	+	+	.	+	+	.	.	.	.	III
Dianthus cartusianorum	1.1	.	+	1.2	+	+	+	+	.	.	.	.	.	.	.	.	.	.	II
Brachypodium pinnatum	.	.	+	.	.	+	+	.	.	.	.	+	+	.	.	+	1.2	.	II
Stachys recta	.	.	.	+	.	+	.	.	.	.	.	r	+	+	.	.	+	+	II
Filipendula vulgaris	1.1	.	.	.	.	.	+	.	.	.	.	.	+	+	1.1	.	.	.	II
Plantago media	+	+	+	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	II
Polygala comosa	+	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	II
Ch. *Trifolio-Geranietea*																			
Origanum vulgare	+	1.1	1.1	+	+	+	1.2	2.2	1.1	+	1.1	.	+	+	+	1.1	2.2	+	V
Medicago falcata	+	.	+	+	.	1.1	+	+	+	2.1	2.1	1.1	2.2	1.1	1.2	1.1	2.2	2.2	V
Thalictrum minus	+	.	+	+	1.2	+	2.2	2.2	1.1	+	+	+	+	+	+	.	.	+	V
Verbascum lychnitis	.	.	.	+	+	.	+	+	+	+	+	+	+	+	+	+	+	+	IV
Galium verum	+	.	.	+	.	.	.	.	.	1.1	2.1	+	.	+	1.2	.	.	.	II
Agrimonia eupatoria	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1.1	+	+	+	II
Clinopodium vulgare	.	.	.	.	+	1.1	1.1	+	.	.	+	.	.	.	.	.	.	+	II
Ch. *Rhamno-Prunetea*																			
Prunus spinosa b/c	1.1	.	.	+	+	.	+	+	+	.	+	+	.	.	+	+	.	+	IV
Rosa canina b/c	+	+	.	+	.	1.1	+	.	+	.	+	1.1	.	.	.	.	+	.	III
Crataegus monogyna b/c	+	.	.	.	+	+	+	+	+	.	+	+	.	.	.	.	.	.	III
Berberis vulgaris b	.	+	1.1	.	+	+	+	.	.	+	.	+	.	.	.	.	.	.	II
Ligustrum vulgare	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	+	II
Ulmus minor b	.	.	+	.	.	.	.	.	.	.	.	.	.	1.1	.	+	+	.	II
Rosa rubiginosa	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	1.1	I
Other accompanying:																			
Pimpinella saxifraga	+	+	+	+	+	+	1.1	+	.	+	.	.	+	1.1	+	1.1	1.1	+	V
Thymus pulegioides	+	+	+	.	+	+	+	+	+	+	+	.	+	+	1.2	+	1.1	.	V
Poa angustifolia	.	.	.	+	.	.	+	1.1	1.2	1.2	2.2	+	1.2	+	+	+	+	+	IV
Hypericum perforatum	+	+	.	.	+	+	+	+	.	.	.	+	+	.	+	+	+	+	IV
Festuca trachyphylla	.	.	.	2.2	+	.	+	.	1.2	r	+	1.2	1.2	.	.	+	+	+	IV
Silene otites	.	.	.	+	+	+	+	+	+	+	+	.	.	.	.	.	.	.	IV
Carduus acanthoides	.	.	.	.	+	.	.	+	r	+	+	.	.	+	.	+	r	.	III

Pinus sylvestris b		+			+			+	+	+	+								III
Coronilla varia												1.1	+			1.1	+	+	II
Juniperus communis		+					+		+			+	r						II
Hieracium pilosella					+			+	+			+			+				II
Dactylis glomerata							+	+	+	+	+								II
Plantago lanceolata									+	+					+	+	+		II
Lappula squarrosa				+						1.1	+			+					II
Erigeron acris					+	+	+	+											II
Cerinthe minor									+		+						+	+	II
Eryngium planum	+			+			+												I
Quercus robur b			+				+		+										I
Echium vulgare		+														+		+	I
Senecio jacobaea				+						+							+		I
Cuscuta epithymum					+		+					+							I
Phscum floerkeanum					+	+	+		+		2.2								II
Encalypta vulgaris							+	+	+	2.2									II
Barbula unguiculata		+												1.1		+		+	II
Bryum caespiticium	+			+										+	+				II
Bryum argenteum						+	+	+			+								II
Abietinella abietina												2.2			+		2.2		I
Weissia controversa				+	+								+						I

Sporadic species:
Ch. *Festucetalia valesiacae*: *Verbascum phoeniceum* 4, *Hieracium piloselloides* 7, *Stipa capillata* 14/1.2.
Ch. *Festuco-Brometea*: *Anthyllis vulneraria subsp. polyphylla* 2, 6, *Centaurea scabiosa* 4, 10, *Sanguisorba minor* 12, 18, *Carex caryophyllea* 2/1.2, *Helianthemum nummularia subsp. obscurum* 2, *Allium oleraceum* 4, *Arabis hirsuta* 9, *Pterygoneurum ovatum* 10/1.2.
Ch. *Trifolio-Geranietea*: *Anthericum ramosum* 2/2.2, 3, *Anemone sylvestris* 2, *Peucedanum cervaria* 3, *Clematis recta* 12, *Fragaria viridis* 15/2.2, *Campanula rapunculoides* 17.
Other accompanying: *Chamaecytisus ratisbonensis* 2, 3, *Hypochoeris radicata* 2, 6, *Camptothecium lutescens* 3/2.2, 17/1.2, *Medicago lupulina* 3, 16, *Pterygoneurum subsessile* b, 16/1.2, *Sedum sexangulare* 8, 9, *Lithospermum officinale* 9, 11, *Ceratodon purpureus* 9/2.2, 10/1.1, *Ononis spinosa* 15, 17, *Linum catharticum* 1, *Campylium chrysophyllum* 2/2.2, *Tortella tortuosa* 2, *Chamaecytisus ruthenicus* 4, *Vincetoxicum hirundinaria* 6, *Arabis glabra* 9, *Festuca guestphalica* 11, *Barbula fallax* 12/1.2, *Carex tomentosa* 12, *Amblystegium serpens* 16, *Phascum cuspidatum* 17.

17 (615). Kazimierz Dolny, Góra III Krzyży, lower part of a slope, alluvial rendzina. Area of phytocoenosis: 60 m². Contact phytocoenoses: shrubs with *Ulmus minor*, *Origano-Brachypodietum* partially developed. 1985-07-31.

18 (353). Janowiec, eroded slope formed of marls. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Ligustro-Prunetum*, *Origano-Brachypodietum*. 1984-07-21.

Thalictro-Salvietum has the character of a dense grassland where the upper layer consists of *Agropyron intermedium* (V^{3556}) (species characteristic of the association), *Achillea pannonica* (V^{1000}), *Salvia pratensis* (V^{877}), *Medicago falcata* (V^{601}), *Origanum vulgare* (V^{338}) and *Artemisia campestris* (V^{92}), and the lower of *Teucrium chamaedrys* (V^{338}), *Euphorbia cyparissias* (V^{173}), *Carex humilis* (III^{958}) and others. In the majority of the analysed phytocoenoses there are shrubs but they rarely exceed 10% of cover. Among the 111 species reported from the analysed phytocoenoses 42 belong to the *Festuco-Brometea* class. The following species occur the most frequently: *Agropyron intermedium* (V^{3556}), *Achillea pannonica* (V^{1000}), *Salvia pratensis* (V^{877}), *Galium album* (V^{559}), *Teucrium chamaedrys* (V^{338}), *Centaurea rhenana* (V^{118}), *Artemisia campestris* (V^{92}) and *Scabiosa ochroleuca* (V^{9}). Species of the *Cirsio-Brachypodion pinnati*

association barely mark their presence (3 species). The *Trifolio-Geranietea* class is represented by 13 species. In records 10-18 *Medicago falcata* has a considerably higher cover. This is not connected, however, with a higher proportion of shrubs or species of the *Trifolio-Geranietea* class.

Thalictro-Salvietum phytocoenoses are found on slopes with southern and south-western exposure (Dobre, Kazimierz Dolny, Janowiec) on rendzinas formed of chalk deposits or on loess soils. They usually occur in the form of patches ranging from 30 to 150 m^2 among shrubs of the *Rhamno-Prunetea* class. The contact zone of these phytocoenoses is often sharply marked, without a typical belt of "saum" communities of the *Trifolio-Geranietea* class. Some of the phytocoenoses also border with *Sisymbrio-Stipetum capillatae* and *Origano-Brachypodietum* phytocoenoses, in this case, however, the intermediate zone is wide.

Origano-Brachypodietum Medw.-Korn. et Kornaś 1963
Table 7

Localities of phytosociological records:

1 (378). Janowiec, edge of a plateau above the village. Area of phytocoenosis: 120 m^2. Contact phytocoenoses: cereal and root plants, *Inuletum ensifoliae* partially developed. 1984-08-01.

2 (396). Janowiec, near the ruins of the castle, edge of a plateau. Area of phytocoenosis: 80 m^2. Contact phytocoenoses: *Ligustro-Prunetum* partially developed, *Festuco-Koelerietum glaucae* partially developed. 1984-08-01.

3 (354). Janowiec, eroded slope. Area of phytocoenosis: 40 m^2. Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1984-07-21.

4 (753). Bochotnica, slope above the village. Area of phytocoenosis: 50 m^2. Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Inuletum ensifoliae* partially developed. 1986-04-28.

5 (360). Oblasy near Janowiec, upper part of a slope. Area of phytocoenosis: 30 m^2. Contact phytocoenoses: *Ligustro-Prunetum*. 1984-07-21.

6 (355). Janowiec, middle part of a chalk slope. Area of phytocoenosis: 150 m^2. Contact phytocoenoses: *Ligustro-Prunetum*. 1984-07-21.

7 (348). Wojszyn near Janowiec, slope south of the village. Area of phytocoenosis: 30 m^2. Contact phytocoenoses: cereal and root plants. 1984-07-16.

8 (745). Bochotnica, slope above the village, edge of a scarp. Area of phytocoenosis: 50 m^2. Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Inuletum ensifoliae* partially developed. 1986-04-22.

9 (436). Dobre, middle part of a slope. Area of phytocoenosis: 100 m^2. Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class. 1984-08-18.

10 (419). Dobre, lower part of a slope. Area of phytocoenosis: 80 m^2. Contact phytocoenoses: *Inuletum ensifoliae*, orchard. 1984-08-13.

11 (415). Dobre, eroded slope. Area of phytocoenosis: 70 m^2. Contact phytocoenoses: *Inuletum ensifoliae*, *Ligustro-Prunetum*. 1984-08-13.

12 (421). Dobre, slope foot. Area of phytocoenosis: 80 m^2. Contact phytocoenoses: *Inuletum ensifoliae*, shrubs of the *Rhamno-Prunetea* class. 1984-08-13.

Table 7. Composition and structure of phytocoenoses *Origano-Brachypodietum* Medw.-Korn. et Kornaś 1963

Succesive number of record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	PRESENCE
Number of record	378	396	354	753	360	355	348	745	436	419	415	421	466	744	468	463	409	577	573	583	
Exposure	-	-	S	S	SE	SE	E	SSW	W	SW	SW	S	SW	SW	W	SW	W	SW	SW	-	
Slope inclination [°]	-	-	25	5	25	25	30	20	30	25	35	20	35	30	30	10	30	30	20	-	
Cover of shrub layer b [%]	-	<5	-	-	-	-	-	5	5	<5	<5	10	10	10	10	10	10	30	10	30	
Cover of herb layer c [%]	90	90	90	90	100	100	100	100	90	80	90	90	100	100	90	90	80	100	100	100	
Cover of moss layer d [%]	20	20	<5	20	10	<5	10	10	30	30	20	20	5	<5	40	10	30	20	10	30	
Area of sample plot [m^2]	50	50	35	30	25	50	30	50	50	50	50	50	50	30	50	50	50	30	40	40	
Number of species	39	29	36	37	30	30	33	36	31	32	31	36	39	41	48	43	39	36	40	46	
D. *Origano-Brachypodietum*																					
Clinopodium vulgare	+	+	+	+	+	+	+	+	+	.	+	+	+	1.1	+	1.1	+	+	+	+	V
Agrimonia eupatoria	+	+	+	+	1.1	1.1	+	+	+	+	+	+	+	+	.	+	.	.	+	+	V
Origanum vulgare	.	.	.	.	.	+	+	1.2	+	+	+	1.1	1.1	1.1	+	+	1.1	+	+	1.1	IV
Coronilla varia	+	+	1.1	+	1.2	1.2	+	+	.	.	.	.	.	.	+	.	.	.	+	.	III
Hypericum perforatum	+	+	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	+	.	.	II
Ch. *Cirsio-Brachypodion*																					
Aster amellus	.	.	.	.	.	+	.	.	.	1.1	1.1	+	+	+	+	+	+	r	+	+	III
Inula ensifolia	+	.	.	.	.	.	.	+	.	2.2	+	+	.	1.1	.	.	+	.	+	+	III
Elymus hispidus	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	+	.	.	I
Carex michelli	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	I
Seseli annuum	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	I
Ch. *Festucetalia valesiacae*																					
Achillea pannonica	1.2	2.2	1.1	1.1	1.2	1.1	1.2	+	1.1	+	1.1	+	+	1.1	+	+	+	+	.	+	V
Salvia verticillata	2.2	2.1	2.2	1.1	1.1	2.2	1.1	+	+	+	+	+	+	+	+	+	+	.	+	.	V
Scabiosa ochroleuca	+	1.1	+	+	1.1	+	+	+	+	+	+	+	+	+	+	+	.	.	.	.	IV
Campanula sibirica	+	1.1	+	+	+	+	+	.	.	.	.	.	.	.	.	+	+	+	.	.	III
Anthemis tinctoria	+	+	+	.	+	1.2	.	.	.	.	.	+	.	.	.	+	.	+	+	.	III
Adonis vernalis	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	+	.	.	+	+	II
Potentilla arenaria	.	.	.	+	.	.	.	.	.	+	+	+	.	.	.	.	.	+	+	.	II
Asparagus officinalis	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	r	.	.	I
Ch. *Festuco-Brometea*																					
Brachypodium pinnatum	4.4	3.3	3.2	3.3	3.2	3.2	3.2	4.4	4.3	3.3	4.3	4.4	4.4	4.3	4.3	3.3	3.3	4.4	5.5	5.5	V
Teucrium chamaedrys	+	1.2	1.2	2.2	2.2	2.2	1.2	1.2	2.2	1.2	1.2	1.1	1.2	1.1	1.2	1.2	1.2	1.2	1.1	1.1	V
Euphorbia cyperissias	+	+	1.1	1.1	2.1	1.1	1.1	+	1.1	1.1	1.1	1.1	1.1	1.1	+	+	+	+	1.1	+	V
Salvia pratensis	2.2	1.1	+	+	1.1	+	+	+	1.1	+	+	+	1.2	+	+	+	.	+	1.1	+	V
Galium album	1.1	+	+	+	.	+	+	+	+	+	+	+	1.2	+	+	+	+	1.1	1.2	+	V
Centaurea rhenana	+	+	+	+	+	+	+	+	.	+	+	+	+	+	+	+	+	+	.	.	V
Carex humilis	+	1.2	+	+	+	.	1.2	+	+	+	1.2	.	+	.	.	+	.	1.2	+	+	IV
Sanguisorba minor	+	+	+	+	+	+	+	+	.	.	.	.	.	.	+	.	.	+	+	.	III
Anthyllis vulneraria subs. *polyphylla*	+	+	.	.	.	.	.	.	+	.	+	+	.	.	.	+	+	+	+	+	III
Plantago media	.	.	.	+	.	.	.	+	.	.	.	.	.	+	+	+	+	+	+	+	III
Centaurea scabiosa	.	+	+	+	1.1	+	+	+	2.2	.	.	.	.	.	.	.	.	.	.	.	.	II
Koeleria macrantha	+	.	.	.	.	.	r	.	.	.	.	.	+	.	.	+	+	+	.	.	II
Carlina vulgaris	+	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II
Veronica spicata	.	.	.	+	+	.	+	.	.	.	.	.	+	+	.	.	.	.	.	.	II
Phleum phleoides	.	.	.	1.1	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	I
Dianthus carthusianorum	.	.	.	+	.	.	+	.	.	.	.	.	+	+	.	.	.	.	.	.	I
Polygala comosa	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	+	.	I
Ch. *Trifolio-Geranietea*																					
Medicago falcata	+	+	+	+	+	1.2	2.2	+	+	+	1.1	2.2	+	+	+	2.2	+	2.1	2.2	3.1	V
Galium verum	+	.	.	.	+	.	1.1	.	+	.	.	.	.	+	+	.	+	+	.	2.1	III
Anthericum ramosum	.	.	.	.	+	.	.	+	1.1	1.1	+	+	+	.	.	.	1.1	.	.	.	II
Fragaria viridis	+	.	2.2	1.1	+	1.1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	II
Thalictrum minus	.	.	+	.	.	+	.	.	.	.	.	.	+	.	.	+	.	.	+	.	II
Anemone sylvestris	.	.	.	.	.	.	.	+	.	.	+	.	.	+	.	.	.	.	+	+	II
Clematis recta	.	.	+	.	.	+	2.2	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Trifolium medium	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	I
Ch. *Rhamno-Prunetea*																					
Berberis vulgaris b/c	.	.	.	.	.	.	.	+	+	+	.	+	1.1	+	1.1	1.1	+	.	+	1.1	III
Prunus spinosa b/c	.	.	.	.	.	.	.	+	.	.	+	2.1	1.1	.	.	+	2.1	.	+	+	III
Rosa canina b/c	.	.	.	.	.	.	.	+	+	.	+	+	+	.	+	1.1	1.1	2.1	.	.	III
Ligustrum vulgare b	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	+	.	.	+	1.1	II
Cornus sanguinea b/c	.	.	.	.	.	.	.	.	+	.	.	+	.	+	+	+	.	1.1	.	+	II

Other accompanying:																				
Pimpinella saxifraga	+	.	.	+	+	+	+	+	+	+	+	1.1	+	+	1.1	+	+	+	.	V
Poa angustifolia	.	.	.	+	.	.	.	.	+	.	+	+	+	1.2	1.2	1.2	+	1.2	+	III
Plantago lanceolata	+	+	+	+	.	+	+	+	+	.	.	.	.	.	.	+	+	+	+	III
Dactylis glomerata	.	.	.	.	.	.	.	+	+	+	.	+	+	+	+	+	+	+	+	III
Daucus carota	.	+	+	.	+	+	.	+	+	+	.	+	.	+	+	+	+	+	+	III
Ononis spinosa	+	+	+	.	1.1	+	.	.	+	+	.	.	.	+	.	+	.	.	+	III
Thymus pulegioides	+	1.2	+	+	+	.	.	+	.	.	.	.	.	+	+	.	.	.	.	II
Briza media	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	1.2	+	r	+	II
Linum catharticum	.	.	.	.	+	.	.	.	+	+	.	+	.	+	+	.	+	.	.	II
Eryngium planum	+	.	+	.	.	.	.	+	.	.	.	.	+	.	+	.	.	.	+	II
Echium vulgare	+	+	+	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	II
Juniperus communis b	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	1.1	.	II
Leontodon hispidus	+	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	+	+	.	II
Medicago lupulina	.	.	1.1	.	.	+	+	.	.	.	.	.	.	+	.	.	.	.	.	I
Cichorium intybus	+	.	.	.	.	.	+	+	.	.	.	.	.	.	+	.	.	.	.	I
Genista tinctoria	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	I
Carex tomentosa	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2.2	.	+	.	.	I
Pinus sylvestris b/c	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	2.2	.	I
Betula pendula b/c	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.	+	.	.	+	I
Hieracium pilosella	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Centaurium pulchellum	.	.	.	.	.	.	.	.	.	+	r	.	.	+	.	.	.	.	.	I
Hypochoeris radicata	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	+	.	.	.	I
Euphrasia stricta	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	.	.	I
Carex flacca	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	I
Viola hirta	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	I
Camptothecium lutescens	.	.	.	+	.	.	2.2	2.2	2.2	.	2.2	2.2	1.2	+	2.2	2.2	2.2	2.2	2.2	IV
Campylium chrysophyllum	2.2	.	.	2.2	2.2	.	.	.	.	2.2	.	.	.	.	2.2	.	2.2	.	+	II
Abietinella abietina	.	.	.	.	.	.	.	.	2.2	.	.	.	+	+	+	.	.	1.2	.	II
Barbula unguiculata	2.2	2.2	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	II

Sporadic species:
Ch. *Cirsio-Brachypodion*: *Veronica austriaca subsp. dentata* 17.
Ch. *Festuco-Brometea*: *Artemisia campestris* 4, 8, *Linosyris vulgaris* 4, 14/2.1, *Filipendula vulgaris* 13, 14, *Acinos arvensis* 3, *Carex caryophyllea* 3, *Stachys recta* 7, *Helianthemum nummularium subsp. obscurum* 15, *Ranunculus bulbosus* 15, *Prunella grandiflora* 17/1.1.
Ch. *Trifolio-Geranietea*: *Campanula rapunculoides* 3, 4/2.1, *Melampyrum cristatum* 1, 20/r, *Veronica teucrium* 14, 20, *Verbascum lychnitis* 4, *Peucedanum cervaria* 11, *Astragalus cicer* 20/1.2.
Ch. *Rhamno-Prunetea*: *Rosa rubiginosa* b 13, 20, *R. caryophyllacea* b 19/2.1, *Rhamnus catharticus* b 20.
Other accompanying: *Campanula trachelium* 1, 3, *Lotus corniculatus* 1, 13, *Vincetoxicum hirundinaria* 3, 20, *Peucedanum oreoselinum* 4/2.1, 20, *Lembotropis nigricans* 7, 14, *Pyrus communis* b 8, 12, *Stachys officinalis* 11, 20, *Cuscuta epithymus* 13, 16, *Solidago virgaurea* 14, 20, *Fissidens taxifolius* 14, 20/1.2, *Prunella vulgaris* 15, 16, *Heissia controversa* 18, 19, *Senecio jacobaea* 7, *Barbula fallax* 10/2.2, *Eurhynchium hians* 11, *Brachythecium albicans* 12/1.2, *Chamaecytisus ratisbonensis* 12, *Populus tremula* b 14/1.1, *Quercus robur* b 14/1.1, *Thymus serpyllum* 19, *Falcaria officinalis* 20, *Monotropa hypopitis* 20.

13 (466). Dobre, upper part of a slope. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Inuletum ensifoliae, Ligustro-Prunetum*. 1984-08-27, 1986-05-20.

14 (744). Bochotnica, slope above the quarry. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Peucedano cervariae-Coryletum*, shrubs of the *Rhamno-Prunetea* class. 1985-08-15.

15 (468). Dobre, lower part of the gully near the road to the fields. Area of phytocoenosis: 70 m². Contact phytocoenoses: shrubs of the *Rhamno-Prunetea* class, *Inuletum ensifoliae* partially developed. 1984-08-30, 1986-04-22.

16 (463). Dobre, lower part of a slope. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Inuletum ensifoliae, Thalictro-Salvietum* partially developed, *Ligustro-Prunetum*. 1984-08-27, 1986--04-22.

17 (409). Dobre, middle part of a slope. Area of phytocoenosis: 70 m². Contact phytocoenoses: *Inuletum ensifoliae*, shrubs of the *Rhamno-Prunetea* class. 1984-08-04.

18 (577). Dobre, lower part of a slope. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Sisymbrio-Stipetum* partially developed, shrubs of the *Rhamno-Prunetea* class. 1985-06-19.

19 (573). Dobre, slope near the road to the fields. Area of phytocoenosis: 40 m². Contact phytocoenoses: *Inuletum ensifoliae*, shrubs of the *Rhamno-Prunetea* class. 1985-06-19.

20 (583). Męćmierz, edge of a plateau. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Ligustro-Prunetum*, pine plantings, *Inuletum ensifoliae* partially developed. 1985-07-12.

Origano-Brachypodietum is a community with strongly marked layers. The upper layer of herbaceous plants is made up of *Brachypodium pinnatum* ($V^{4\,2\,5\,0}$),

which is the dominant species here, and less abundant *Medicago falcata* (V^{681}), *Salvia verticillata* (V^{430}), *Achillea pannonica* (V^{317}) and *Salvia pratensis* (V^{219}). In the lower layer *Teucrium chamaedrys* (V^{726}) and *Euphorbia cyparissias* (V^{367}) are the most frequent species. The cover of bryophytes is rather low (up to 40% of the area). Among the differential species for *Origano-Brachypodietum* only *Clinopodium vulgare* (V^{59}), *Agrimonia eupatoria* (V^{58}) and *Origanum vulgare* (IV^{155}) attain higher degrees of permanence; *Coronilla varia* and *Hypericum perforatum* occur only in some phytocoenoses. In phytocoenoses of this association species of the *Festuco-Brometea* class (45 species) dominate, and the *Trifolio-Geranietea* (14 species) and *Rhamno-Prunetea* classes (8 species) are represented less abundantly.

Among *Origano-Brachypodietum* phytocoenoses there are forms without any shrubs (records 1-7) (Table 7) with a big amount of *Salvia verticillata* and a form with a high proportion of shrubs (records 8-20) with *Prunus spinosa* (III^{203}), *Rosa canina* (III^{141}), *Berberis vulgaris* (III^{104}) and others. In the area of the Kazimierz Landscape Park *Origano-Brachypodietum* occurs in Dobre, Męćmierz, Kazimierz, Bochotnica and Janowiec on sunny slopes, rarely on plateaux. It prefers shallow or moderately deep rendzinas formed of marls and siliceous chalks. *Origano-Brachypodietum* phytocoenoses develop into the form of patches of different shape, the most typical arrangement being a belt separating other grasslands of the *Festuco-Brometea* class from shrubs or an "island" in shrubs of the *Rhamno-Prunetea* class. Deep penetration of *Origano-Brachypodietum* into pine plantings or shrubs has also been observed (Męćmierz, Bochotnica).

Geranio-Peucedanetum cervariae (Kuhn 1937) Müll. 1961
Table 8

Localities of phytosociological records:

1 (664). Kazimierz Dolny, Albrechtówka, middle part of a slope. Area of phytocoenosis: 40 m². Contact phytocoenoses: *Peucedano cervariae-Coryletum*. 1985-08-12.

2 (564). Dobre, ravine near the road to Kazimierz. Area of phytocoenosis: 25 m². Contact phytocoenoses: *Ligustro-Prunetum, Origano-Brachypodietum* partially developed. 1985-06-13.

3 (673). Męćmierz, south of the village, edge of a plateau. Area of phytocoenosis: 35 m². Contact phytocoenoses: *Ligustro-Prunetum, Origano-Brachypodietum* partially developed. 1985-08-12, 1994--06-15.

4 (674). See record no 3. Area of phytocoenosis: 20 m².

5 (523). Parchatka, upper part of a slope above the village. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Ligustro-Prunetum, Origano-Brachypodietum, Inuletum ensifoliae* partially developed. 1985-05-31.

6 (1029). Męćmierz, south of the village, edge of a plateau. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Ligustro-Prunetum, Inuletum ensifoliae*, pine plantings. 1986-07-31, 1994-06-15.

Table 8. Composition and structure of phytocoenoses *Geranio-Peucedanetum cervariae* (K u h n 1937) M ü l l. 1961

Succesive number of record	1	2	3	4	5	6	7	8	9	10	
Number of record	664	564	673	674	523	1029	417	1080	416	939	
Exposure	NW	SW	SW	N	SW	NW	S	SW	SW	SW	
Slope inclination [°]	15	30	30	30	30	25	30	20	30	5	PRESENCE
Cover of shrub layer b [%]	<5	<5	20	5	10	10	10	10	10	20	
Cover of herb layer c [%]	80	80	70	70	80	70	80	70	80	90	
Cover of moss layer d [%]	30	10	30	30	-	40	10	10	20	<5	
Area of sample plot [m^2]	40	25	30	20	50	20	50	30	40	20	
Number of species	30	27	29	29	30	28	33	30	36	28	
Ch. *Geranium-Peucedanetum*											
Peucedanum cervaria	2.2	2.2	3.2	3.2	3.2	3.2	4.3	4.3	4.3	4.3	V
Ch. *Geranion sanguinei*											
Anemone sylvestris	1.1	2.1	1.1	1.1	1.1	1.1	+	+	+	+	V
Fragaria viridis	1.1	+	.	+	+	2.1	+	+	.	.	IV
Geranium sanguineum	1.2	1.2	2.2	2.2	2.1	2.2	.	.	.	.	III
Anthericum ramosum	.	.	.	.	.	.	1.1	1.1	1.1	3.2	II
Veronica teucrium	+	+	.	.	.	.	.	.	+	.	II
Melampyrum cristatum	1.1	.	.	.	.	.	.	.	.	+	I
Lathyrus niger	+	+	.	.	.	.	.	.	.	.	I
Thalictrum minus	.	.	.	.	.	.	+	.	+	.	I
Clematis recta	.	.	.	.	.	.	.	+	+	.	I
Ch. *Trifolio-Geranietea*											
Origanum vulgare	2.1	2.1	1.1	1.1	1.1	1.1	1.1	1.1	2.2	2.2	V
Medicago falcata	+	1.1	+	1.1	1.1	1.1	1.2	1.1	+	2.1	V
Agrimonia eupatoria	.	.	1.1	.	+	+	+	.	+	1.1	III
Clinopodium vulgare	1.1	.	.	1.1	.	.	+	+	+	.	III
Galium verum	+	+	+	+	.	.	.	.	.	1.2	III
Coronilla varia	.	.	.	+	+	.	.	+	+	.	II
Vicia tenuifolia	+	1.1	.	+	.	.	.	.	.	.	II
Campanula rapunculoides	.	.	.	+	+	+	.	.	.	.	II
Ch. *Festuco-Brometea*											
Brachypodium pinnatum	1.2	1.2	1.2	1.2	1.2	1.2	2.2	1.2	1.2	1.2	V
Teucrium chamaedrys	1.1	+	1.2	+	+	2.1	+	+	+	+	V
Euphorbia cyparissias	.	+	+	+	+	+	+	+	+	+	V
Galium album	.	1.1	1.1	+	.	.	+	+	+	+	IV
Achillea pannonica	.	.	1.1	+	+	.	+	+	+	1.1	IV
Salvia pratensis	.	1.1	1.1	+	1.1	.	+	.	+	.	III
Inula ensifolia	.	.	+	.	+	+	+	.	+	.	III
Thesium linophyllon	.	.	.	+	+	1.1	.	+	+	.	III
Filipendula vulgaris	.	.	.	+	1.2	+	.	.	.	1.1	II
Adonis vernalis	.	.	1.1	.	.	.	+	+	+	.	II
Carex humilis	.	.	+	.	+	.	.	+	1.2	.	II
Scabiosa ochroleuca	.	.	.	.	.	+	+	+	+	.	II
Aster amellus	.	.	.	.	.	+	+	.	+	.	II
Centaurea scabiosa	.	.	.	.	.	.	+	+	+	.	II
Centaurea rhenana	.	.	.	.	.	.	+	+	+	.	II
Salvia verticillata	.	.	.	.	.	.	+	+	+	.	II
Campanula glomerata	+	+	.	.	.	.	.	.	.	.	I
Asparagus officinalis	.	+	.	.	+	.	.	.	.	.	I
Asperula tinctoria	.	.	.	.	.	.	+	+	.	.	I
Ch. *Rhamno-Prunetea*											
Prunus spinosa b/c	.	+	2.2	+	1.1	+	2.2	1.1	1.1	2.2	V
Rosa canina b/c	.	+	.	+	+	.	+	+	+	+	IV
Ligustrum vulgare b/c	+	.	1.1	.	+	.	.	+	1.1	.	III
Rosa tomentosa b	.	.	.	+	+	.	+	.	+	.	II
Ulmus minor b	.	.	+	.	1.1	.	.	.	.	+	II
Berberis vulgaris b	.	+	.	.	.	.	+	.	+	.	II

Other accompanying:											
Poa angustifolia	2.2	+	.	+	+	.	1.2	+	.	1.2	IV
Betonica officinalis	.	.	+	.	.	+	1.1	1.1	1.1	.	III
Dactylis glomerata	.	+	+	+	1.2	.	.	.	.	.	II
Pteridium aquilinum	+	+	+	.	.	1.1	.	.	.	.	II
Primula veris	+	.	+	.	+	+	.	.	.	.	II
Vincentoxicum hirundinaria	.	2.2	2.2	2.1	.	.	.	.	.	.	II
Pimpinella saxifraga	+	.	.	.	.	1.1	1.1	.	.	.	II
Plantago lanceolata	+	.	.	1.1	+	.	.	.	.	.	II
Thymus pulegioides	+	+	.	.	.	+	.	.	.	.	II
Hypericum perforatum	.	.	.	.	.	.	.	+	+	+	II
Juniperus communis b	.	.	2.1	.	+	.	.	.	.	.	I
Knautia arvensis	+	.	.	.	.	.	.	.	.	+	I
Captothecium lutescens	.	2.2	1.2	1.2	.	.	.	2.2	2.2	+	III
Campyllum chrysophyllum	.	+	2.2	2.2	.	3.2	.	+	1.2	.	III
Eurhynchium hians	.	.	+	+	.	+	2.2	.	.	+	III

Sporadic species:
Ch. *Trifolio-Geranietea*: *Verbascum lychnitis* 7, *Trifolium medium* 10/1.2.
Ch. *Festuco-Brometea*: *Sesell annum* 1/1.1, *Veronica spicata* 1, *Aster linosyris* 5, *Ranunculus bulbosus* 5, *Plantago media* 6, *Carex caryophyllea* 9, *Allium oleraceum* 10, *Helianthemum nummularia subsp. obscurum* 10, *Phleum phleoides* 10.
Ch. *Trifolio-Geranietea*: *Rhamnus catharticus* b 1, *Cornus sanguinea* b 4.
Other accompanying: *Rhytidiadelphus triquetrus* 1/2.2, *Lembotropis nigricans* 1, *Quercus robur* b 1, *Veronica chamaedrys* 1, *Chamaecytisus ruthenicus* 3, *Pinus sylvestris* b 6/ 2.2, *Abietinella abietina* 6/1.2, *Linum catharticum* 6, *Cichorium intybus* 7, *Genista tinctoria* 10/2.1, *Ononis spinosa* 10, *Trifolium montanum* 10.

7 (417). Dobre, near a road to the fields, lower part of a slope. Area of phytocoenosis: 120 m². Contact phytocoenoses: *Ligustro-Prunetum*, *Inuletum ensifoliae*, *Origano-Brachypodietum* partially developed. 1984-08-13.

8 (1080). Dobre, upper part of a slope. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Ligustro-Prunetum*, *Origano-Brachypodietum*, *Inuletum ensifoliae* partially developed. 1986-07-31.

9 (416). See record no 7.

10 (939). Kazimierz Dolny, Góra III Krzyży, upper part of a slope. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Ligustro-Prunetum spinosae*. 1986-07-19.

Geranio-Peucedanetum is a "saum" community with rich flora. The physiognomy of the community is connected with its dominant species – *Peucedanum cervaria* (V^{4350}). A permanent element of the phytocoenosis are shrubs, mainly *Prunus spinosa* (V^{678}), *Rosa canina* (IV^{7}) and *Ligustrum vulgare* (III^{103}). From the species characteristic of the association *Peucedanum cervaria* (V^{4350}) occurs here. Apart from *Anemone sylvestris* (V^{429}) and *Geranium sanguineum* (III^{800}) other species of the *Geranion sanguinei* alliance grow only in some phytocoenoses and even there they are sparse. In general, the *Trifolio-Geranietea* class is represented by 20 species. Species from the *Festuco-Brometea* class are a bit more numerous (30 species). However, apart from *Brachypodium pinnatum* (V^{625}) and *Teucrium chamaedrys* (V^{282}) plants of this class do not constitute a very important element in the make-up of the phytocoenoses.

Geranio-Peucedanetum phytocoenoses are not homogenous. It is possible to distinguish a facies with *Geranium sanguineum* (records 1-6) (Table 8) and one with *Anthericum ramosum* (records 7-10). The spatial arrangement of the discussed association in the area in question is closely connected with the occurrence of thermophilous shrubs and grasslands (Parchatka, Kazimierz Dolny, Męćmierz, Dobre). It results from the similar habitat requirements of the

phytocoenoses (soil rich in calcium, slopes of southern, south-western and south-eastern exposure) and the border-like character of this association. It grows in the form of a narrow belt on the border between *Ligustro-Prunetum* (rarely *Corylus avellana* shrubs) and xerothermic grasslands (*Origano-Brachypodietum, Inuletum ensifoliae*).

Geranio-Trifolietum alpestris Müller 1961

The only phytocoenosis of this association was found in Dobre in a ravine near the road to Kazimierz Dolny. It occupies the area of 16 m² at the foot of a slope with south-western exposure and the inclination of 25°. The structure and syntaxonomic composition of the phytocoenosis is shown in record no 563 (1985-06-13).

The cover of layers: b – 5%, c – 90%, d – sparse

Ch. *D. *Geranio-Trifolietum*		*Euphorbia cyparissias*	1.1
Trifolium alpestre	3.1	*Artemisia campestris*	1.1
Lathyrus niger	+	*Adonis vernalis*	+
**Hieracium umbellatum*	+	*Achillea pannonica*	+
Ch. *Geranion sanguinei*		*Teucrium chamaedrys*	+
Geranium sanguineum	1.1	Other accompanying:	
Veronica teucrium	+	*Corylus avellana* b	1.1
Anemone sylvestris	+	*Pteridium aquilinum*	+
Fragaria viridis	+	*Berberis vulgaris* b	+
Ch. *Trifolio-Geranietea*		*Rosa canina* b	+
Origanum vulgare	2.1	*Solidago gigantea*	+
Medicago falcata	+	*Equisetum arvense*	+
Ch. *Festuco-Brometea*		*Vincetoxicum hirundinaria*	+
Helianthemum mummularium	2.2	*Carex tomentosa*	+
Galium album	1.1	*Pohlia cruda*	+
Phleum phleoides	1.2		

The presented phytocoenosis was a "saum" formation of *Corylus avellana, Berberis vulgaris* shrubs and various species of roses, on the other side it bordered with a partially developed *Origano-Brachypodietum*.

Prunetum fruticosae Dziubałt. 1925
Table 9

Localities of phytosociological records:

1 (410). Dobre, middle part of a chalk slope. Area of phytocoenosis: 25 m². Contact phytocoenoses: *Origano-Brachypodietum, Thalictro-Salvietum* partially developed, *Ligustro-Prunetum*. 1984-08-04, 1996-06-20.

Table 9. Composition and structure of phytocoenoses *Prunetum fruticosae* Dziub. 1925

Succesive number of record	1	2	3	4	5	6
Number of record	410	938	474	1082	1081	451
Exposure	S	-	E	S	SSW	SSW
Slope inclination [°]	30	-	30	40	30	25
Cover of shrub layer b [%]	50	60	60	60	50	40
Cover of herb layer c [%]	60	50	50	50	60	60
Cover of moss layer d [%]	20	10	20	<5	20	<5
Area of sample plot [m^2]	25	8	40	20	25	40
Number of species	25	28	32	34	35	36
Ch. *Prunetum fruticosae*						
Prunus fruticosa b	3.3	4.5	4.4	4.4	3.3	3.3
Prunus fruticosa c	+	+	+	+	1.1	+
Ch. * *Berberidion, Rhamno-Prunetea*						
Cornus sanguinea b	+	+	+	1.1	1.1	+
Cornus sanguinea c	+	.	.	+	+	.
**Berberis vulgaris* b	+	+	+	+	+	+
Rosa canina b	.	.	+	+	.	1.1
Rhamnus catharticus b	.	.	+	+	.	+
Rosa tomentosa b	.	.	.	+	1.1	.
**Ligustrum vulgare* b	.	.	.	.	1.1	+
Prunus spinosa b	.	+	+	.	.	.
Ch. *Trifolio-Geranietea*						
Origanum vulgare	3.2	1.1	2.2	1.1	1.1	2.2
Medicago falcata	1.1	2.2	1.1	3.2	1.1	+
Clinopodium vulgare	+	1.1	+	+	+	+
Fragaria viridis	+	+	+	+	+	.
Agrimonia eupatoria	.	1.1	+	+	.	.
Trifolium medium	.	1.1	+	.	.	+
Anemone sylvestris	.	.	.	+	+	+
Galium verum	.	+	+	.	.	.
Verbascum lychnitis	.	.	.	.	+	+
Vicia tenuifolia	.	.	.	.	+	+
Ch. *Festuco-Brometea*						
Teucrium chamaedrys	1.2	1.2	+	1.1	1.1	1.1
Achillea pannonica	1.1	1.1	+	2.1	1.1	+
Galium album	+	+	1.1	1.1	+	1.1
Salvia pratensis	+	+	+	+	1.1	+
Veronica spicata	+	+	1.1	+	.	+
Agropyron intermedium subsp. *intermedium*	1.2	2.2	1.2	2.1	.	.
Euphorbia cyparissias	.	.	+	2.1	1.1	.
Artemisia campestris	.	.	.	1.1	1.1	+
Scabiosa ochroleuca	.	+	+	.	.	+
Carex humilis	1.2	.	.	.	.	3.2
Centaurea rhenana	.	.	+	1.1	.	.
Acinos arvensis	+	+	.	.	.	.
Asparagus officinalis	+	.	.	.	+	.
Polygala comosa	.	.	.	+	+	.
Centaurea scabiosa	.	.	.	+	.	+

Other accompanying:						
Poa angustifolia	+	1.1	1.1	2.2	2.2	+
Thymus pulegioides	+	1.1	+	+	+	+
Hypericum perforatum	+	+	1.1	+	+	+
Calamagrostis epigejos	2.2	1.1	+	+	1.1	.
Pimpinella saxifraga	.	.	+	+	+	+
Daucus carota	.	.	+	+	+	+
Camptothecium lutescens	+	2.2	2.2	+	+	+
Abietinella abietina	1.2	+	.	.	.	+
Eurhynchium hians	.	.	.	+	2.2	.

Sporadic species:
Ch. *Trifolio-Geranietea*: *Melampyrum cristatum* 2/2.2, *Thalictrum minus* 2/1.1.
Ch. *Festuco-Brometea*: *Aster amellus* 1, *Campanula sibirica* 4/2.1, *Anthemis tinctoria* 4, *Brachypodium pinnatum* 5, *Potentilla arenaria* 5, *Filipendula vulgaris* 6/1.1, *Sesleria annua* 6/1.1, *Allium oleraceum* 6, *Dianthus carthusianorum* 6.
Other accompanying: *Amblystegium serpens* 1/2.2, *Juniperus communis* 6.1, *Dactylis glomerata* 3, *Erigeron acer* 3, *Chamaecytisus ruthenicus* 5/1.1, *Rubus caesius* 5, *Veronica chamaedrys* 5, *Pinus sylvestris* 6.

2 (938). Kazimierz Dolny, Góra III Krzyży, edge of a plateau. Area of phytocoenosis: 8 m². Contact phytocoenoses: *Ligustro-Prunetum* partially developed, *Thalictro-Salvietum*. 1986-07-19, 1996-06-20.

3 (474). Dobre, slope of a ravine. Area of phytocoenosis: 100 m². Contact phytocoenoses: *Ligustro-Prunetum, Origano-Brachypodietum, Thalictro-Salvietum* partially developed. 1984-08-30, 1996-06-20.

4 (1082). Dobre, loess cap in the upper part of a slope. Area of phytocoenosis: 20 m². Contact phytocoenoses: shrubs with *Corylus avellana, Origano-Brachypodietum* partially developed. 1986-05--06, 1996-06-20.

5 (1081). Dobre, loess cap in the upper part of a slope. Area of phytocoenosis: 25 m². Contact phytocoenoses: shrubs with *Corylus avellana, Festuco-Koelerietum, Origano-Brachypodietum* partially developed. 1986-05-06, 1996-06-20.

6 (451). See record no 5. Area of phytocoenosis: 50 m².

Prunetum fruticosae phytocoenoses have the character of low (up to 1 m), loose (40-60% of cover) shrubs, consisting mainly of *Prunus fruticosa* (6^{5000}). The loose layer of shrubs facilitates the development of undergrowth, which covers 50-60% of the area. The most frequent species of the undergrowth are *Origanum vulgare* (6^{1458}), *Medicago falcata* (6^{1168}), *Poa angustifolia* (6^{753}) and *Achillea pannonica* (6^{545}). The proportion of bryophytes is rather low, from the 4 species reported from here only *Camptothecium lutescens* (6^{590}) occurs permanently. The *Rhamno-Prunetea* class is represented by 8 species, among which the most frequent are *Prunus fruticosa* (6^{5000}) – a characteristic species of the association, *Cornus sanguinea* (6^{173}), *Berberis vulgaris* (6^{10}) and others. In the big group of accompanying species plants of the *Trifolio-Geranietea* (12 species) and *Festuco-Brometea* classes (24 species) predominate. From the former the most frequent and abundant are *Origanum vulgare* (6^{1458}), *Medicago falcata* (6^{1168}) and *Clinopodium vulgare* (6^{92}), from the latter *Achillea pannonica* (6^{545}), *Teucrium chamaedrys* (6^{418}), *Galium album* (6^{255}) and *Salvia pratensis* (6^{92}).

Prunetum fruticosae phytocoenoses have been reported from Dobre and Kazimierz Dolny. They form patches of between 8 to 100 m² on slopes of south,

south-western and eastern exposure or small fragments of plateaux on loess ground. They border with xerothermic grasslands: *Origano-Brachypodietum*, *Koelerio-Festucetum sulcatae* and partially developed *Thalictro-Salvietum pratensis* as well as shrubs with *Corylus avellana* and *Ligustro-Prunetum*. The border between the phytocoenoses of *Prunetum fruticosae* and *Origano-Brachypodietum* is non-distinct and often difficult to point. The contact zone of the discussed shrubs and other grasslands and shrubs is narrow and it is easy to differentiate the phytocoenoses.

Ligustro-Prunetum R. T x. 1952
Table 10

Localities of phytosociological records:

1 (324). Podgórz, slope of a road ravine. Area of phytocoenosis: 25 m². Contact phytocoenoses: *Origano-Brachypodietum* partially developed, *Consolido-Brometum*. 1984-07-10.

2 (639). Męćmierz, bottom of a ravine near the road. Area of phytocoenosis: 35 m². Contact phytocoenoses: *Festuco-Koelerietum glaucae, Lolio-Plantaginetum*. 1985-08-05.

3 (418). Dobre, upper part of a slope. Area of phytocoenosis: 140 m². Contact phytocoenoses: *Origano-Brachypodietum, Geranio-Peucedanetum* partially developed, *Aperetalia*-comm. 1984-08-13.

4 (399). See record no 3.

5 (1019). Męćmierz, edge of a plateau south of the village. Area of phytocoenosis: 16 m². Contact phytocoenoses: *Inuletum ensifoliae, Origano-Brachypodietum* partially developed. 1986-07-31.

6 (437). Dobre, upper part of a slope. Area of phytocoenosis: 60 m². Contact phytocoenoses: *Origano-Brachypodietum, Aperetalia*-comm. 1984-08-18.

7 (425). See record no 6.

8 (422). See record no 6.

9 (432). Podgórz, upper part of a slope. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Origano-Brachypodietum* partially developed, *Thalictro-Salvietum* partially developed, *Geranio-Peucedanetum* partially developed. 1984-08-18.

10 (424). Dobre, upper part of a slope. Area of phytocoenosis: 40 m. Contact phytocoenoses: *Origano-Brachypodietum, Aperetalia*-comm. 1984-08-13.

11 (413). Dobre, edge of a road and a slope. Area of phytocoenosis: 60 m. Contact phytocoenoses: *Geranio-Peucedanetum, Lolio-Plantaginetum* partially developed. 1984-08-13.

12 (667). Kazimierz Dolny, Albrechtówka, upper part of a slope. Area of phytocoenosis: 40 m². Contact phytocoenoses: *Origano-Brachypodietum, Aperetalia*-comm. 1985-08-18.

13 (335). Nasiłów, slope of a ravine. Area of phytocoenosis: 40 m². Contact phytocoenoses: *Origano-Brachypodietum, Aperetalia*-comm. 1984-07-16.

14 (1018). Męćmierz, edge of a plateau south of the village. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Origano-Brachypodietum*. 1986-07-31.

15 (1024). Męćmierz, edge of the fields on a plateau. Area of phytocoenosis: 30 m². Contact phytocoenoses: *Inuletum ensifoliae, Consolido-Brometum*. 1986-07-31.

16 (427). See record no 6. Area of phytocoenosis: 70 m².

17 (449). Dobre, upper part of a ravine. Area of phytocoenosis: 120 m². Contact phytocoenoses: *Origano-Brachypodietum* partially developed, *Aperetalia*-comm. 1984-08-22.

Table 10. Composition and structure of phytocoenoses *Ligustro-Prunetum* R. Tx. 1952

Succesive number of record	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	PRESENCE
Number of record	324	639	418	399	1019	437	425	422	432	424	413	667	35	1018	1024	427	449	452	423	426	453	454	455	459	462	617	754	1025	1027	1026	
Exposure	S	-	SW	SW	W	W	SW	SW	SW	SW	SW	-	SW	W	-	SW	SSW	SW	SW	SSW	SSW	SW	SW	SW	SW	S	S	-	-	-	
Slope inclination [°]	20	-	30	15	10	35	35	30	30	40	35	-	30	25	-	40	35	30	15	40	15	30	35	25	30	25	30	-	-	-	
Cover of shrub layer b [%]	70	80	90	70	70	80	80	60	100	80	90	100	60	80	90	90	90	70	90	80	90	80	90	90	90	90	90	90	80	70	
Cover of herb layer c [%]	50	30	20	40	40	20	20	50	20	50	20	40	20	20	20	10	30	40	20	30	20	20	20	20	10	30	20	30	30	40	
Cover of moss layer d [%]	40	<5	40	40	30	50	20	30	<5	<5	20	20	30	20	40	20	10	20	50	40	60	60	50	60	30	60	20	30	30	30	
Area of sample plot [m²]	25	35	40	35	16	60	40	60	50	40	60	40	40	30	30	70	140	50	30	50	30	40	20	25	40	60	20	40	20	50	
Number of species	24	21	25	28	27	28	29	30	28	30	36	30	25	26	24	24	27	28	25	31	31	28	28	35	23	28	22	20	21	17	
Ch. *Ligustro-Prunetum*																															
Prunus spinosa b	3.2	4.4	4.4	4.4	3.3	2.2	2.2	3.3	3.3	4.4	3.3	3.3	3.3	3.3	2.2	3.2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	V
Prunus spinosa c	+	1.1	1.1	1.1	+	1.1	1.1	1.1	+	+	+	+	+	1.1	+	+	.	.	.	.	.	+	.	+	.	.	+.	.	.	.	III
Ligustrum vulgare b	3.3	2.1	3.3	1.1	1.1	3.3	3.2	1.2	3.2	2.2	3.2	3.2	2.2	3.3	2.2	3.2	1.1	+	+	+	+	+	+	+	1.1	1.1	1.1	1.1	1.1	1.1	V
Ligustrum vulgare c	+	+	+	+	.	+	+	+	+	+	+	+	+	+	+	1.1	+	+	+	.	.	.	.	+	+	+	1.1	.	.	.	IV
Ch. **Berberidion, Rhamno-Prunetea*																															
Cornus sanguinea b	.	+	+	+	+	1.1	1.2	1.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3	3.3	3.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	4.5	4.5	4.5	V
Cornus sanguinea c	.	.	.	.	.	+	+	+	+	+	+	+	.	+	+	+	1.1	+	1.1	1.1	1.1	1.1	+	1.1	+	1.1	1.1	1.1	1.1	+	IV
**Berberis vulgaris* b/c	2.2	1.1	1.1	+	1.1	1.1	1.1	+	+	1.1	+	+	1.1	+	.	.	.	1.1	+	+	+	.	+	+	.	.	+	.	1.1	.	IV
Rosa canina b/c	.	+	.	.	.	.	1.2	1.1	.	.	+	+	+	.	.	.	+	1.1	.	+	+	+	+	+	+	.	.	.	.	.	III
**Rosa rubiginosa* b/c	+	.	+	+	+	1.2	.	+	+	1.2	1.1	.	.	.	.	1.1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	II
Viburnum opulus b	.	.	.	.	1.1	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	+	+	.	.	.	.	+	+	+	2.2	II
Crataegus monogyna b	.	.	.	.	.	.	3.2	+	+	+	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	II
Rhamnus catharticus b	.	.	.	.	2.2	.	.	.	.	.	.	.	.	2.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.	.	I
Ch. *Trifolio-Geranietea*																															
Origanum vulgare	+	1.1	+	1.1	1.2	+	1.2	1.1	+	1.2	+	2.2	+	1.1	+	+	+	2.1	1.1	1.1	+	+	+	+	+	+	+	1.1	1.1	2.1	V
Medicago falcata	2.1	1.1	+	1.1	1.2	+	+	+	+	1.2	+	2.2	.	+	1.1	+	+	.	+	+	+	+	.	.	.	.	.	.	+	.	IV
Agrimonia eupatoria	+	.	+	+	+	.	.	.	.	.	+	2.1	1.1	1.2	+	.	1.1	.	.	.	.	.	.	.	.	.	.	+	1.2	.	II
Clinopodium vulgare	.	.	.	.	.	1.1	+	.	.	.	.	.	.	.	.	+	1.1	2.1	1.1	+	+	+	+	+	+	+	.	.	.	.	II
Fragaria viridis	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	+	+	+	+	+	+	+	+	.	.	.	.	.	II
Coronilla varia	+	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	+	.	+	.	+	.	.	.	.	II
Vicia tenuifolia	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	+	.	+	.	+	+	.	.	.	.	+	.	II
Anemone sylvestris	+	.	.	.	1.1	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Galium verum	.	.	.	.	.	.	.	.	+	1.1	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	I
Thalictrum minus	.	.	+	.	.	.	+	.	.	+	+	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Peucedanum cervaria	.	.	1.1	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
Trifolium medium	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Astragallus glycyphyllos	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I
Ch. *Festuco-Brometea*																															
Galium album	+	.	+	+	1.2	+	1.1	+	+	+	+	1.2	+	.	1.2	+	+	1.1	+	+	+	+	+	+	+	+	.	.	1.2	1.1	V
Teucrium chamaedrys	1.1	.	.	2.2	2.2	1.2	.	1.2	.	+	.	+	.	.	1.1	.	+	1.1	+	+	+	+	+	+	+	+	+	.	+	2.1	1.1	IV
Euphorbia cyparissias	+	1.1	+	+	.	+	+	+	+	.	+	.	+	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	1.1	.	IV
Achillea pannonica	+	+	.	.	.	+	+	+	1.1	2.2	+	.	+	+	.	.	+	+	.	+	+	.	.	+	+	.	+	.	+	.	III
Brachypodium pinnatum	.	+	1.2	.	.	.	.	.	.	.	1.2	1.2	1.2	1.2	1.2	.	+	.	.	+	+	1.2	.	1.2	.	.	.	1.2	1.2	1.2	III
Inula ensifolia	.	.	+	.	1.2	.	.	.	.	2.2	.	.	.	.	1.1	.	.	.	.	.	+	.	.	.	+	.	+	1.1	1.1	2.2	II
Aster amellus	.	.	.	.	+	.	.	1.1	.	.	.	.	.	.	+	.	.	+	.	.	+	+	+	.	+	.	.	.	.	+	II
Salvia verticillata	.	.	.	.	1.1	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	II

Salvia pratensis	1.1	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	II
Dianthus carthusianorum	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	.	+	+	1.1	.	.	+	.	.	.	.	.	.	II
Seseli annuum	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	+	.	.	.	.	I
Carex caryophyllea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	+	+	.	.	.	.	I
Veronica spicata	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Agropyron intermedium																														
subsp. intermedium	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Asparagus officinalis	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Anthemis tinctoria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.	.	.	I
Other accompanying:																														
Pimpinella saxifraga	.	+	+	+	.	+	.	+	+	+	+	+	.	.	+	+	+	+	+	1.1	+	+	+	+	+	+	.	+	.	IV
Juniperus communis b	.	.	.	.	1.1	+	.	+	+	.	.	.	.	+	1.1	.	+	+	.	+	+	.	+	+	.	.	1.1	.	1.1	III
Dactylis glomerata	.	.	.	.	1.2	+	+	.	+	+	+	+	.	1.1	+	+	+	+	.	.	.	.	.	+	.	.	.	1.2	.	.	III
Poa angustifolia	2.2	.	.	+	.	.	+	1.2	+	1.2	1.2	.	.	+	1.2	+	.	.	.	.	+	.	+	+	.	.	.	.	.	.	III
Thymus pulegioides	+	.	.	1.2	.	.	+	1.2	+	.	+	.	+	.	.	.	.	.	+	+	+	+	+	+	.	.	.	.	.	.	III
Hypericum perforatum	+	.	.	+	.	.	+	+	+	.	.	+	+	.	.	.	.	+	.	+	.	.	.	+	.	+	.	.	.	.	II
Rubus caesius	.	.	.	.	.	.	.	.	.	+	.	1.1	.	.	.	.	+	.	+	.	+	.	.	.	.	.	2.2	+	.	II
Viola hirta	.	.	.	.	.	.	.	+	.	.	.	.	.	1.2	.	.	.	1.1	.	.	+	.	+	.	.	+	.	.	.	1.2	II
Corylus avellana	.	.	.	.	.	.	+	.	.	+	.	+	.	.	.	.	2.1	.	.	+	.	.	.	.	.	.	1.1	.	.	.	I
Leontodon hispidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	+	.	.	.	1.1	I
Daucus carota	.	.	+	+	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	I
Taraxacum officinale s. l.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	.	.	+	I
Plantago lanceolata	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	.	.	.	.	I
Briza media	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	I
Melilotus officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	.	.	.	.	.	I
Aquailegia vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.	.	.	.	I
Stachys officinalis	.	.	+	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Cichorium intybus	.	.	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Prunella vulgaris	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	I
Fallopia dumetorum	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Camptothecium lutescens	3.2	+	3.2	3.2	2.2	3.3	1.2	2.2	+	+	+	.	.	2.2	3.2	2.2	1.2	2.2	4.3	2.2	4.3	4.3	4.3	4.3	3.3	2.2	1.2	3.2	3.2	3.2	V
Eurhynchium hians	+	.	+	1.2	.	1.1	2.2	.	+	+	.	1.2	1.2	.	.	.	.	.	.	.	.	.	.	+	.	1.2	+	.	.	.	II
Amblystegium serpens	.	.	.	.	+	.	.	.	.	.	.	.	.	1.2	+	1.2	1.2	.	.	1.2	.	.	.	.	1.2	2.2	.	+	.	.	II
Abietinella abietina	+	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	2.2	.	.	1.2	+	.	.	.	.	1.2	+	II
Fissidens taxifolius	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	1.2	+	.	.	.	.	.	.	.	.	3.2	2.2	.	.	.	I
Calliergonella cuspidata	.	.	.	+	.	.	.	.	+	.	2.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Plagiomnium cuspidatum	.	.	.	+	.	.	.	.	.	.	+	+	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Campylium stellatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	I

Sporadic species:

Ch. *Rhamno-Prunetea*: *Ulmus minor* b/c 26/2.1, *Clematis vitalba* 26.

Ch. *Trifolio- Geranietea*: *Melampyrum cristatum* 6 28/1.1, *Verbascum lychnitis* 3, *Anthericum ramosum* 5/1.2, *Hieracium umbellatum* 8, *Clematis recta* 11, *Geranium sanguineum* 19.

Ch. *Festuco-Brometea*: *Sanguisorba minor* 1, 13, *Artemisia campestris* 2/1.1, 10, *Scabiosa ochroleuca* 4, 6, *Adonis vernalis* 5, 11, *Stachys recta* 6, 26, *Filipendula vulgaris* 7, 10, *Sedum maximum* 7, 16, *Anthyllis vulneraria subsp. polyphylla* 22, 24, *Carex humilis* 25, 27/1.2, *Acinos arvensis* 1, *Phleum phleoides* 10, *Potentilla arenaria* 11.

Other accompanying: *Medicago lupulina* 2/1.1, 13, *Vincentoxicum hirundinaria* 5, 14/1.1, *Plagiomnium rostratum* 9, 12, *Knautia arvensis* 11, 14, *Hepatica nobilis* 14, 30, *Fraxinus excelsior* b 15, 28, *Poa nemoralis* 20, 26/1.2, *Artemisia vulgaris* 2, *Conyza canadensis* 2, *Trifolium arvense* 2, *Urtica dioica* 2, *Cuscuta epithymum* 7, *Streblotrichum convolutum* 8/1.2, *Lithospermum officinale* 8, *Primula veris* 8, *Senecio jacobaea* 8, *Festuca rubra* 12, *Silene alba* 12, *Convolvulus arvensis* 13, *Eryngium planum* 13/r, *Solidago gigantea* 13, *Pastinaca sativa* 15, *Silene otites* 16, *Pinus sylvestris* b 18, *Campanula trachelium* 27/1.1.

18 (452). Dobre, foot of a ravine slope. Area of phytocoenosis: 50 m². Contact phytocoenoses: *Origano-Brachypodietum*. 1984-08-22.

19 (423). Dobre, slope foot at the opening of a ravine. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Origano-Brachypodietum* partially developed. 1984-08-13.

20 (426). Dobre, erosion channel in the upper part of a slope. Area of phytocoenosis: 80 m². Contact phytocoenoses: comm. with *Salvia verticillata*. 1984-08-13.

21 (453). Dobre, slope foot. Area of phytocoenosis:100 m². Contact phytocoenoses: *Origano-Brachypodietum, Inuletum ensifoliae*. 1984-08-27.

22 (454). See record no 21.

23 (455). See record no 20.

24 (459). See record no 21.

25 (462). Dobre, erosion channel in the upper part of a slope. Area of phytocoenosis: 80 m². Contact phytocoenoses: *Inuletum ensifoliae*. 1984-08-27.

26 (617). Kazimierz Dolny, Góra III Krzyży, middle part of a slope. Area of phytocoenosis: 60 m². Contact phytocoenoses: comm. with *Ulmus minor*. 1985-07-31.

27 (754). Bochotnica, slope above the quarry. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Origano-Brachypodietum* partially developed. 1986-04-31.

28 (1025). Męćmierz, edge of the fields south of the village. Area of phytocoenosis: 40 m². Contact phytocoenoses: *Inuletum ensifoliae, Consolido-Brometum*. 1986-07-31.

29 (1027). Męćmierz, erosion channel. Area of phytocoenosis: 20 m². Contact phytocoenoses: *Inuletum ensifoliae, Origano-Brachypodietum*. 1986-07-31.

30 (1026). See record no 29.

Ligustro-Prunetum phytocoenoses have the form of dense shrubs made up mainly of *Cornus sanguinea* (V^{4018}), *Prunus spinosa* (V^{2138}), *Ligustrum vulgare* (V^{1511}) and *Berberis vulgaris* (IV^{212}). The layer of undergrowth is poorly developed, it usually covers 20-30% of the area, and when the shrubs grow more loosely, the cover of this layer reaches 50%. Apart from seedlings and young shrubs, *Origanum vulgare* (V^{363}), *Galium album* (V^{123}), *Medicago falcata* (IV^{205}), *Teucrium chamaedrys* (IV^{279}) and *Pimpinella saxifraga* (IV^{24}) always occur in the undergrowth layer. In most of the phytocoenoses, the layer of bryophytes is well developed, with the cover reaching up to 60%. From the 10 species of bryophytes reported from the analysed phytocoenoses only *Camptothecium lutescens* (V^{1152}) occurs here permanently.

The syntaxonomic composition of *Ligustro-Prunetum* phytocoenoses can be presented as follows: among the 102 species of vascular plants reported from the analysed phytocoenoses 11 are characteristic of *Rhamno-Prunetea*. Apart from species characteristic of the association: *Prunus spinosa* (V^{2138}) and *Ligustrum vulgare* (V^{1511}) as well as *Cornus sanguinea* (V^{4018}) and *Berberis vulgaris* (IV^{212}), other species of the class occur sparsely and in few phytocoenoses. The undergrowth, rich in species, consists mainly of plants of the *Trifolio-Geranietea* (19 species) and *Festuco-Brometea* classes (26 species); however, only few species of *Trifolio-Geranietea*: *Origanum vulgare* (V^{365}) and *Medicago falcata* (IV^{205}), and of *Festuco-Brometea*: *Galium album* (V^{123}) and *Teucrium chamaedrys* (IV^{279}) occur here as a permanent element.

The internal variability of the association shows in the facial formation of the bush layer. Phytocoenoses with *Prunus spinosa* and *Ligustrum vulgare* as the dominant species (records 1-16) (Table 10) as well as those where *Cornus sanguinea* predominates (records 17-30) have been observed.

In the area of the Kazimierz Landscape Park *Ligustro-Prunetum* shrubs occur usually on slopes with southern, south-western and western exposure, on soils formed of marls and loesses (Dobre, Podgórz, Kazimierz, Nasiłów, Bochotnica). Rarely do they occupy small patches on plateaux (Męćmierz). Phytocoenoses of the discussed association usually have the form of a belt of shrubs covering up to 140 m^2 at the foot and on the top of a slope, separating xerothermic grasslands (*Origano-Brachypodietum, Inuletum ensifoliae*) from fields and gardens. While the border-line between the phytocoenoses in question and crops is very sharp, the change from shrubs to grasslands, in particular to *Origano-Brachypodietum*, is gradual. Typical "saum" communities (*Geranio-Peucedanetum*) seldom occur here. The role of such communities in *Ligustro-Prunetum* growing in erosion channels is played by a very narrow belt of *Origano-Brachypodietum* which on strongly eroded slopes passes gradually into a loose grassland with *Salvia verticillata*.

Community with *Ulmus minor* var. *suberosa*
Table 11

Localities of phytosociological records:

1 (347). Nasiłów, slope south of the quarries. Area of phytocoenosis: 40 m^2. Contact phytocoenoses: *Ligustro-Prunetum* partially developed, *Origano-Brachypodietum*. 1984-07-16.

2 (613). Kazimierz Dolny, Góra III Krzyży, upper part of a slope. Area of phytocoenosis: 50 m^2. Contact phytocoenoses: *Ligustro-Prunetum*, *Origano-Brachypodietum* partially developed. 1985-07-31.

3 (614). Kazimierz Dolny, Góra III Krzyży, middle part of a slope. Area of phytocoenosis: 120 m^2. Contact phytocoenoses: *Ligustro-Prunetum*, *Thalictro-Salvietum*. 1985-07-31.

4 (621). See record no 3.

5 (750). Bochotnica, slope above the quarry. Area of phytocoenosis: 70 m^2. Contact phytocoenoses: *Ligustro-Prunetum*. 1986-04-28.

The community has the form of loose shrubs where *Ulmus minor* var. *suberosa* (5^{6750}) predominates. Other species that make up the bush layer belong to *Rhamno-Prunetea*, mainly to *Berberidion*. Of this group of plants the only permanent species is *Cornus sanguinea* (5^{456}). The layer of undergrowth covers from 10 to 40% of the area. The most frequent and the most abundant species here are *Origanum vulgare* (5^{804}), *Medicago falcata* (5^{750}), *Achillea pannonica* (5^{206}) and *Pimpinella saxifraga* (5^{108}). The layer of bryophytes with the cover of 10-40% consists mainly of *Eurhynchium hians* (5^{1800}) and *Camptothecium*

Table 11. Composition and structure of phytocoenoses of community with *Ulmus minor* var. *suberosa*

Succesive number of record	1	2	3	4	5
Number of record	347	613	614	621	750
Exposure	E	SSW	S	S	SW
Slope inclination [°]	25	30	30	30	35
Cover of shrub layer b [%]	70	70	70	60	80
Cover of herb layer c [%]	10	30	20	40	20
Cover of moss layer d [%]	40	40	40	30	10
Area of sample plot [m^2]	40	30	50	50	70
Number of species	31	34	28	30	29
D. comm. with *Ulmus minor*					
Ulmus minor var. suberosa b	4.4	4.3	4.3	4.3	5.5
Ulmus minor var. suberosa c	+	.	+	.	.
Ch. *Berberidion*					
Cornus sanguinea b/c	2.2	1.1	+	+	+
Rosa rubiginosa	.	+	+	+	+
Ligustrum vulgare b/c	+	.	.	.	+
Berberis vulgaris b	.	.	.	+	+
Ch. *Rhamno-Prunetea*					
Prunus spinosa b	.	+	1.2	.	.
Viburnum opulus b	+	+	.	.	.
Clematis vitalba	.	+	+	.	.
Rhamnus catharticus b	.	.	.	+	+
Ch. *Trifolio-Geranietea*					
Medicago falcata	1.1	1.1	1.1	2.2	1.1
Origanum vulgare	1.1	2.1	2.1	+	+
Clinopodium vulgare	+	+	+	+	+
Agrimonia eupatoria	+	+	.	.	+
Fragaria viridis	+	.	.	.	+
Coronilla varia	.	+	.	+	.
Ch. *Festuco-Brometea*					
Achillea pannonica	+	+	1.1	1.1	+
Euphorbia cyparissias	+	1.1	+	+	+
Brachypodium pinnatum	+	+	+	+	+
Centaurea rhenana	+	+	+	+	.
Acinos arvensis	+	+	+	.	+
Hieracium piloselloides	+	+	.	2.2	.
Scabiosa ochroleuca	+	+	+	.	.
Salvia verticillata	.	+	.	1.1	.
Galium album	+	+	.	.	.
Other accompanying:					
Pimpinella saxifraga	+	+	+	1.1	+
Hypericum perforatum	+	+	+	+	.
Viola hirta	+	+	+	.	+
Taraxacum officinale s. l.	+	+	.	.	1.1
Festuca rubra	.	1.2	+	+	.
Senecio jacobaea	+	+	+	.	.
Daucus carota	+	+	.	+	.
Lonicera caprifolium	.	.	+	2.2	.
Dactylis glomerata	+	+	.	.	.
Leucanthemum vulgare	+	+	.	.	.
Euonymus verrucosa b	+	.	.	.	+
Cichorium intybus	.	+	+	.	.
Eurhynchium hians	1.2	3.2	3.3	1.2	1.2
Camptothecium lutescens	2.2	+	2.2	2.2	1.2
Abietinella abietina	2.2	.	.	.	+
Barbula unguiculata	.	.	+	1.2	.

Sporadic species:
Ch. *Festuco-Brometea*: *Allium oleraceum* 2, *Veronica austriaca* 2, *Agropyron intermedium subsp. intermedium* 3, *Stachys recta* 3, *Anthemis tinctoria* 4, *Campanula sibirica* 4, *Plantago media* 4, *Potentilla arenaria* 4, *Sanguisorba minor* 4, *Carex michelii* 5/1.1, *Carex humilis* 5/1.2.
Other accompanying: *Geum urbanum* 1, *Trifolium pratense* 2, *Carduus acanthoides* 3, *Plantago lanceolata* 3, *Torilis japonica* 3/r, *Bryum capillare* 4, *Poa angustifolia* 4, *Chamaecytisus ruthenicus* 5, *Corylus avellana* b 5, *Juniperus communis* b 5, *Quercus robur* b 5.

lutescens (5^{1152}). The number of species in individual phytocoenoses ranges from 26 to 34. From the 62 species of vascular plants reported from the analysed phytocoenoses 9 are species characteristic of *Rhamno-Prunetea*. In the big group of accompanying species, those of the *Trifolio-Geranietea* (9 species) and *Festuco-Brometea* (20 species) classes are the most numerous. The most frequent are *Origanum vulgare* (5^{804}), *Medicago falcata* (5^{750}), *Achillea pannonica* (5^{206}), *Euphorbia cyparissias* (5^{108}), *Brachypodium pinnatum* (5^{10}) and *Clinopodium vulgare* (5^{10}).

Communities with *Ulmus minor* var. *suberosa* have been reported from Kazimierz Dolny, Nasiłów and Bochotnica. They grow on slopes with southern, south-western and eastern exposure, on shallow rendzinas formed of chalk deposits. Phytocoenoses with the area between 40 and 120 m^2 occur in *Ligustro-Prunetum* shrubs and come in contact with xerothermic grasslands (*Origano-Brachypodietum, Thalictro-Salvietum*).

CONCLUSION

From the area of the Kazimierz Landscape Park (SE Poland) 8 associations of xerothermic grasslands have been reported: phytocoenoses of 2 of them (the cl. *Sedo-Scleranthetea*) occur on sandy substrata, those of the remaining 6 (the cl. *Festuco-Brometea*) can be found on soils formed from carbonate rocks. Xerothermic shrubs phytocoenoses have been classified into 2 associations and 1 community of the *Rhamno-Prunetea* class. Between the grasslands and xerothermic shrubs occur "saum" phytocoenoses, which have been classified as belonging to 2 associations of the *Trifolio-Geranietea* class.

Xerothermic grasslands found in Poland have on extrazone character. Their origin is connected with human activity, and species composition reflects the routes of Quarternary migrations of species. The Kazimierz Landscape Park is located on the route from Podolia and Volhynia through the Lublin Upland to the valley of the lower Vistula. Another possible migration route lead through the Moravian Gate, the Little Poland Upland to the valley of the lower Vistula (Kornaś, Medwecka-Kornaś 1977).

The composition of the analysed phytocoenoses partialy reflects the unique location of the Park on the junction of the two migration routes. It can be observed on the example of grasslands with *Stipa capillata* as the dominant species, which have been described as *Potentillo-Stipetum capillatae* and *Sisymbrio-Stipetum capillatae*. The former has locations on the lower Oder and Vistula (Ceynowa 1968, Filipek 1974), the latter – on the Kielce-Sandomierz Upland (Głazek 1968, Cieśliński 1979), in the Nida Basin (Dziubałtowski 1925, Medwecka-Kornaś 1959) and on the Little Poland Upland (Kozłowska 1928). The grasslands with *Stipa capillata* from Kazimierz Dolny and Dobre have the character of simplified *Sisymbrio-Stipetum capillatae*.

Also simplified are the *Thalictro-Salvietum* pratensis phytocoenoses. The *Thalictro-Salvietum* has been reported from the Nida Basin, where it grows on gypsum rendzinas (Medwecka-Kornaś 1959). From the characteristic species of this association, *Eryngium campestre, Campanula bononiensis* and *Ranunculus illiricus* do not occur in the Kazimierz Landscape Park.

Inuletum ensifoliae in the western part of the Lublin Upland also lacks some of its characteristic species. Among the species listed by Kozłowska (1926) the following are missing in the *Inuletum ensifoliae* phytocoenoses: *Cirsium pannonicum, Iris apylla, Linum flavum* and *L. hirsutum*. Some of them have been reported in the phytocoenosis of this association from the eastern part of the Lublin Upland (Fijałkowski, Izdebski 1959) and on the Western Volhynia Upland (Kulczyński, Motyka 1936).

Grasslands with *Brachypodium pinnatum* as the dominant species are the most frequent association of the *Festuco-Brometea* class on the Lublin Upland. They have been described as associations of *Brachypodium pinnatum-Teucrium chamaedrys, Brachypodio-Teucrietum* (Fijałkowski 1962, 1965) and *Adonido-Brachypodietum* (Fijałkowski, Adamczyk 1980). Such grasslands from the Kazimierz Landscape Park have been classified into *Origano-Brachypodietum*, reported from the Ojców National Park and the Pieniny Mts. (Medwecka-Kornaś, Kornaś 1963, Grodzińska 1970). The syntaxonomic position of the grasslands with *Brachypodium pinnatum* from the Lublin Upland is not clear and requires a further syntaxonomic analysis not only through comparing it with similar grasslands in Poland but also in the Ukraine.

The classification of the remaining xerothermic grasslands into proper associations does not pose any difficulties. *Koelerio-Festucetum sulcatae* from the Kazimierz LP does not differ considerably from the phytocoenoses reported from the uplands of southern Poland (Medwecka-Kornaś 1959, Medwecka-Kornaś, Kornaś 1963, Cieśliński 1979, Głazek 1968, 1985).

The *Festuco-Koelerietum glaucae* association has been described from the Czech Republic (Klika 1931), it grows in the areas with continental climate and its composition resembles that of Eastern European sandy steppes of the *Festucetalia vaginae* order from the Pontic-Pannonian area (Matuszkiewicz 1981). In Poland it occurs in dispersal localities in the upland of the southern Poland (Fijałkowski 1967, Cieśliński 1979), on the lower Vistula and Oder (Ceynowa 1968, Radomski, Jasnowska 1965) and near Wrocław (Wika 1975).

Among grasslands occuring on sandy soils the most freguent is *Spergulo-Corynephoretum*. It occurs widely in Poland (Czyżewska 1997, Fijałkowski 1967, Głazek 1985, Cieśliński 1979, Wika 1975). Grasslands with *Corynephorus canescens* are widespread in Central Europe (Oberdorfer 1978, Mucina, Maglocky 1985).

"Saum" associations found in the Kazimierz LP are rarely reported from the area of Poland. Apart from the data from Great Poland (Brzeg 1988), the

records that can be classified as *Geranio-Peucedanetum* are found on tables of *Peucedano cervariae-Coryletum* (Fijałkowski 1962, Ceynowa 1968), *Carici--Inuletum* (Fijałkowski 1962) and *Brachypodio-Teucrietum* (Fijałkowski 1965). It seems that the association is quite frequent but so far it has not been distinguished as a separate one by Polish authors. *Geranio-Trifolietum* has been reported only from Great Poland (Brzeg 1988). Both of these associations have been found in the neighbouring countries (Lang 1973, Oberdorfer 1978, Mucina, Maglocky 1985).

Among associations of xerothermic shrubs *Prunetum fruticosae* is particularly worth noting. These shrubs are widespread in the uplands of southern Poland (Fijałkowski, Izdebski 1959, Fijałkowski, Wawer 1982, Głazek 1968, 1985, Dziubałtowski 1925). Similar phytocoenoses have been reported from the valley of the lower Vistula (Ceynowa 1968). Thermophilous shrubs with *Prunus fruticosa* are described as communities of the Pontic-Pannonian type of range, widespread in south-eastern Europe (Matuszkiewicz 1981).

Shrubs with *Ulmus minor* var. *suberosa* are known from the Lublin Upland (Fijałkowski 1965, Fijałkowski, Adamczyk 1980). *Ligustro-Prunetum* occurs in southern Poland (Fijałkowski, Adamczyk 1980, Głazek 1968, Matuszkiewicz 1981) and in the neighbouring countries (Oberdorfer 1957, Lang 1973, Müller 1974, Mucina, Maglocky 1985).

REFERENCES

1. Braun-Blanquet J.: Pflanzensoziologie Grundzüge der Vegetationskunde. Springer, Wien--New York 1964.
2. Brzeg A.: Ciepłolubne zbiorowiska okrajkowe z klasy *Trifolio-Geranietea sanguinei* w Wielkopolsce. Pozn. Tow. Przyj. Nauk, Prace Kom. Biol. **71**, 1-65 (1988).
3. Ceynowa M.: Zbiorowiska roślinności kserotermicznej nad dolną Wisłą. Stud. Soc. Sc. Torun. sectio D **8**, 1-156 (1968).
4. Cieśliński S.: Udział oraz rola diagnostyczna porostów naziemnych w zbiorowiskach roślin naczyniowych Wyżyny Kielecko-Sandomierskiej i jej pobrzeży. WSP, Kielce 1979.
5. Czyżewska K.: Pionierskie murawy napiaskowe Polski. [in:] Roślinność obszarów piaszczystych. Ed. S. Wika. WBiOŚ UŚ, ZJPK, Katowice-Dąbrowa Górnicza 1977, pp. 67-80.
6. Dierschke H.: Saumgesellschaften im Vegetations- und Standortsgefälle an Waldrändern. Scripta geobot. **6**, 1-246 (1974).
7. Dziubałtowski S.: Les associations steppiques sur la Petite Pologne et leurs succesions. Acta Soc. Bot. Pol. **3**, 164-195 (1925).
8. Fijałkowski D.: Rezerwat leśny Bachus koło Chełma. Ann. Univ. Mariae Curie-Skłodowska, sectio C **14**, 297-342 (1961).
9. Fijałkowski D.: Miłek wiosenny (*Adonis vernalis* L.) w województwie lubelskim. Ann. Univ. Mariae Curie-Skłodowska, sectio C **16**, 49-76 (1962).
10. Fijałkowski D.: Zbiorowiska kserotermiczne okolic Izbicy na Wyżynie Lubelskiej. Ann. Univ. Mariae Curie-Skłodowska, sectio C **19**, 239-259 (1965).
11. Fijałkowski D.: Zbiorowiska roślinne lewobrzeżnej doliny Bugu w granicach województwa lubelskiego. Ann. Univ. Mariae Curie-Skłodowska, sectio C **21**, 247-312 (1967).

12. Fijałkowski D., Adamczyk B.: Roślinność stepowa w Broczówce k. Skierbieszowa. Ann. Univ. Mariae Curie-Skłodowska, sectio C **35**, 65-76 (1980).
13. Fijałkowski D., Izdebski K.: Zbiorowiska stepowe na Wyżynie Lubelskiej. Ann. Univ. Mariae Curie-Skłodowska, sectio B **12**, 167-199 (1959).
14. Fijałkowski D., Wawer M.: Wiśnia karłowata (*Cerasus fruticosa* (Pall.) Woronow) na Lubelszczyźnie. Ann. Univ. Mariae Curie-Skłodowska, sectio C **37**, 303-312 (1982).
15. Filipek M.: Murawy kserotermiczne regionu dolnej Odry i Warty. Pozn. Tow. Przyj. Nauk, Prace Kom. Biol. **38**, 1-110 (1974).
16. Głazek T.: Roślinność kserotermiczna Wyżyny Sandomierskiej i Przedgórza Iłżeckiego. Monogr. Bot. **25**, 1-135 (1968).
17. Głazek T.: Szata roślinna wybranych powierzchni obszaru Gór Świętokrzyskich i terenów przyległych na tle warunków siedliskowych. Fragm. Faun. **29**, 153-234 (1985).
18. Grodzińska K.: Zbiorowiska kserotermiczne Skalic Nowotarskich i Spiskich (Pieniński Pas Skałkowy). Fragm. Flor. et Geobot. **16**, 401-432 (1970).
19. Grolle R.: Verzeichnis der Lebermoose Europas und benachbarter Gebiete. Fedd. Repert. **87**, 171-279 (1976).
20. Klika J.: O rostlinnych společenstvech a jejich sukcesi na obnažených písečných pudach lesních ve středním Polabí. Sbor. Čes. Acad. Zeměd. 6A (1931).
21. Kornaś J., Medwecka-Kornaś A.: In: Zespoły stepów i suchych muraw. [in:] Szata roślinna Polski. Ed. W. Szafer, K. Zarzycki. **1**. PWN, Warszawa 1977, pp. 352-366.
22. Kozłowska A.: Zmienność kostrzewy owczej (*Festuca ovina* L.) w związku z sukcesją zespołów stepowych na Wyżynie Małopolskiej. Spraw. Kom. Fizjogr. **60**, 63-110 (1926).
23. Kozłowska A.: Naskalne zbiorowiska roślin na Wyżynie Małopolskiej. Rozpr. Wydz. Mat.-Przyr. PAU, Ser. A/B **67**, 325-373 (1928).
24. Kucharczyk M.: Zespoły i zbiorowiska roślinne Kazimierskiego Parku Krajobrazowego. I. Zespoły łąkowe i pastwiskowe. Ann. Univ. Mariae Curie-Skłodowska, sectio C **51**, 105-132 (1996).
25. Kulczyński S., Motyka J.: Zespoły leśne i stepowe okolic Łysej Góry koło Złoczowa. Kosmos, Ser. A **61**, 187-217 (1936).
26. Lang G.: Die Vegetation des westlischen Bodenseegebietes. Pflanzensoziologie **17**, 1-451 (1973).
27. Matuszkiewicz W.: Przewodnik do oznaczania zbiorowisk roślinnych Polski. PWN, Warszawa 1981.
28. Medwecka-Kornaś A.: Roślinność rezerwatu stepowego „Skorocice" koło Buska. Ochr. Przyr. **26**, 172-260 (1959).
29. Medwecka-Kornaś A., Kornaś J.: Mapa zbiorowisk roślinnych Ojcowskiego Parku Narodowego. Ochr. Przyr. **29**, 17-87 (1963).
30. Medwecka-Kornaś A., Kornaś J., Pawłowski B., Zarzycki K.: Przegląd ważniejszych zespołów roślinnych Polski. [in:] Szata roślinna Polski. Ed. W. Szafer, K. Zarzycki. **1**. PWN, Warszawa 1977, pp. 279-481.
31. Mirek Z., Piękoś-Mirek H., Zając A., Zając M.: Vascular plants of Poland. A checklist. Polish Botanical Studies, Guidebook Series **15**, 1-303 (1995).
32. Mucina L., Maglocky S.: A List of Vegetation Units of Slovakia. Doc. Phytosoc. N.S. **9**, 175-220 (1985).
33. Müller Th.: Die Saumgesellschaften der Klasse *Trifolio-Geranietea sanguinei*. Mitt. flor.-soz. Arbeitsgem. N.F. **9**, 95-140 (1962).
34. Müller Th.: Gebuschgesellschaften im Taubergiessengebiet in das Taugebiessengebiet, eine Rheinauenlandschaft. Die Natur. und Landschaftschutzgebiet **7**, 400-421 (1974).
35. Oberdorfer E.: Süddeutsche Pflanzengesellschaften. Pflanzensoziol. **10**, 1-564 (1957).
36. Oberdorfer E.: Süddeutsche Pflanzengesellschaften. Teil II. G. Fischer Verlag, Stuttgart-New York 1978.

37. Ochyra R., Szmajda P.: An Annotated List of Polish Mosses. Fragm. Flor. et Geobot. **24**, 93-145 (1978).
38. Pawłowski B.: Skład i budowa zbiorowisk roślinnych oraz metody ich badania. [in:] Szata roślinna Polski. Ed. W. Szafer, K. Zarzycki, **1**, PWN, Warszawa 1977, pp. 237-278.
39. Radomski J., Jasnowska J.: Roślinność zbiorowisk murawowych na zachodniej krawędzi doliny dolnej Odry. Cz. III. Charakterystyka fitosocjologiczna muraw kserotermicznych. Zesz. Nauk. WSR Szczecin **19**, 69-83 (1965).
40. Wika S.: Roślinność zbiorowisk murawowych okolic Kamionny i Dormowa w powiecie międzychodzkim. Pozn. Tow. Przyj. Nauk, Prace Kom. Biolog. **40**, 1-48 (1975).

STRESZCZENIE

Na terenie Kazimierskiego Parku Krajobrazowego (SE Polska) stwierdzono występowanie fitocenoz 8 zespołów muraw kserotermicznych: dwóch napiaskowych z klasy *Sedo-Scleranthetea* i 6 z klasy *Festuco-Brometea* występujących na skałach węglanowych i lessach. Kserotermiczne zarośla zakwalifikowano do 2 zespołów i jednego zbiorowiska z klasy *Rhamno-Prunetea*. Na obrzeżach zarośli występują fitocenozy okrajkowe, które zakwalifikowano do 2 zespołów z klasy *Trifolio-Geranietea*.

Skład obserwowanych fitocenoz po części odzwierciedla specyficzne położenie Parku na styku dwóch szlaków migracyjnych (21). Można to zaobserwować w przypadku muraw z panującą *Stipa capillata*, które były opisywane jako *Potentillo-Stipetum capillatae* i *Sisymbrio-Stipetum capillatae*. Pierwszy z zespołów ma stanowiska nad dolną Odrą i Wisłą (3, 15), drugi – na Wyż. Kielecko-Sandomierskiej (4, 16), w Niecce Nidziańskiej (7, 28) i na Wyż. Małopolskiej (23). Murawy ze *Stipa capillata* z Kazimierza Dolnego i Dobrego mają charakter uproszczonego *Sisymbrio-Stipetum capillatae*.

Uproszczony charakter mają także fitocenozy *Thalictro-Salvietum pratensis*. Zespół *Thalictro-Salvietum* został opisany z Niecki Nidziańskiej, gdzie występuje na rędzinach gipsowych (28). Spośród gatunków charakterystycznych na badanym terenie nie występują: *Eryngium campestre*, *Campanula bononiensis* i *Ranunculus illiricus*.

Inuletum ensifoliae w zachodniej części Wyżyny Lubelskiej również pozbawiony jest części gatunków charakterystycznych. Spośród podawanych przez Kozłowską (22) gatunków charakterystycznych nie występuje tu: *Cirsium pannonicum*, *Iris apylla*, *Linum flavum* i *L. hirsutum*. Część z tych gatunków była notowana w fitocenozach tego zespołu we wschodniej części Wyżyny Lubelskiej (13) i na Wyż. Zachodniowołyńskiej (25).

Murawy z panującą *Brachypodium pinnatum* są najczęstszym zbiorowiskiem z klasy *Festuco-Brometea* na Wyż. Lubelskiej. Były one opisywane jako zbiorowisko *Brachypodium pinnatum-Teucrium chamaedrys*, *Brachypodio-Teucrietum* (9, 10) i *Adonido-Brachypodietum* (12). Murawy z panującą *Brachypodium pinnatum* w KPK zakwalifikowano do *Origano-Brachypodietum* opisywanego z Ojcowskiego Parku Narodowego i z Pienin (18, 29). Pozycja syntaksonomiczna muraw z *Brachypodium pinnatum* z Wyżyny Lubelskiej nie jest jasna i wymaga szczegółowych badań syntaksonomicznych.

Zakwalifikowanie pozostałych muraw kserotermicznych do poszczególnych zespołów nie nastręczało trudności. *Koelerio-Festucetum sulcatae* z Kazimierskiego PK nie różni się istotnie od fitocenoz opisanych z wyżyn południowej Polski (4, 16, 17, 28, 29). Podobnie *Festuco-Koelerietum glaucae*, który został opisany z Czech (20), a w Polsce występuje na rozproszonych stanowiskach w pasie wyżyn (4, 11), nad dolną Wisłą i Odrą (3, 39) oraz w okolicach Wrocławia (40). Swoim składem nawiązuje do południowo-wschodnioeuropejskich stepów piaskowych z rzędu *Festucetalia vaginae* obszaru pontyjsko-pannońskiego (27).

Spośród muraw napiaskowych najpospolitszym zespołem w KPK jest *Spergulo-Corynephoretum*. Występuje w całej Polsce (4, 5, 11, 17, 40). Murawy z *Corynephorus canescens* są także szeroko rozpowszechnione w środkowej Europie (32, 36).

Stwierdzone w KPK zespoły okrajkowe były rzadko opisywane z terenu Polski. Poza danymi z Wielkopolski (2), zdjęcia, które można zaliczyć do *Geranio-Peucedanetum* można odnaleźć w tabelach *Peucedano cervariae-Coryletum* (3, 9), *Carici-Inuletum* (9) i *Brachypodio-Teucrietum* (10). Wydaje się, że zespół ten jest szerzej rozpowszechniony, lecz dotychczas nie wyróżniany przez polskich autorów. *Geranio-Trifolietum* podawano jedynie z Wielkopolski (2). Obydwa zespoły opisywane były z krajów sąsiednich (26, 32, 36).

Spośród zespołów zarośli kserotermicznych na szczególną uwagę zasługuje *Prunetum fruticosae*. Zarośla te są dość rozpowszechnione na wyżynach południowej Polski (7, 13, 14, 16, 17). Zbliżone fitocenozy zostały opisane z doliny dolnej Wisły (3). Ciepłolubne zarośla z *Prunus fruticosa*, określane jako zbiorowiska o pontyjsko-pannońskim typie zasięgu, rozpowszechnione są w południowo-wschodniej Europie (27).

Zarośla z *Ulmus minor* var. *suberosa* znane są z Wyżyny Lubelskiej (10, 12). *Ligustro-Prunetum* występuje w południowej Polsce (12, 16, 27), a także w krajach sąsiednich (26, 32, 34, 35).