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Diversity of xerothermic grasslands in the Bug River valley
(in the neighbourhood of Kryłów and Stare Stulno)

Zróżnicowanie muraw kserotermicznych w dolinie Bugu
(okolice Kryłowa i Starego Stulna)

SUMMARY

The paper presents the results of geobotanical studies conducted on xerothermic grasslands located on the slopes of the Bug River valley near Kryłów, Kosmów and Stare Stulno. Patches of 4 associations and 2 communities of xerothermic grasslands of the class *Festuco-Brometea* and *Trifolio-Geranietea sanguinei* were found in this area. The share of xerothermic species was distinct in patches of semi-ruderal communities of *Elymus hispidus* and *Elymus repens*. Rare and protected plant species were present in the studied communities. Some fragments of the studied slopes appeared floristically valuable. Localities abundant in rare species, e.g., *Nepeta pannonica* (c.a. 200 specimens) and *Euphorbia villosa* (more than 50 clumps) were found. The most valuable objects should be legally protected as nature reserves or ecological grounds.

STRESZCZENIE

W pracy przedstawiono wyniki badań geobotanicznych przeprowadzonych na murawach kserotermicznych zlokalizowanych na zboczach doliny Bugu w okolicach Kryłowa, Kosmowa i Starego Stulna. Stwierdzono tu występowanie płatów 4 zespołów i 2 zbiorowisk muraw kserotermicznych z klasy *Festuco-Brometea* i *Trifolio-Geranietea sanguinei*. Udział gatunków kserotermicznych zaznaczał się także w płatach półruderalnych zbiorowisk z *Elymus hispidus* i *Elymus repens*. W badanych zbiorowiskach występowały rzadkie i chronione gatunki roślin. Niektóre fragmenty badanych zboczy okazały się cenne florystycznie. Odnaleziono na nich bogate stanowiska rzadkich gatunków, jak: *Nepeta pannonica* (ok. 200 okazów) oraz *Euphorbia villosa* (ponad 50 kęp). Najcenniejsze obiekty powinny być objęte ochroną prawną jako rezerваты lub użytki ekologiczne.

Key words: xerothermic grasslands, Bug River valley, neighbourhood of Kryłów and Stare Stulno

INTRODUCTION

The most typical xerothermic grasslands occur only in some regions of Poland, which provide specific climatic, geomorphological and soil conditions, i.e. in Małopolska and Lubelska Uplands, Volhynia, Silesia, near Przemyśl, and along the lower Vistula and Oder Rivers in northern Poland (19).

Remnants of steppe communities in the Lubelskie region have survived on the warm and steep slopes of river valleys, gullies, and ravines (3, 5, 8, 9, 10, 14, 15, 21). According to Kucharczyk (13), the current distribution of xerothermic grasslands in the Lubelskie region is distinctly centred (the western centre – at the western and north-western edge of the Lubelska Upland, and the eastern centre – Western Volhynia and the eastern part of the Lubelska Upland, i.e. Pagóry Chełmskie and Działy Grabowieckie). Currently, most of the patches are of secondary nature. They are the effect of extensive herding and agricultural activities on fallow hills and slopes that were difficult to cultivate. The xerothermic grasslands located at the edges of the Bug River valley near Mielnik (2), Czumów and Gródek (4, 22, 20) are especially interesting.

The study presented in this paper was carried out on small patches of xerothermic grassland located on dry hills and steep slopes of the Bug River valley near Kryłów, Kosmów and Stare Stulno.

RESEARCH METHODS

The basic geobotanical research was conducted in 2010–2011, mainly in June and July, i.e. in the period of full vegetation of xerothermic grasslands. Thirty three phytosociological relevés were taken with the Braun-Blanquet method (1). The phytosociological classification and nomenclature follow the papers by Matuszkiewicz (16) and Fijałkowski (6). The names of vascular plants are consistent with the work by Mirek et al. (17). Occurrence and distribution of rare and protected plants were also studied.

STUDY OBJECTS

The study involved plant communities of small patches of grasslands near Kryłów, Kosmów and Stare Stulno. Near Kryłów, the grasslands occurred on the steep and undulating escarpment of the Bug River valley. The escarpment forms a vast arch (up to 2.5 km long) adjacent to the Bug River in the north and to Kryłów in the south. It rises with its steep slopes (with an eastern and south-eastern aspect) 5–15 m above the valley bottom. Close to the grasslands, there are meadow communities (in the valley) and arable fields (on the hill plateau). Another study object is situated at the edge of the valley escarpment near the village of Kosmów; it borders arable lands in the south-west and forest and shrub communities growing on a steep slope of the Bug River valley in the north-east. The next object is part of the western slope of “Grybiniowa Góra”, which is located near Stare Stulno. Meadow and forest communities predominate in the surroundings.

In terms of administration, the study objects are located in the districts of Mircze and Wola Uhruska in the Lublin province. According to the physical-geographical division developed by Kondracki (11), they are located in the Hrubieszowska Basin, which is part of the Volyn Upland (Kryłów and Kosmów) and the Łęczyńsko-Włodawska Plain (Stare Stulno) – a mesoregion of the Western Pole-

Zwarcie warstwy runa c w % Cover of herb-layer c in %	100	90	100	90	100	100	90	90	90	90	80	80	100	100
Zwarcie warstwy mchów d w % Cover of moss-layer d in %	.	.	90	.	.	.	.	.	.	.	.	.	.	.
Powierzchnia zdjęcia w m ² Record surface in m ²	50	50	10	20	50	50	5	10	20	40	20	20	50	5
<i>Quercus robur</i> b	+	.	+	+	1	.	.	.	.	.	.	.	.	.
<i>Alnus glutinosa</i> b	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Prunus spinosa</i> b	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Frangula alnus</i> b	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Tilia cordata</i> b	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rhamnus cathartica</i> b	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cornus sanguinea</i> b	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Padus serotina</i> b	.	.	+	.	.	.	.	.	.	.	.	.	.	.
1. <i>Origanum vulgare</i>	2	.	.	.	.	.	.	.	.	.	.	.	.	.
1. <i>Brachypodium pinnatum</i>	+	5	5	4	5	4	3	4	4	+	.	.	.	.
2. <i>Salvia pratensis</i>	.	.	.	.	+	1	1	2	2	4	4	3	3	.
3. <i>Achillea setacea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Festuco-Brometea:														
<i>Euphorbia cyparissias</i>	+	+	.	.	.	+	+	+	.	.	.	+	+	.
<i>Centaurea scabiosa</i>	+	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Dianthus carthusianorum</i>	+	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Plantago media</i>	+	.	.	.	.	.	.	.	.	1	.	.	.	.
<i>Carex praecox</i>	.	.	+	.	.	.	.	.	.	+	.	.	+	.
<i>Phleum phleoides</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Centaurea stoebe</i>	.	.	.	+	+	.	.	2	2	.	+	.	+	.
<i>Anthyllis vulneraria</i>	.	.	.	.	.	.	.	.	+	+	.	.	.	.
<i>Asparagus officinalis</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Achillea pannonica</i>	.	.	.	.	.	.	.	.	.	.	.	.	1	.
<i>Campanula bononiensis</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Trifolio-Geranietea:														
<i>Vicia tenuifolia</i>	+	+	.	.	.	.	.	.	4	+	.	.	+	.
<i>Agrimonia eupatoria</i>	+	.	.	.	.	+	.	.	.	+	.	+	+	.
<i>Campanula rapuncu- loides</i>	+	.	.	.	.	+	.	.	+	.	.	.	.	.
<i>Galium verum</i>	.	1	+	+	.	2	+	.	.	+	+	+	+	.
<i>Peucedanum cervaria</i>	.	.	2	1	+	+	+	+	+	2	2	.	3	.

Towarzyszące (Accompanying): *Artemisia campestris* 1/+; *Carex flacca* 4/+, 10/+, 12/+; *Chamaecytisus ruthenicus* 7/2; *Cichorium intybus* 6/+; *Cruciata glabra* 1/+, 3/+; *Eryngium planum* 1/+, 6/+, 7/+; *Filipendula vulgaris* 2/1, 3/1, 4/1, 7/1; *Fragaria vesca* 1/+, *Hieracium umbellatum* 1/+, 10/+; *Medicago falcata* 1/+, 11/+, 12/+, 13/+; *Medicago sativa* 2/+, 2/+, 6/+; *Peucedanum alsaticum* 1/2, 6/3; *Picris hieracioides* 7/+; *Pimpinella saxifraga* 1/+, 6/+, 10/+, 13/+; *Polygala vulgaris* 6/+, 10/+; *Primula veris* 3/+, 4/2, 8/+, 11/+; *Rubus plicatus* 4/+, 7/+, 9/+, 11/+, 13/1; *Sedum maximum* 12/+, 14/+; *Thymus pulegioides* 1/+, 2/+; *Verbascum phlomoides* 2/+, 13/+; *Veronica chamaedrys* 1/+, 3/+, 6/+, 7/+, 10/+, 12/+, 13/+; *Verbascum nigrum* 6/+.

Another association – *Thalictro-Salvietum pratensis* – occurred less frequently. According to Fijałkowski et al. (9), this community accompanies all steppe grasslands in the Lubelskie region. The patches of *Thalictro-Salvietum pratensis* were found on the isolated slopes of the Bug River valley near the village of Kryłów. The association was dominated by *Salvia pratensis*, which exhibited a density of 30 to 50% (Table 1, relevés 10–14). *Carex praecox* and *Campanula bononiensis*, species typical of this association, occurred sporadically. Species of the class *Festuco-Brometea* (9 species), *Trifolio-Geranietea* (5 species) and *Agropyretea intermedio-repentis* (4 species) constituted additional elements. The distinctive species for the association – *Elymus hispidus* – was not found in the study grasslands; the species, however, was abundant in the association *Thalictro-Salvietum pratensis*, e.g. in Czumów (20), the Kazimierski Landscape Park (14) and Wielkopolska (12).

Several small vegetation patches dominated by *Achillea setacea* (Table 1, relevé 14) were found on the top fragments of the steep valley slopes near Kryłów. The highest density was recorded in *Agropyron repens*, *Poa pratensis* and *Carex hirta*. The study conducted by Fijałkowski (4) on the slopes in Czumów demonstrated that the patches with a considerable share of *Achillea setacea* constituted a part of the association *Prunetum fruticosae* (facies with *Achillea setacea*).

Table 2. Floristic composition of communities *Trifolio-Geranietea* TH. MÜLLER 1962 class 4 – *Geranio-Peucedanetum cervariae* (KUNH 1937) TH. MÜLLER 1961, 5 – Community *Astragalus cicer*, 6 – *Coronilletum variae* Fijałkowski 1991

Nr zespołu/zbiorowiska No. of association/community	4	4	5	5	5	5	6	6
Nr zdjęcia No. of record	15	16	17	18	19	20	21	22
Zwarcie warstwy krzewów b w % Cover of shrub-layer b in %	10	+	.	.	.	.	.	.
Zwarcie warstwy runa c w % Cover of herb-layer c in %	100	100	100	100	100	100	100	100
Zwarcie warstwy mchów d w % Cover of moss-layer d in %	70	70	.	.	.	.	.	.
Powierzchnia zdjęcia w m ² Record surface in m ²	20	10	5	6	10	10	8	2

<i>Artemisia vulgaris</i>	.	.	+	+	.	.	.	.	.
Bryophyta:									
<i>Abietinella abietina</i>	4	.	.	.	.	.	.	.	.
<i>Plagiomium affine</i>	1	1	.	.	.	.	.	.	.
<i>Thuidium tamariscinum</i>	.	3	.	.	.	.	.	.	.
Towarzyszące (Accompanying): <i>Agrostis vulgaris</i> 15/+, 17/1; <i>Ballota nigra</i> 2/+; <i>Calamagrostis epigeios</i> 15/+, 16/+, 20/2, 21/+; <i>Chamaecytisus ruthenicus</i> 15/+, 16/+; <i>Hypericum perforatum</i> 15/+; <i>Lavatera thuringiaca</i> 22/+; <i>Medicago sativa</i> 21/1; <i>Peucedanum alsaticum</i> 17/+; <i>Pimpinella saxifraga</i> 16/+, 20/+; <i>Primula veris</i> 15/+; <i>Rubus plicatus</i> 17/+, 18/1, 20/+, 21/+; <i>Solidago virgaurea</i> 15/+; <i>Stachys arvensis</i> 17/+; <i>Stellaria graminea</i> 15/+; <i>Thymus pulegioides</i> 15/+; <i>Urtica dioica</i> 20/+; <i>Viola canina</i> 15/+.									

The class *Trifolio-Geranietea sanguinei* was represented by the associations *Geranio-Peucedanetum cervariae* and *Coronilletum variae* and the community with *Astragalus cicer* (Table 2, relevés 15–22). Small patches of a fringe community *Geranio-Peucedanetum cervariae* were found on the slopes of “Grybnyio-wa Góra”. The highest density was exhibited by a species that is characteristic of the association, i.e. *Peucedanum cervaria* (Table 2, relevés 15–16). The herbaceous plant layer was characterized by a considerable share of *Anthericum ramosum* (Table 2, relevé 16. The layer of bryophytes (70% density) was formed by *Abietinella abietina*, *Plagiomium affine* and *Thuidium tamariscinum*.

Several patches dominated by *Astragalus cicer* (Table 2, relevé 17–21) were found on the valley slopes near Kryłów. The additional elements were species of the class *Agropyreteae intermedio-repentis* (5 species), *Molinio-Arhenatheretea* (4 species) and *Trifolio-Geranietea sanguinei* (4 species).

The association *Coronilletum variae* (Table 2, relevé 22), distinguished by Fi-jałkowski (6), occurred on the slopes only infrequently. The dominant species (up to 90% of coverage) was *Coronilla varia*, and the accompanying species included several plants of the classes *Trifolio-Geranietea*, *Festuco-Brometea* and *Molinio-Arhenatheretea*. *Coronilla varia* patches were described on other xerothermic slopes of the Lubelskie region as well (15, 22).

Table 3. Floristic composition of communities *Agropyreteae intermedio-repentis* (OBERD. et al. 1967) MÜLLER et GÖRS 1969 class

7 – Community *Elymus hispidus*, 8 – Community *Elymus repens*, 9 – Community *Bromus inermis*, 10 – Community *Chamaecytisus ruthenicus*

Nr zespołu/zbiorowiska No. of association/community	7	7	7	8	8	8	9	9	10	10
Nr zdjęć No. of record	23	24	25	26	27	28	29	30	31	32
Zwarcie warstwy krzewów b w % Cover of shrub-layer b in %	.	.	.	.	.	.	.	+	.	10

Zwarcie warstwy runa c w % Cover of herb-layer c in %	100	100	90	100	100	100	100	100	100	100
Powierzchnia zdjęcia w m ² Record surface in m ²	10	20	10	10	20	20	20	20	20	10
<i>Prunus spinosa</i> b	.	.	.	.	.	.	.	.	.	1
<i>Crataegus monogyna</i> b	.	.	.	.	.	.	.	+	.	.
7. <i>Elymus hispidus</i>	4	4	3	.	.	.	.	.	.	.
8. <i>Elymus repens</i>	1	.	.	5	4	4	.	1	.	.
9. <i>Bromus inermis</i>	.	.	.	1	+	.	4	3	4	2
10. <i>Chamaecytisus ruthenicus</i>	.	.	.	.	.	.	.	.	3	5
Agropyreteea intermedio-repentis:										
<i>Equisetum arvense</i>	+	+	+	.	.	.	.	+	.	.
<i>Convolvulus arvensis</i>	+	+	+	2	1	2	.	1	+	+
<i>Falcaria vulgars</i>	.	.	.	.	2	2	.	2	.	.
Festuco-Brometea:										
<i>Carex praecox</i>	1	.	.	.	.	.	.	.	.	.
<i>Euphorbia cyparissias</i>	.	+	1	.	.	+	.	.	+	.
<i>Salvia pratensis</i>	.	+	.	.	.	.	.	.	1	.
<i>Achillea setacea</i>	.	+	.	.	.	.	.	.	.	.
<i>Campanula sibirica</i>	.	+	.	.	.	.	.	.	.	.
<i>Libanotis pyrenaica</i>	.	.	.	+	.	.	.	+	.	.
<i>Thalictrum minor</i>	.	.	.	.	+	.	.	.	.	.
<i>Centaurea stoebe</i>	.	.	.	.	.	.	.	+	+	.
<i>Brachypodium pinnatum</i>	.	.	.	.	.	.	.	.	.	1
Trifolio-Geranietea:										
<i>Galium verum</i>	2	1	.	.	+	2	+	2	1	.
<i>Astragalus glycyphyllos</i>	+	+	.	.	.	.	.	.	.	.
<i>Vicia tenuifolia</i>	.	1	1	.	.	.	.	.	.	.
<i>Clinopodium vulgare</i>	.	.	+	.	.	.	.	.	.	.
<i>Coronilla varia</i>	.	.	.	.	.	+	.	.	.	.
<i>Campanula rapunculoides</i>	.	.	.	.	.	+	.	.	.	.
<i>Peucedanum cervaria</i>	.	.	.	.	.	.	+	.	+	.
<i>Agrimonia eupatoria</i>	.	.	.	.	.	.	.	+	+	+
<i>Fragaria viridis</i>	.	.	.	.	.	.	.	1	.	.
<i>Astragalus cicer</i>	.	.	.	.	.	.	.	.	+	.
Inne (Other):										
Molinio-Arrhenatheretea:										
<i>Alopecurus pratensis</i>	2	.	.	.	.	.	.	.	.	.
<i>Vicia cracca</i>	+	.	.	.	.	.	.	.	.	.
<i>Poa pratensis</i>	.	+	2	.	.	.	1	+	.	.
<i>Dactylis glomerata</i>	.	+	+	+	2	1	+	4	.	.
<i>Carex hirta</i>	.	1	1	.	.	.	.	.	.	.
<i>Rumex crispus</i>	.	.	.	+	.	.	.	.	.	.
<i>Lotus corniculatus</i>	.	.	.	.	+	.	.	.	.	.
<i>Festuca rubra</i>	.	.	.	.	.	1	1	1	1	.
<i>Achillea millefolium</i>	.	.	.	.	.	.	+	+	.	.

<i>Geranium pratense</i>	.	.	.	.	.	.	.	.	2	2
<i>Knautia arvensis</i>	.	.	.	.	.	.	.	.	+	.
<i>Inula salicina</i>	.	.	.	.	.	.	.	.	2	.
<i>Galium mollugo</i>	.	.	.	.	.	.	.	.	+	.
Artemisietea:										
<i>Galium aparine</i>	+	.	.	.	.	.	.	.	.	.
<i>Melandrium album</i>	+	+	+	.	.	+	.	+	.	.
<i>Linaria vulgaris</i>	1	.	.	.	+	.	.	.	.	.
<i>Cirsium arvense</i>	.	+	.	.	.	.	.	+	.	.
<i>Artemisia vulgaris</i>	.	.	.	2	.	.	+	+	.	.
Towarzyszące (Accompanying): <i>Euphorbia villosa</i> 30/3; <i>Filipendula vulgaris</i> 24/+, 28/+; <i>Hypericum perforatum</i> 26/+, 29/+, 31/+; <i>Galeopsis tetrahit</i> 28/+; <i>Galium aparine</i> 26/+; <i>Lavatera thuringiaca</i> 27/2; <i>Linaria vulgaris</i> 27/+; <i>Nepeta pannonica</i> 24/1; <i>Medicago sativa</i> 29/+, 31/+; <i>Ononis arvensis</i> 25/+; <i>Peucedanum alsaticum</i> 30/+; <i>Pimpinella saxifraga</i> 31/+, 32/+; <i>Rubus plicatus</i> 33/1; <i>Stachys arvensis</i> 28/+; <i>Urtica dioica</i> 25/+, 27/, 28/+; <i>Verbascum nigrum</i> 29/1, 31/+; <i>Verbascum phlomooides</i> 24/2, 26/1, 27/+, 30/+; <i>Veronica chamaedrys</i> 30/+; <i>Vincetoxicum hirundinaria</i> 26/+; <i>Viola canina</i> 28/+.										

Pioneer semi-ruderal xerothermic communities of the class *Agropyretea intermedio-repentis* were reported mainly in the top parts of the slopes. These were patches dominated by *Elymus hispidus* (Table 3, relevés 23–25) or *Elymus repens* (Table 3, relevés 26–28). There were also grassland species of the class *Festuco-Brometea*, fringe *Trifolio-Geranietae* species, and meadow species of the class *Molinio-Arrhenatheretea*. Rare species, e.g. *Nepeta pannonica* and *Campanula sibirica* (Table 3, relevé 24) or *Libanotis pyrenaica* (Table 3, relevé 26), were found in some patches of these phytocoenoses. Numerous *Falcaria vulgaris* plants occurred in areas neighbouring arable fields (Table 3, relevés 27–28).

Legally protected species such as *Primula veris* (valley slopes near Kryłów and slopes of Grybniowa Góra near Stare Stulno), and *Campanula sibirica*, *Campanula bononiensis*, *Clematis recta*, and *Ononis arvensis* (valley slopes near Kryłów) were present in the studied communities. The remarkable group of rare species included *Achillea pannonica*, *Achillea setacea*, *Elymus hispidus*, *Euphorbia villosa*, *Libanotis pyrenaica*, *Nepeta pannonica*, *Peucedanum alsaticum* and *Viola hirta* (valley slopes near Kryłów) and *Chamaecytisus ruthenicus* and *Phleum bohemeri* (valley slopes near Kryłów and slopes of Grybniowa Góra near Stulno). Localities of nearly all the above-mentioned rare and protected species were also reported from the nearby village of Czumów on the Bug River (4, 20) and other areas of the Bug River valley (7, 22). The locality of *Euphorbia villosa* is new in the area. The discovered locality of a population of 50–60 clump-forming specimens is one of the most abundant in the Lublin region. Investigations conducted by other authors indicate that, in the Lublin Province, *Euphorbia villosa* occurs very rarely in the valleys of the Bug (7), Vistula (14), and Szyszła Rivers (Michalcuk W. – personal communication 2007).

The studied grasslands are specific habitat islands of numerous xerothermic communities and plants, including those that are rare or legally protected. Lack of herding activities, which promotes introduction of trees and shrubs; afforestation; landfills; ploughing; and biogenic runoff from fields located on the plateau pose a considerable threat to these phytocoenoses.

REFERENCES

1. Braun-Blanquet J. 1964. *Pflanzensoziologie. Grundzüge der Vegetationskunde*. Wyd. 3. Springer Verlag, Wien-New York, 865 pages.
2. Celiński F. 1954. Flora pontyjska w Mielniku nad Bugiem. *Chr. Przyr. Ojcz.*, 10.
3. "Dolina Szyszły". Standardowy Formularz Danych, 2008.
4. Fijałkowski D. 1954. Szata roślinna wąwozów okolic Lublina na tle niektórych warunków siedliskowych. *Ann. UMCS*, s. B, 9, 125–215.
5. Fijałkowski D. 1957. Zbiorowiska kserotermiczne projektowanego rezerwatu stepowego koło Czumowa nad Bugiem. *Ann. UMCS*, s. C, 10, 311–319.
6. Fijałkowski D. 1964. Zbiorowiska kserotermiczne okolic Izbicy na Wyżynie Lubelskiej. *Ann. UMCS*, s. C, 19, 139–259.
7. Fijałkowski D. 1991. *Zespoły roślinne Lubelszczyzny*. Wyd. UMCS, Lublin, 303 pages.
8. Fijałkowski D. 1994. *Flora roślin naczyniowych Lubelszczyzny*. T. I, Lubelskie Towarzystwo Naukowe, 389 pages.
9. Fijałkowski D., Izdebski K. 1959. Zbiorowiska stepowe na Wyżynie Lubelskiej. *Ann. UMCS*, s. B, 11, 167–200.
10. Fijałkowski D., Świerczyńska S., Grądział T. 1988. Flora i zbiorowiska stepowe rezerwatu Podzamcze koło Bychawy. *Ann. UMCS*, s. C, 43, 173–185.
11. Izdebski K., Fijałkowski D. 1956. Fragment roślinności kserotermicznej w Kątach pod Zamościem. *Ann. UMCS*, s. C, 11, 507–521.
12. Kondracki J. 2001. *Geografia regionalna Polski*. Wyd. nauk. PWN, Warszawa, 441 pages.
13. Kostuch R., Misztal A. 2007. Roślinność kserotermiczna istotnym elementem bioróżnorodności biologicznej Wyżyny Małopolskiej. *Woda-Środowisko-Obszary Wiejskie*, 7, 2b, 99–110.
14. Kucharczyk M. 1998. Analiza rozmieszczenia gatunków muraw kserotermicznych na Wyżynie Lubelskiej, Roztoczu i Wołyniu Zachodnim. *Mat. konf. 51 Zjazdu PTB "Botanika polska u progu XXI wieku"*. Gdańsk.
15. Kucharczyk M. 2000. Plant associations and communities of the Kazimierz Landscape Paerk. V Xerothermic grasslands and shrubs associations. *Ann. UMCS*, s. C 40, 193–220.
16. Łuczycza-Popiel A., Urban D. 1995. Roślinność wąwozów w dorzeczu Ciemięgi na Wyżynie Lubelskiej. *Ann. Univ. Mariae Curie-Skłodowska*, s. C, 50, 11–38.
17. Matuszkiewicz W. 2005. *Przewodnik do oznaczania zbiorowisk roślinnych Polski*. Wyd. Naukowe PWN, Warszawa: 536 ss.
18. Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M. 2002. Flowering plants and pteridophytes of Poland a checklist. *W. Szafer Inst. of Botany, Polish Academy of Sciences, Kraków*: 442 pages.
19. Niedźwiecka J. 1998. Rośliny rzadkie i chronione w Tarnogórze koło Izbicy (Wyżyna Lubelska). *Mat. 51 Zjazdu PTB, Gdańsk*, 352.
20. Szafer W., Zarzycki K. (eds.) 1977. *Szata roślinna Polski*. PWN, Warszawa.
21. Trąba Cz. 2006. Różnorodność florystyczna muraw kserotermicznych w zależności od niektórych czynników ekologicznych. *Zesz. Naukowe Akademii Rolniczej im. H. Kołłątaja. Inżynieria środowiska*, 433, 27, 253–269.

22. Urban D. 2006. Zbiorowiska kserotermiczne obszaru chronionego krajobrazu "Dolina Ciemięgi". Zesz. Naukowe Akademii Rolniczej im. H. Kołłątaja. Inżynieria środowiska, 433, 27, 277–285.
23. Urban D., Wójciak H. 2002. Szata roślinna doliny Bugu w Polsce – odcinek środkowy. [in:] Rzeka Bug – korytarz ekologiczny (eds. Dombrowski A., Głowacki Z., Kovalchuk I., Michalczyk Z., Sz wajgier W., Wojciechowski K. H.). IUCN Office for Central Europe, 96–112.