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FLORIAN ŚWIĘS

A survey of ruderal vegetation in Poland: phytocenoses with *Lycium barbarum* L.

Przegląd roślinności ruderalnej na obszarze Polski: fitocenozy z *Lycium barbarum* L.

INTRODUCTION

The natural range of *Lycium barbarum L.* (*L. halimifolium* Mill.) covers the area extending from South West Asia in the temperate zone to the regions around the Mediterranean in the meridional zone (41). This shrub is occupying, through bringing in accidentally, larger and larger areas that are situated mainly beyond the north-western boundary of its natural range (33). *Lycium barbarum* has been spreading in Poland and other European countries since the mid-18th century as a holagriophyte of the ergasioepekophyte type, having been brought in from China to gardens and parks (12, 25, 26, 58). This is a shrub 3.5–4 to 10 m high, with dynamics of vegetative (sprouts and layers) and generative propagation on thermophilous ruderal habitats (39, 42). This plant is commonly planted as a shrub with a practical antierosion property and is used for setting up fences and reclamation of all manner of rubbish heaps and wasteland (42). In Poland stations of phytocenoses with *Lycium barbarum*, planted or gone wild, are recorded most often in the warmer lowland-upland and submontane regions (2, Fig. 1).

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SCOPE AND METHODS OF RESEARCH

Communities with *Lycium barbarum* investigated in Europe for several dozen years do not yet have a definitive phytosociological structure and rank. That is why the present study presents a comprehensive syntaxonomic and ecological characteristics of this ruderal community that was formed in Poland. The investigations were based on materials collected from all available studies, both published and ready for publication. The materials utilized contain 155 phytosociological records and 10 soil pits examined for their chemical properties.

First, all the collected phytosociological records of the studied community with *Lycium barbarum* were listed in a working table[1] according to their similarity with respect to the percentage by quantity of major plant species. The basic data of the phytosociological records used and their assigning to the distinguished secondary communities with *Lycium barbarum* were listed in Table 6. Stations of phytosociological records were presented in Figure 1. Comprehensive data on chemical properties of soils and on the floristic and phytosociological structure of all the identified forms of communities with *Lycium barbarum* were shown in Tables 1–5. The statistical examination of those phytocenoses was carried out using the Pawłowski method (38).

The taxonomy of pteridophytes and flower plants, and bryophytes was given after Jasiewicz (18) and Koponen et al. (23) respectively. Assigning of those plants to their particular syntaxonomic and ecological groups was determined mainly after Matuszkiewicz (31) and partly after other phytosociologists (36, 49, 50). The appended photographs show major stations and succession forms of expanses of communities with *Lycium barbarum* (Fig. 2–7).

Basic statistical and floristic data on communities with *Lycium barbarum* were presented in such a way that they could, if necessary, be supplemented with new materials of phytosociological records. A syntaxonomic study of phytocenoses with *Lycium barbarum* like the present one has so far been prepared only on phytocenoses with *Reynoutria sachalinensis* and *R. japonica* and with *Rudbeckia laciniata, Solidago canadensis* and *S. gigantea* (49, 50).

GENERAL STATE OF STUDIES ON PHYTOCENOSES WITH *LYCIUM BARBARUM*

The studied phytocenoses with *Lycium barbarum* have so far been described only from anthropogenic habitats in some European countries, most frequently from Poland. According to Soó (45) the phytocenosis in question was first characterized by Bojko (3) from the Seewinkel district in Germany as a phytosociologically indeterminate facies with *Lycium halimifolium*. The first and comparatively detailed phytosociological characteristics of the studied phytocenosis having the rank of association with *Lycium halimifolium* in the alliance of *Prunion spinosae* and a group of communities of *Aestifruticetea* was presented only by Felföldy (11) on the basis of 5 phytosociological records from Hungary. The phytocenosis under study is also classified as an association *Lycietum hamilifolii* within the alliance *Eu-Arction* (= *Arction lappae*) and the order *Onopordetalia* in the class *Rudero-Secalinetea* (5, 43–45, 54) or the class *Chenopodietea* (43–45).

[1] Not included in the study on account of large size.

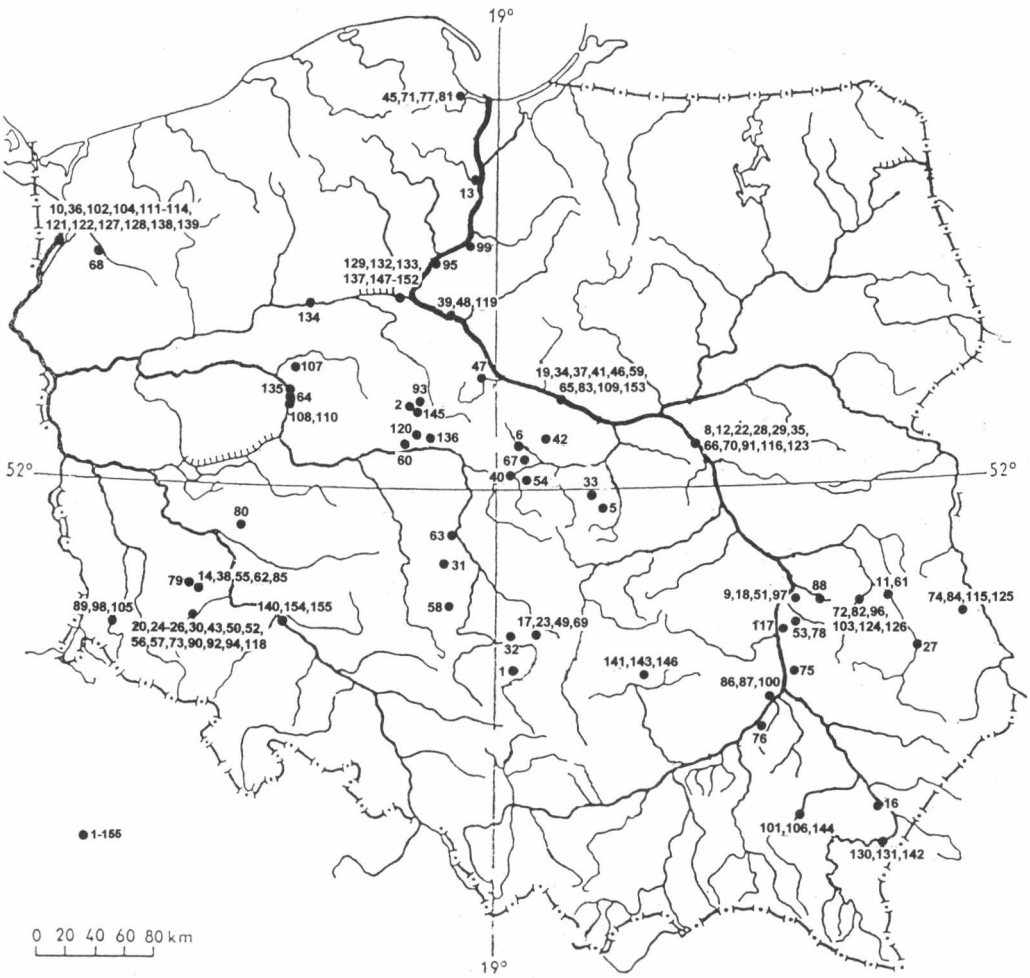

Fig. 1. Map of 155 stations of phytosociological records (Table 6) of *Lycietum barbari* association in the variants: thick undergrowth (rec. 1–20), ruderal (rec. 21–127) and impoverished (rec. 128–155)

That phytocenosis was first characterized from Poland (Chełm) by Fijałkowski (13) as a community with *Lycium halimifolium* from the alliance *Eu-Arction*, order *Onopordetalia acanthii* and the class *Artemisietea*. While first characterizing in Slovakia the association with *Lycium halimifolium*, described earlier by Felföldy (11), Jurko (19) gave new names both to the association (*Anthrisco-Lycietum halimifolii*) and to higher syntaxonomic units (order *Robinio-Lycietalia*, class *Robinio-Lycietea* [*Robinietea*]). At a further stage of studies on

phytocenoses with *Lycium barbarum*, an association of *Lycio-Syringetum* was described from Köhl (Germany) on the basis of 3 phytosociological records. Bornkamm (4) assigns it probably after Oberdorfer (35) to the *Berberidion* alliance of the *Querco-Fagetea* class. The first two phytosociological records concerning the *Lycio-Syringetum* association refer, without doubt, to the typical phytocenosis with *Lycium barbarum* while the third one belongs to a separate community with *Syringa vulgaris*. According to Bornkamm, the *Lycio-Syringetum* phytocenosis was first characterized by Krausch (24) from Brandenburg.

The phytocenoses with *Lycium barbarum* described in Poland are classified within different basic and higher phytosociological units (Table 6). Those phytocenoses are uncritically assigned the rank of an alliance called *Lycietum halimifolii* or *Anthrisco-Lycietum halimifolii*, or as phytosociologically indeterminate community with *Lycium halimifolium*. Those forms of phytocenoses with *Lycium barbarum* are most often classified within the class *Artemisietea vulgaris* of the order *Onopordetalia acanthii* and the alliance *Eu-Arction* (= *Arction lappae*) and exceptionally in the alliance *Onopordion* (*acanthii*). They are very seldom placed within the *Artemisietea* class alone or the *Epilobietea angustifolii* class, order *Epilobietalia angustifolii* and the *Epilobion angustifolii* alliance or in the order *Sambucetalia* and the alliance *Sambuco-Salicion* (Table 6). It must be added that in older phytosociological studies, both at home and abroad, most of the aforementioned orders and alliances of associations were included in the class *Rudero-Secalietea* (= *Rudero-Secalinetea*) or in the class of *Chenopodietea* (Table 6; e.g. 32, 45).

Worth noting is the first attempt to comprehensively characterize phytocenoses with *Lycium halimifolium* by Wojterska (56) on the basis of 50 phytosociological records, 48 taken from several regions in Poland and 2 from Köhl (Germany). According to Wojterska's study, those phytocenoses with *L. barbarum* belong to the *Lycietum halimifolii* association of the *Eu-Arction* alliance, the order of *Onopordetalia acanthii* and the *Artemisietea* class. It should be noted that in Polish and foreign phytosociological literature the almost identical syntaxonomic treatment for phytocenoses with *L. barbarum* as given by Wojterska (56) was earlier applied by Soó (43, 45), Ubirzsy (54, 55), Fijałkowski (13) and Kępczyński (20).

Apart from the often described classical forms of the association *Lycietum barbari*, attention should be drawn to lower units, less often characterized, of separate plant associations with a large percentage of *Lycium barbarum*. These include: a subassociation *Artemisietum vulgaris lycietosum* (22, 55) and an association *Balloto-Chenopodietum* in a facies with *Lycium halimifolium* (48). The two forms of phytocenoses in the rank of subassociation and facies with *Lycium barbarum* most probably represent succession transition stages

between the associations *Tanaceto-Artemisietum* and *Balloto-Chenopodietum*, and the association *Lycietum barbari*.

THE PHYTOSOCIOLOGICAL AND ECOLOGICAL STRUCTURE OF PHYTOCENOSES WITH *LYCIUM BARBARUM* IN POLAND

Taxonomy and Phytosociological Rank

Particular expanses of phytocenoses with *Lycium barbarum* can be classified either as a weakly emerging association with *Lycietum barbari* or as a phytosociologically indeterminate community with *Lycium barbarum*. This is a general property of the phytosociological structure of most plant communities of the shrub type (49, 50).

In the first case the naming, taxonomy, phytosociological rank and variability of phytocenoses with *Lycium barbarum* should go as follows:
Cl. *Artemisietea vulgaris* Lohm., Prsg. et Tx. 1950
O. *Onopordetalia acanthii* Br.-Bl. et Tx. em. Görs 1966
Al. *Eu-Arction* R. Tx. 1937, em. Siss 1946
association: *Lycietum barbari* (Bojko 1934) Felf. 1942, Soó 1947, Święs em. n. nomen

1. variant: thick undergrowth,
2. variant: ruderal,
3. variant: typical.

The suggested criteria concerning the name, phytosociological rank and position of the *Lycietum barbari* association formed in Poland, are basically the same as those defined by the main authors of this association (3, 11), and subsequently accepted and verified by other Polish and foreign phytosociologists (13, 43–45, 53, 56; Table 6). In the present monograph characterization of the association only its oldest name has been changed: from *Lycietum halimifolii* to *Lycietum barbari* in accordance with the latest binding name for *Lycium barbarum*, from which the naming was derived for the association in question. The right authors of the association were also named. It must also be noted that the accepted simplified name for the studied association as *Lycietum barbari*, or as *Lycietum halimifolii*, is more appropriate than the often used name of *Anthrisco-Lycietum halimifolii* for the same association on account of the following two main reasons: its very simplified floristic structure at the stage of its optimum growth, then composed of mainly *Lycium barbarum*; except for *Lycium barbarum*, no other species can be recognized as a diagnostic species for that association formed in the territory of Poland.

In an alternative case, it should be noted that phytocenoses with *Lycium barbarum* do not represent a classically formed association also for the following reasons: a highly heterogeneous floristic composition (Tables 3–5); the entire absence of the so-called specific combination of characteristic and accompanying species; a semi-artificial origin.

In that case, the assigning of phytosociologically indeterminate phytocenoses with *Lycium barbarum* to higher phytosociological units can greatly vary, depending on their origin, the surrounding plant communities, the stage of growth and their habitat conditions. The following classes would primarily apply: mainly *Artemisietea vulgaris,* less often *Robinio-Lycietea, Festuco-Brometea* and *Epilobietea angustifolii.*

The Internal Variability and Dynamics of the Association

It turns out that the *Lycietum barbari* association does not exhibit in Poland a distinct diversity of permanent lower phytosociological units with a regional or ecological characteristics. In the association in question on the basis of a definite composition of plant species and their percentage, no more than three lower phytosociological units were distinguished bearing the rank of variants, (thick undergrowth, ruderal, typical) each containing several facies systems. The variants and facies distinguished in the *Lycietum barbari* association do in fact represent particular succession stages and phases of the association's development.

1. The thick undergrowth variant. This variant of the *Lycietum barbari* association was characterized on the basis of 20 phytosociological records taken from the following habitats:

— roadsides, fallows, wasteland (rec. 1, 5),[2]

— old rubble and garbage heaps (rec. 6, 17),

— fences and fenceside ground (rec. 13, 14, 20),

— the sides of scarps, excavations, small valleys and road embankments (rec. 9, 10, 16, 18, 19),

— indeterminate ruderal habitats, probably of the above types (rec. 2–4, 7, 8, 11, 12, 15).

Floristically, the variant in question is characterized in the association by comparatively the most frequent and largest presence of numerous species of herbal, thick undergrowth, forest, and shrub plants. They include: *Rubus caesius, R. plicatus, R. idaeus, Coronilla varia, Torilis japonica, Aegopodium podagraria, Solidago canadensis* and *Humulus lupulus.* Out of other plants in some expanses

[2] Not of all phytosociological records are identical with those in Figure 1 and Table 6, according to their successive order in the working table.

of this variant, the most numerous are: *Achillea millefolium, Chenopodium album, Urtica dioica, U. urens, Artemisia vulgaris, Ballota nigra, Chelidonium majus, Convolvulus arvensis, Elymus repens*, and *Cirsium arvense*. Those plants make up at the same time the main facies systems within the variant. The thick undergrowth variant can be regarded (with a large approximation) as a highly advanced initial development stage of the association. The variant in question is characterized by the comparatively least compact occurrence of *Lycium barbarum*, owing to which many accompanying plant species from the surrounding plant communities developed abundantly.

2. The ruderal variant. The next distinguished ruderal variant of the *Lycietum barbari* association was identified basing on 107 phytosociological records taken from the following habitat types:

— rubbish dump (rec. 26),

— weathered brickwork of old military fortifications (rec. 39, 48),

— old, garbage-strewn rubble heaps (rec. 23, 49, 104, 119),

— wasteland, fallows, squares (rec. 42, 45, 69, 77, 81, 106),

— roadsides (rec. 31, 33, 40, 54, 63, 90, 97, 105),

— sides of scarps, and road and railway embankments (rec. 36, 47, 56, 67, 68, 76, 86, 87, 89, 95, 99, 100, 102, 111–114, 121, 122, 124, 127),

— fences and fenceside ground (rec. 24, 25, 30, 32, 38, 43, 50, 52, 55, 57, 58, 62, 73, 79, 85, 92, 94, 98, 101, 118),

— indeterminate synanthropic habitats, probably of the types defined above (rec. 21, 22, 27–29, 34, 35, 37, 41, 44, 46, 51, 53, 59, 60, 61, 64–66, 70, 72, 74, 75, 78, 80, 82–84, 88, 91, 93, 96, 103, 107–110, 115–117, 120, 123, 125, 126).

The ruderal variant is the most commonly described form of the *Lycietum barbari* association. It represents a fairly advanced stage of the association's development, which is evidenced by: a fairly compact occurrence of *Lycium barbarum* in clumps and a comparatively complex composition of ruderal species that are scanty and are found chiefly among the least compact clumps of that shrub.

The plants that have comparatively the highest occurrence in particular phytosociological records of this variant include: *Poa pratensis, Rumex acetosa, Anthriscus sylvestris, Chenopodium album, Atriplex patula, Sisymbrium loeseli, S. altissimum, Atriplex nitens, Bromus tectorum, Cardaria draba, Convolvulus arvensis, Elymus repens, Cirsium arvense, Artemisia vulgaris, Urtica dioica, Dipsacus fullonum, Ballota nigra, Chelidonium majus, Solidago canadensis, Polygonum dumetorum, Galeopsis tetrahit, Galium aparine, Bromus inermis, Melica altissima*. Most of those species make up independent or mixed, weakly differentiated and impermanent facies systems.

3. The typical variant. It was characterized basing on 28 phytosociological records taken in the following habitat types:

— fences and fenceside ground (rec. 131, 142),

— old, garbage-strewn rubble heaps (rec. 130, 139, 144),

— sides of road and railway embankments (rec. 128, 138, 141, 143, 146, 153),

— indeterminate synanthropic habitats, probably of the above type (rec. 129, 132–137, 140, 145, 147–152, 154, 155).

This variant represents, without doubt, the optimum forms of the association's succession development. It is primarily characterized by the most compact occurrence of *Lycium barbarum*. Moreover, this phytocenosis has an exceptionally heterogeneous floristic composition. The most frequent plants include: *Ballota nigra, Lamium album, Berteroa incana, Galium aparine, Conyza canadensis*.

A greater degree of covering is found only with some bryophyte species, especially *Amblystegium serpens*. In the expanses of the association, due to a considerable overshadowing of the substratum, by largely overgrown shots of *Lycium barbarum*, there occurs with time an extreme reduction of the earlier settled stations, of herbal plants more sensitive to overshadowing.

Occurrence and Biotopic Conditions

In the territory of Poland the stations of the studied phytocenoses with *Lycium barbarum* are grouped like a wide belt that extends from south-west to north-west (Fig. 1). It is interesting that there are no stations of the association in question taken from colder regions in the south and north-east of Poland (Fig. 1).

The succesion development of phytocenoses with *Lycium barbarum* starts most often with planting this shrub for various practical purposes. For example, plantations with *Lycium barbarum* are set up primarily in the areas exposed to intense erosion: steep slopes of scarps, excavations, road and railway embankments. This shrub is often planted for reclamation of nuisant ruderal places like rubbish or rubble heaps. It is also used for hedging various buildings. When planted, *Lycium barbarum* exhibits the highest expansion on drier, sun-lit loess or sandy slopes (Fig. 2–7). Although this shrub grows on garbage-strewn rubble heaps, it does not exhibit greater expansion there. *Lycium barbarum* probably does avoid very overshadowed, humid and weakly permeable soils in natural and anthropogenic habitats.

The soils in the *Lycietum barbari* association do not significantly stand out with respect to their chemical properties studied (Table 1). They are most often highly alkaline soils, not particularly diversified for the content of humus, $CaCO_3$, P_2O_5 and K_2O. These soils contain few $N\text{–}NO_3^-$ and $N\text{–}NH_4^+$ compounds. The investigation ration C:N in those soils shows that they are weakly biologically active.

Table 1. Some chemical soil properties after the authors quoted in particular expanses of *Lycietum barbari* association. No. of association variant: 1. thick undergrowth, 2. ruderal, 3. impoverished

Authors	Number of		Depht of horizon in cm	Content in									pH in	
				%				mg/100 g of soil						
	variant	records		$CaCO_3$	C	N	C/N	P_2O_5	K_2O	Mg	$N\text{-}NH_4^+$	$N\text{-}NO_3^-$	H_2O	1n KCl
Janecki (1983)	1-3	?	?	0,000	5,20	.	.	220,0	36,8	25,0	.	2,00	7,8	7,0
		?	?	2,100	3,10	.	.	51,5	16,5	7,8	.	7,80	8,2	7,2
		?	?	1,000	1,50	.	.	4,8	18,0	6,6	.	5,40	7,7	7,4
Czaplewska (1980)	1-3	-/5	0-30	4,710	0,85	0,185	.	65,0	13,8	.	.	.	7,4	6,9
			31-85	5,120	0,28	0,145	.	40,2	10,6	.	.	.	7,7	5,4
			86-102	3,840	1,81	0,097	.	53,5	11,6	.	.	.	7,4	7,0
		-/14	0-7	5,280	0,79	0,030	.	12,5	8,1	.	.	.	7,7	7,5
			8-94	6,140	0,03	0,011	.	9,7	2,3	.	.	.	7,9	7,5
Święs, Kucharczyk (1982)	2	76/81	5-20	0,463	.	.	.	18,2	21,0	17,2	0,22	.	7,6	7,4
Kucharczyk H., Kucharczyk M. (1983)	2	100/95	5-20	0,435	.	.	.	16,0	37,0	24,3	1,04	0,65	7,1	7,0
Święs, Witkowska-Wawer (1988)	3	131/378	5-20	0,200	3,16	.	.	12,5	27,0	.	.	3,60	6,5	6,5
Maciejczak (1985)	3	141/1	0-12	2,860	3,78	0,129	.	29,7	22,8	6,9	.	.	7,2	6,7
			13-30	1,370	1,77	0,092	.	39,9	14,0	7,0	.	.	7,3	6,8
			31-48	1,320	1,65	0,053	.	30,0	12,0	6,6	.	.	7,6	6,9
			49-90	0,290	0,81	0,041	.	58,5	20,0	8,1	.	.	7,5	6,8
Święs (1993)	3	144/273	5-20	0,080	3,07	.	.	27,0	36,7	14,2	.	1,30	6,6	6,1
Kępczyński (1975)	3	?	0-10	0,980	2,30	0,190	12,10	30,2	20,0	.	.	.	7,5	6,5
			35-45	0,160	0,73	0,180	7,03	29,0	8,6	.	.	.	7,3	6,8
			60-70	0,120	0,31	0,050	6,00	28,6	8,0	.	.	.	6,8	6,2
			90-100	.	0,71	0,550	13,00	25,6	10,0	.	.	.	7,2	6,8
	3	?	0-10	1,140	0,51	0,060	8,82	14,0	15,0	.	.	.	7,6	6,9
			40-50	1,200	0,42	0,070	6,00	19,7	10,0	.	.	.	7,6	6,8
			70-80	0,560	0,26	0,040	6,50	8,5	10,0	.	.	.	7,0	6,7

Floristic Affinity Coefficients (Table 2)

Table 2. Floristic affinity coefficients in *Lycietum barbari* association between variants: 1. thick undergrowth, 2. ruderal, 3. impoverished. NB. The floristic affinity coefficients listed were calculated according to the Kulczyński formula (38)

A,B

1	75	53
	3	88
		2

C

1	64	53
	2	59
		3

D

1	59	30
	2	70
		3

A-D

1.1.	65	55
	2	62
		3

Floristic affinity coefficients were calculated for the three discriminated variants of the *Lycietum barbari* association. Plant species were taken into account that came both from all (A–C) and from separate plant layers: trees and shrubs (A, B), the undergrowth (C), and bryophytes (D). It turned out that between the three successively characterized variants of the association *Lycietum barbari* there are clear differences regarding the values of their floristic affinity coefficients. It must be emphasized that the differences in the values of floristic affinity coefficients are more marked with bryophyte species (D) than with species from the trees and shrubs layer (A, B) or from the undergrowth (C), or even with species taken from all the layers (A–D). It is also worth noting that in regard of the values of floristic affinity coefficients in the species from the trees and shrubs layer the thick undergrowth variant is closer to the impovershed rather than ruderal variant.

Floristic Structure (Table 3 and 5)

The association *Lycietum barbari* is characterized by a very rich and yet exceptionally heterogeneous floristic composition. In all the three variants discriminated of this association 256 plant species were reported, of which: 10 tree and shrubs species, 227 herbal plants and semi-subshrubs, and 9 bryophyte species. On one variant of the *Lycietum barbari* association fall 92–225 plant species from all the layers. Plants with the lowest classes of frequency and covering (addition-

Table 4. Syntaxonomic plant groups. x-variants of *Lycietum barbari* association: 1. thick undergrowth, 2. ruderal, 3. typical; xx — calculation parameters: z — number of species, g — sum total of species occurrences from all syntaxonomic groups; G — systematic value of species. NB. These values were calculated basing on data in Table 5, according to the formula given by Pawłowski (38)

Number of variant[x]			1-3	1			2			3		
Syntaxonomical units and systematic value[xx]			z	z	g	D	z	g	D	z	g	D
		A, B. Trees and shrubs										
I.	Al	Eu-Arction	2	2	20	3,096	2	110	3,497	2	29	4,160
	Al	Alliarion	1	1	1	0,015	1	6	0,021	.	.	.
	Cl (total)	Epilobietea angustifolii	1	1	6	0,557	1	29	0,485	1	3	0,089
	Cl (total)	Rhamno-Prunetea	5	4	4	0,061	2	3	0,002	.	.	.
	Xs	other synanthropic species	7	3	3	0,046	4	12	0,021	1	2	0,029
II.	Cl	Querco-Fagetea	2	.	.	.	1	5	0,014	2	3	0,044
	O	Fagetalia silvaticae	1	.	.	.	1	1	0,005	.	.	.
	Al	Alno-Padion	1	.	.	.	1	1	0,005	.	.	.
	Al	Carpinion betuli	1	1	1	0,015	.	.	.	.	.	.
	Xl	other forest species	1	1	1	0,015	.	.	.	.	.	.
		C. Herbaceaus plants										
I	Cl (total)	Phragmitetea	2	.	.	.	1	1	0,005	2	3	0,044
	Cl, O	Bidentetea tripartiti, Bidentetalia tripartiti	1	.	.	.	1	3	0,005	.	.	.
	Al	Chenopodion fluviatile	2	.	.	.	2	2	0,001	.	.	.
	Cl	Alnetea glutinosae	1	.	.	.	1	1	0,005	.	.	.
	Xb	other marshy species	1	.	.	.	.	.	.	1	1	0,009
II.	Cl	Molinio-Arrhenatheretea	10	4	13	0,653	9	73	0,342	3	9	0,267
	O	Molinietalia coeruleae	1	1	1	0,015	1	1	0,005	.	.	.
	Al	Molinion coeruleae	1	.	.	.	1	1	0,005	.	.	.
	O	Arrhenatheretalia	7	5	13	0,523	6	80	0,616	5	16	0,566
	Al	Arrhenatherion	3	2	4	0,123	3	10	0,019	2	3	0,044
	Al	Cynosurion	3	1	2	0,061	3	7	0,009	.	.	.
III.	O (total)	Trifolio-fragiferi-Agrostietalia	5	3	3	0,046	5	10	0,011	3	3	0,029
	O (total)	Plantaginetalia majoris	2	2	3	0,069	2	28	0,226	2	7	0,242
	Cl (total)	Polygono-Poëtea annuae	5	2	4	0,123	5	45	0,234	2	15	1,112
IV.	Cl	Secalietea	1	1	1	0,015	1	2	0,002	.	.	.
	O	Secalietalia	1	1	2	0,061	1	3	0,005	.	.	.
	O	Aperetalia	2	2	2	0,030	1	1	0,005	.	.	.
	Al	Aphanion	3	2	3	0,069	3	6	0,006	.	.	.
V.	Cl	Chenopodietea	4	4	7	0,189	4	76	0,834	4	31	2,376
	O	Polygono-Chenopodietalia	4	2	2	0,030	3	4	0,003	.	.	.
	Al	Eu-Polygono-Chenopodion	6	3	3	0,046	5	15	0,025	4	21	1,090
	Al	Panico-Setarion	1	.	.	.	1	3	0,005	.	.	.
	O, Al	Sisymbrietalia, Sisymbrion	19	9	21	0,758	19	120	0,437	5	15	0,445
	O, Al	Eragrostietalia, Eragrostion	1	.	.	.	1	1	0,005	.	.	.
	Cl (total)	Agropyretea intermedii-repentis	7	4	23	2,047	7	140	1,618	4	25	1,545
VI.	Cl	Artemisietea vulgaris	5	4	31	3,718	5	168	3,262	5	44	3,830
	O	Onopordetalia acanthii	7	4	14	0,758	7	60	0,297	2	6	0,178
	Al	Onopordion acanthii	14	6	11	0,312	14	65	0,174	5	17	0,571
	Al	Eu-Arction	9	5	20	1,238	9	157	1,582	5	39	3,009
	Al	Alliarion	5	5	13	0,523	8	50	0,181	4	9	0,200
	O	Convolvuletalia sepium	1	1	1	0,015	1	7	0,028	1	1	0,009
	Al	Senecion fluviatilis	3	2	5	0,193	3	13	0,032	3	9	0,267
	Xs	other synanthropic species	50	16	35	1,188	36	162	0,421	14	33	0,769
VII.	Cl (total)	Sedo-Scleranthetea	7	2	2	0,030	7	12	0,011	2	2	0,019
	Cl (total)	Festuco-Brometea	10	4	7	0,189	10	38	0,083	1	1	0,009
	Xk	other xerothermic species	3	.	.	.	3	7	0,009	1	1	0,009
VIII.	Cl (total)	Epilobietea angustifolii	3	3	8	0,330	3	19	0,069	1	3	0,089
	Cl (total)	Rhamno-Prunetea	2	2	3	0,069	.	.	.	.	.	.
	Cl (total)	Trifolio-Geranietea sanguinei	2	2	6	0,278	2	9	0,023	.	.	.
	Xz	other species of scrub	3	5	10	0,310	6	36	0,124	5	7	0,096
IX.	Cl	Querco-Fagetea	1	2	4	0,123	1	3	0,005	.	.	.
	O	Fagetalia silvaticae	1	1	1	0,015	.	.	.	.	.	.
	Xl	other forest species	4	3	8	0,330	3	8	0,012	.	.	.
		D. Mosses										
I.	Cl (total)	Sedo-Scleranthetea	1	.	.	.	1	2	0,002	.	.	.
II.	Xu	other species forest and all	7	2	2	0,030	6	9	0,007	3	3	0,029

ally differentiated and marked as r, + and s, + respectively) outnumber plants with somewhat higher classes of frequency and covering (I–II, 1–3) several times. In individual variants of this association there are no more than 1 to 3 species with higher classes of frequency and covering (IV–V, 4–5). In all the three variants of the association only *Lycium barbarum* is commonly found.

Table 3. Distribution of frequency classes (a) and mean covering grade (b) of plant species in the trees and shrubs layer (A, B), the undergrowth (C), bryophytes (D) and their total (A–D) in definite variants of the association *Lycietum barbari*: (after Table 5): 1. thick undergrowth, 2. ruderal, 3. impoverished

Per cent and classe of presence /a/ and cover species /b/		Number of variant / Layer of phytocenosis											
		1				2				3			
		A–D	A,B	C	D	A–D	A,B	C	D	A–D	A,B	C	D
a.													
<5;1;3%	s	69	10	57	2	80	5	72	3	37	2	32	3
6;2;4-9	+	.	.	.	.	104	6	94	4	17	2	15	.
10-20	I	44	.	44	.	26	.	26	.	19	1	18	.
21-40	II	11	1	10	.	8	1	7	.	14	.	14	.
41-60	III	4	.	4	.	3	.	3	.	1	.	1	.
61-80	IV	1	.	1	.	2	.	2	.	3	.	3	.
81-100	V	1	1	.	.	1	1	.	.	1	1	.	.
b													
<0,09%	r	79	8	69	2	174	9	158	7	87	5	81	1
0,1-0,19	+	.	.	.	.	17	.	17	.	2	.	1	1
0,2-5,0	1	49	3	46	.	30	2	28	.	2	.	1	1
5,1-17,5	2	1	.	1	.	1	.	1	.	.	.	.	.
17,6-37,5	3	.	.	.	.	.	.	.	.	.	.	.	.
37,6-62,5	4	.	.	.	.	.	.	.	.	.	.	.	.
62,6-87-5	5	1	1	.	.	1	1	.	.	1	1	.	.
Total		130	12	116	2	224	13	204	7	92	6	83	3

Syntaxonomic Structure (Tables 4 and 5)

The structure of the *Lycietum barbari* association and its three variants is highly complex and difficult to unequivocally define as far as the general syntaxonomic composition of species and their group values are concerned. What is worth noting is first of all the occurrence of plant species recognized as characteristic of very different habitats and phytocenoses, from mesophilous wetland plants to xerophilous species and plants growing on sand. The greatest differentation in the syntaxonomic composition is found in herbal plants and semi-subshrubs, by far lowest — in trees, shrubs and bryophytes. For all this diversity and syntaxonomic

Table 5. Syntaxonomic groups, frequency and numerical strength of plant species

Constancy (A, A_1, A_2) and cover of species (B, B_1, B_2)[x]	A						B					
	A_1			A_2			B_1			B_2		
Number of variant[xx]	1	2	3	1	2	3	1	2	3	1	2	3
	1	2			3			4			5	
A,B. Trees and shrubs												
I. Ch: a (Al) - Eu-Arction, b (Al) - Alliarion, c (Cl, total - Epilobietea angustifolii, d (Cl, total - Rhamno-Prunetea, e (Xs) - other synanthropic species												
a Lycium barbarum b	20	107	28	V	V	V	1130,1	6785,0	2400,0	5	5	5
a Lycium barbarum c	.	3	1	.	+	s	.	5,2	0,1	.	r	r
b Robinia pseudoacacia b	1	6	.	s	+	.	0,1	22,9	.	r	1	.
c Sambucus nigra b/c (= Vie)	6	29	3	II	II	I	10,4	62,2	0,3	1	1	r
d Prunus spinosa b	1	2	.	s	+	.	5,0	0,2	.	1	r	.
e Acer negundo b/c	1	3	.	s	+	.	0,1	0,3	.	r	r	.
e Syringa vulgaris b/c	.	7	2	.	+	+	.	10,5	0,2	.	r	r
II. Ch: a (Cl) - Querco-Fagetea, b (O) - Fagetalia silvaticae (ss), C (Al) - Alno-Padion (ss), d (Al) - Carpinion betuli (ss), e (Xl) - other forest species (ss)												
a Fraxinus excelsior b/c	.	5	2	.	+	+	.	10,3	0,2	.	r	r
C. Herbaceous plants												
I. Ch: a (Cl, total) - Phragmitetea, b (Cl, O) - Bidentetea tripartiti, Bidentetalia tripartiti, c (Al) - Chenopodion fluviatile (ss), d (Cl) - Alnetea glutinosae (ss), e (Xb) - other marshy species (ss)												
a Solanum dulcamara	1	1	.	s	s	.	5,0	5,0	.	1	r	.
a Phragmites australis	.	2	.	.	+	.	.	0,2	.	.	r	.
b Bidens tripartita	.	3	.	.	+	.	.	0,3	.	.	r	.
II. Ch: a (Cl) - Molinio-Arrhenatheretea, b (O) - Molinietalia coeruleae, c (Al) - Molinion coeruleae (ss), d (O) - Arrhenatheretalia, e (Al) - Arrhenatherion, f (Al) - Cynosurion												
a Trifolium pratense	1	1	.	s	s	.	0,1	0,1	.	r	r	.
a Achillea millefolium	10	42	5	III	II	I	28,2	48,3	0,5	1	1	r
a Poa pratensis	1	12	3	s	I	I	0,1	58,3	0,3	r	1	r
a Rumex acetosa	.	6	1	.	+	s	.	22,9	0,1	.	1	r
a Plantago lanceolata	.	8	.	.	+	.	.	0,8	.	.	r	.
b Deschampsia caespitosa	1	1	.	s	s	.	0,1	0,1	.	r	r	.
d Bromus hordeaceus	3	3	.	I	+	.	5,2	0,3	.	1	r	.
d Taraxacum officinale	5	30	6	II	II	II	2,3	27,5	0,6	+	1	r
d Anthriscus sylvestris	3	20	4	I	I	I	5,2	29,2	0,4	1	1	r
d Dactylis glomerata	1	24	4	s	II	I	0,1	12,2	0,4	r	+	r
d Heracleum sphondylium ssp.sph.	1	2	1	s	+	s	0,1	17,6	0,1	r	+	r
e Pastinaca sativa	1	4	1	s	+	s	0,1	0,4	0,1	r	r	r
e Arrhenatherum elatius	3	5	2	I	+	+	0,3	0,5	0,2	r	r	r
f Cynosurus cristatus	2	1	.	I	s	.	0,2	0,1	.	r	r	.
f Trifolium repens	.	5	.	.	+	.	.	0,5	.	.	r	.
III. Ch: a (O, total) - Trifolio fragiferi-Agrostietalia, b (O, total) - Plantaginetalia majoris, c (Cl, total) - Polygono-Poëtea annuae												
a Rumex crispus	1	2	1	s	+	s	0,1	5,1	0,5	r	r	r
a Ranunculus repens	1	2	1	s	+	s	0,1	0,2	0,1	r	r	r
a Agrostis alba (stolonifera)	.	4	.	.	+	.	.	10,2	.	.	r	.
b Lolium perenne	2	19	4	I	I	I	5,1	21,5	0,4	1	1	r
b Plantago major	1	9	3	s	+	I	0,1	10,7	0,3	r	+	r
c Chamomilla suaveolens	1	1	.	s	s	.	0,1	0,1	.	r	r	.
c Poa annua	3	12	6	I	I	II	0,3	6,1	0,6	r	r	r
c Polygonum aviculare	.	19	9	.	I	II	.	11,7	0,9	.	+	r
c Capsella bursa-pastoris	.	12	.	.	I	.	.	1,2	.	.	r	.
IV. Ch: a (Cl) - Secalietea, b (O) - Secalietalia, c (O) - Aperetalia, d (Al) - Aphanion												
a Papaver rhoeas	1	2	.	s	+	.	0,1	0,2	.	r	r	.
b Aethusa cynapium	2	3	.	I	+	.	0,2	0,3	.	r	r	.
c Apera spica-venti	1	1	.	s	s	.	0,1	0,1	.	r	r	.
d Matricaria perforata	2	4	.	I	+	.	0,2	5,3	.	r	r	.
d Consolida regalis	1	1	.	s	s	.	0,1	0,1	.	r	r	.
V. Ch: a (Cl) - Chenopodietea, b (O) - Polygono-Chenopodietalia, c (Al) - Eu-Polygono-Chenopodion, d (Al) - Panico-Setarion, e (O, Al) - Sisymbrietalia, Sisymbrion, f (O, Al) - Eragrostietalia, Eragrostion (ss), g (Cl, total) - Agropyretea intermedii-repentis												
a Atriplex patula	2	21	6	I	I	II	0,2	53,8	0,6	r	1	r
a Chenopodium album	1	43	20	s	II	IV	17,5	97,9	2,0	1	1	r
a Geranium pusillum	3	9	2	I	+	+	0,3	5,8	0,2	r	r	r
a Solanum nigrum	1	3	3	s	+	I	0,1	0,3	0,3	r	r	r
b Echinochloa crus-galli	1	1	.	s	s	.	5,0	0,1	.	1	r	.
b Sonchus arvensis	.	2	.	.	+	.	.	0,2	.	.	r	.
b Polygonum lapathifolium	1	1	.	s	s	.	0,1	0,1	.	r	r	.
c Oxalis stricta	1	1	.	s	s	.	0,1	0,1	.	r	r	.
c Lamium purpureum	1	2	3	s	+	I	0,1	0,2	0,3	r	r	r
c Galinsoga parviflora	1	3	9	s	+	II	0,1	5,2	0,9	r	r	r
c Sonchus oleraceus	.	7	8	.	+	II	.	0,7	0,8	.	r	r
c Sonchus asper	.	2	.	.	+	.	.	0,2	.	.	r	.
d Setaria viridis	.	3	.	.	+	.	.	5,2	.	.	r	.
e Urtica urens	3	7	.	I	+	.	35,1	0,7	.	1	r	.
e Cannabis ruderalis	2	7	.	I	+	.	0,2	10,5	.	r	r	.
e Bromus tectorum	2	11	.	I	I	.	5,0	23,4	.	1	1	.

Table 5 — continued

1	2				3			4			5		
e Lactuca serriola	3	3	.	I	+	.	5,2	0,3	.	1	r	.
e Descurainia sophia	5	14	3	II	I	I	0,5	1,4	0,3	r	r	r
e Sisymbrium officinale	2	15	7	I	I	II	0,2	30,9	0,7	r	1	r
e Sisymbrium loeselii	1	12	2	s	I	+	0,1	83,2	0,2	r	1	r
e Malva neglecta	2	8	1	I	+	s	5,1	0,8	0,1	1	r	r
e Cannabis sativa	1	2	2	s	+	+	0,1	0,2	0,2	r	r	r
e Malva silvestris	.	14	.	.	I	.	.	6,3	.	.	r	.
e Hordeum murinum	.	6	.	.	+	.	.	27,8	.	.	1	.
e Atriplex nitens	.	6	.	.	+	.	.	32,7	.	.	1	.
e Bromus sterilis	.	5	.	.	+	.	.	10,3	.	.	r	.
e Sisymbrium altissimum	.	4	.	.	+	.	.	17,8	.	.	+	.
e Chenopodium opulifolium	.	2	.	.	+	.	.	10,0	.	.	r	.
g Convolvulus arvensis	11	48	11	III	III	II	33,2	78,8	1,1	1	1	r
g Elymus repens	8	61	4	II	III	I	50,3	410,5	0,4	1	1	r
g Cirsium arvense	3	19	9	I	I	II	17,7	38,9	0,9	1	1	r
g Poa compressa	1	5	1	s	+	s	0,1	0,5	0,1	r	r	r
g Equisetum arvense	.	5	.	.	+	.	.	0,5	.	.	r	.
VI. Ch: a (Cl) - Artemisietea vulgaris, b (O) - Onopordetalia acanthii, c (Al) - Onopordion acanthii, d (Al) - Eu-Arction, e (Al) - Alliarion, f (O) - Convolvuletalia sepium, g (Al) - Senecion fluviatilis, h (Xs) - other synanthropic species												
a Artemisia vulgaris	15	82	22	IV	IV	IV	90,9	324,2	2,2	1	1	r
a Urtica dioica	12	63	16	III	III	III	122,9	242,4	1,6	2	1	r
a Tanacetum vulgare	2	10	3	I	+	I	0,2	10,8	0,3	r	+	r
a Daucus carota	2	7	2	I	+	+	5,1	0,7	0,2	1	r	r
a Carduus crispus	.	6	1	.	+	s	.	5,5	0,1	.	r	r
b Anchusa officinalis	4	2	.	I	+	.	0,4	0,2	.	r	r	.
b Nepeta cataria	1	9	.	s	+	.	5,0	5,8	.	1	r	.
b Artemisia absinthium	2	15	1	I	I	s	5,1	16,2	0,1	1	+	r
b Silene alba	7	30	5	II	II	I	0,7	12,8	0,5	r	+	r
b Arctium minus	.	2	.	.	+	.	.	0,2	.	.	r	.
c Melilotus albus	2	3	.	I	+	.	0,2	0,3	.	r	r	.
c Echium vulgare	1	3	.	s	+	.	5,0	5,2	.	1	r	.
c Berteroa incana	5	18	9	II	I	II	10,3	6,7	0,9	1	r	r
c Carduus acanthoides	1	16	3	s	I	+	0,1	21,2	0,3	r	+	r
c Onopordon acanthium	1	10	3	s	+	I	0,1	10,8	0,3	r	+	r
c Oenothera biennis	1	3	1	s	+	s	0,1	0,3	0,1	r	r	r
c Melilotus officinalis	.	1	1	.	s	s	.	0,1	0,1	.	r	r
c Hyoscyamus niger	.	2	.	.	+	.	.	0,2	.	.	r	.
d Armoracia rusticana	1	2	.	s	+	.	0,1	5,1	.	r	r	.
d Ballota nigra	9	84	19	III	IV	IV	60,2	577,8	6,8	1	2	1
d Lamium album	4	20	11	I	I	II	0,4	11,8	1,1	r	+	r
d Arctium tomentosum	3	16	2	I	I	+	5,2	21,2	0,2	1	+	r
d Leonurus cardiaca	3	9	2	I	+	+	0,3	10,7	0,2	r	+	r
d Rumex obtusifolius	.	2	.	.	+	.	.	5,1	.	.	r	.
e Bryonia alba	1	8	.	s	+	.	0,1	5,7	.	r	r	.
e Viola odorata	2	.	.	I	.	.	0,2	.	.	r	.	.
e Chaerophyllum aromaticum	1	2	.	s	+	.	5,0	5,1	.	1	r	.
e Impatiens parviflora	2	2	.	I	+	.	0,2	0,2	.	r	r	.
e Chelidonium majus	7	34	6	II	II	II	50,2	87,2	0,6	1	1	r
e Alliaria petiolata	.	1	1	.	s	s	.	0,1	0,1	.	r	r
e Chaerophyllum bulbosum	.	1	1	.	s	s	.	0,1	0,1	.	r	r
f Calystegia sepium (= VI e)	1	7	1	s	+	s	0,1	5,6	0,1	r	r	r
g Solidago canadensis (= VIe)	4	8	2	I	+	+	22,7	40,5	0,2	1	1	r
g Saponaria officinalis (= VIe)	1	2	3	s	+	I	5,0	5,1	0,3	1	r	r
g Solidago gigantea (= VIe)	.	3	4	.	+	I	.	0,3	0,4	.	r	r
h Galeopsis tetrahit	3	5	.	I	+	.	0,3	22,8	.	r	1	.
h Atriplex sp.	1	2	.	s	+	.	0,1	0,2	.	r	r	.
h Linaria vulgaris	1	1	.	s	s	.	0,1	0,1	.	r	r	.
h Medicago lupulina	1	2	.	s	+	.	0,1	0,2	.	r	r	.
h Bilderdykia dumetorum	3	13	2	I	I	+	17,7	75,7	0,2	1	1	r
h Bilderdykia convolvulus	2	17	2	I	I	+	0,2	11,5	0,2	r	+	r
h Galium aparine	7	39	6	II	II	II	18,1	241,6	0,6	1	1	r
h Conyza canadensis	3	12	9	I	I	II	5,2	6,1	0,9	1	r	r
h Stellaria media	3	4	2	I	+	+	5,2	0,4	0,2	1	r	r
h Galeopsis pubescens	1	4	1	s	+	s	0,1	0,4	0,1	r	r	r
h Lapsana communis	3	5	1	I	+	s	0,3	0,5	0,1	r	r	r
h Hypericum perforatum	1	3	1	s	+	s	0,1	0,3	0,1	r	r	r
h Chenopodium hybridum	3	9	1	I	+	s	0,3	0,9	0,1	r	r	r
h Amaranthus retroflexus	.	6	2	.	+	+	.	0,6	0,2	.	r	r
h Senecio vulgaris	.	5	2	.	+	+	.	0,5	0,2	.	r	r
h Solanum tuberosum	.	3	1	.	+	s	.	0,3	0,1	.	r	r
h Erysimum cheiranthoides	.	2	2	.	+	+	.	0,2	0,2	.	r	r
h Festuca rubra	.	2	1	.	+	s	.	17,6	0,1	.	+	r
h Agrostis tenuis	.	2	.	.	+	.	.	5,1	.	.	r	.
h Chenopodium viride	.	2	.	.	+	.	.	5,1	.	.	r	.
VII. Ch: a (Cl, total) - Sedo-Scleranthetea, b (Cl, total) - Festuco-Brometea, c (Xk) - other xerothermic species												
a Potentilla argentea	1	1	.	s	s	.	0,1	0,1	r	r	.
a Arenaria serpyllifolia	1	2	1	s	+	s	0,1	0,2	0,1	r	r	r
a Rumex acetosella	.	2	1	.	+	s	.	5,1	0,1	.	r	r
a Cerastium arvense	.	2	.	.	+	.	.	0,2	.	.	r	.
a Hieracium pilosella	.	2	.	.	+	.	.	0,2	.	.	r	.
a Myosotis stricta	.	2	.	.	+	.	.	0,2	.	.	r	.

Table 5 — continued

1	2			3			4			5		
b Bromus inermis	3	11	.	I	I	.	10,1	28,3	.	1	1	.
b Galium mollugo	1	14	.	+	I	.	0,1	6,3	.	r	r	.
b Artemisia campestris	2	2	.	I	+	.	0,2	5,1	.	r	r	.
b Achillea pannonica	1	1	.	s	s	.	0,1	0,1	.	r	r	.
b Centaurea rhenana	.	3	1	.	+	s	.	0,3	0,1	.	r	r
b Acinos arvensis	.	3	.	.	+	.	.	5,2	.	.	r	.
c Melica altissima	.	3	.	.	+	.	.	87,7	.	.	1	.
c Falcaria vulgaris	.	3	1	.	+	s	.	0,3	0,1	.	r	r
VIII. Ch: a (Cl, total) - Epilobietea angustifolii, b (Cl, total) - Rhamno-Prunetea, c (Cl, total) - Trifolio-Geranietea sanguinei, d (Xz) - other species of scrub)												
a Torilis japonica	2	8	.	I	+	.	17,6	0,8	.	1	r	.
a Rubus idaeus	1	2	.	s	+	.	5,0	0,2	.	1	r	.
a Rubus caesius	5	9	3	II	+	I	37,5	5,8	0,3	1	r	r
b Rubus plicatus	2	.	.	I	.	.	22,5	.	.	1	.	.
c Medicago sativa	5	8	.	II	+	.	25,0	0,8	.	1	r	.
d Festuca ovina	2	.	1	I	.	s	10,0	.	0,1	1	.	r
d Cuscuta epithymum	1	1	.	s	s	.	5,0	0,1	.	1	r	.
d Pimpinella saxifraga	2	2	.	I	+	.	0,2	0,2	.	r	r	.
d Veronica chamaedrys	1	3	.	s	+	.	0,1	0,3	.	r	r	.
d Glechoma hederacea	4	14	4	I	I	I	0,4	21,0	0,4	r	+	r
d Cichorium intybus	.	11	.	.	I	.	.	1,1	.	.	r	.
d Euphorbia esula	.	4	.	.	+	.	.	0,4	.	.	r	.
d Silene vulgaris	.	2	.	.	+	.	.	0,2	.	.	r	.
IX. Ch: a (Cl) - Querco-Fagetea, b (O) - Fagetalia silvaticae (ss), c (X1) - other forest species												
a Aegopodium podagraria	3	3	.	I	+	.	72,5	5,2	.	1	r	.
c Humulus lupulus	5	2	.	II	+	.	40,2	0,2	.	1	r	.
c Geum urbanum	2	5	.	I	+	.	0,2	0,5	.	r	r	.
D. Mosses												
I. Ch: (Cl, total) - Sedo-Scleranthetea												
Brachythecium albicans	.	2	.	.	+	.	.	0,2	.	.	r	.
II. Ch: (U) - other forest and all species												
Brachythecium salebrosum	1	2	1	s	+	s	0,1	0,2	5,0	r	r	+
Amblystegium serpens	1	.	1	s	.	s	0,1	.	37,5	r	.	1
Brachythecium rutabulum	.	2	.	.	+	.	.	5,1	.	.	r	.
Leptobryum puriforme	.	2	.	.	+	.	.	0,2	.	.	r	.

Sporadic species

A, B. Trees and shrubs: Id: 1. Crataegus monogyna b (1), Rosa rubiginosa b (+), R. sp. b/c (+); 2. Euonymus europaea b (+). b (+). Ie: 1. Ligustrum vulgare b (+). Symphoricarpos albus b (+); 2. Aesculus hippocastanum b (+), Morus alba b (1). IIa: 3. Acer platanoides b (+). IIb: 2. Ulmus minor b (+). IIc: 2. Acer pseudoplatanus c (+), IId: 1. Prunus avium b (+). IIe: 1. Quercus robur b (+).

C. Herbaceous plants: Ic: 2. Atriplex hastata (+), Chenopodium rubrum +. Id: 2. Lycopus europaeus +. Ie: 3. Epilobium roseum +. IIa: 1. Poa trivialis v. stricta 1; 2. Cerastium vulgatum x, Centaurea jacea +, Phleum pratense +, Vicia cracca +. IIc: 2. Thalictrum flavum +. IId: 2. Heracleum sphondylium ssp. sibiricum +; 3. Bellis perennis +. IIe: 2. Knautia arvensis +. IIf: 2. Leontodon autumnalis +. IIIa: 2. Potentilla reptans +; 3. P. anserina +. IIIc: 2. Lepidium ruderale +. IVc: 1. Vicia hirsuta +. IVd: 2. Chamomilla recutica +. Vc: 3. Galinsoga quadriradiata +. Ve: 2. Atriplex tatarica +, A. oblongifolium +, Bunias orientalis +, Iva xanthiifolia +. Vf: 2. Eragrostis poaeoides +. Vg: 2. Cardaria draba 2, Carex hirta +. VIb: 2. Arctium sp. +, Dipsacus fullonum 2. VIc: 1. Carduus nutans +, Cynoglossum officinale 1, Marrubium vulgare +, Lappula squarrosa +, Oenothera rubricaulis +. VId: 2. Helianthus tuberosus (= VIe) +. VIe: 2. Bryonia cretica +, Sicyos angulata +; 3. Echinocystis lobata +. VIh: 1. Centaurea stoebe (+), Lamium maculatum 1, Secale cereale +; 2. Anthemis arvensis +, Brassica nigra +, Crepis tectorum +, Camelina sativa +, Carum carvi +, Chenopodium sp. +, Echinops sphaerocephalus +, Epilobium sp. +, Diplotaxis muralis 1, Eryngium planum 1, Malva pusilla +, Medicago sativa +, Parthenocissus quinquefolia +, Polygonum persicaria 1, Prunella vulgaris +, Sinapis arvensis +. VIIa: 2. Sedum maximum +. VIIb: 2. Anthemis tinctoria +, Allium oleraceum +, Centaurea scabiosa +, Euphorbia cyparissias +. VIIc: 2. Cardaminopsis arenosa +. VIIIb: 1. Clematis vitalba 1. VIIIc: 1. Coronilla varia 2; 2. Agrimonia eupatoria +. VIIId: 3. Picris hieracioides +, Veronica hederifolia 1. IXa: 1. Brachypodium silvaticum +. IXb: 1. Lysimachia nemorum +. IXc: 1. Hedera helix 1; 2. Glechoma hirsuta +.

D. Mosses: II: 2. Barbula unguiculata +, Camptothecium lutescens 1, Tortula ruralis +; 3. Brachythecium sp. +.

Explanations. x: A — species frequency: A1 — number of occurrences, A2 — class of percent frequency, B — species covering in percent: B1 — total, B2 — class of mean percent species covering. xx: No of variant of *Lycietum barbari* association: 1. thick undergrowth (20 phytosociological records), 2. ruderal (106 phytosociological records), 3. impoverished (28 phytosociological records).

Data after Table 2. In the list of species occurring only in one phytosociological record with regard to all the variants examined (no. 1–3) the following order was given: no. of syntaxonomic group and variant no., and after a species listed — the grade of its covering in percent on a 5-grade scale defined in Table 2. ss — mark of the syntaxonomic plant group containing only sporadic species listed at the bottom of the Table.

Table 6. List of materials used for the syntaxonomic characteristics of *Lycietum barbari* association in Poland. x — author, publication year and rank (zp. — association, zb. — community) of phytocenosis listed and its assignment to a higher phytosociological unit: RS — class *Rudero-Secalietea*, Av — class *Artemisietea vulgaris*, Oaa — order *Onopordetalia acanthii*, On — alliance *Onopordion*, EA — alliance *Eu-Arction* (=Arction lappae), Epa — class *Epilobietea angustifolii*, Eaa — order *Epilobietalia angustifolii*, Ean — alliance *Epilobion angustiofolii*, Sa — order *Sambucetalia*, SSn — alliance *Sambuco-Salicion*. xx — variant no. of association: 1. thick undergrowth, 2. ruderal, 3. impoverished. xxx — nos of phytosociological records: first — according to their succession order in the working table (not included), and after "/" — after the authors cited

Basic informations about exploited phytosociological materials[x]	Number of variant[xx] / Number of records[xxx]		
	1	2	3
Święs, Piórecki (1988). RS, Sa, SSn, zp. Anthrisco-Lycietum halimifolii. Tab. 9	16/141		
Harasim (1978). Av, Oaa, zp. Anthrisco-Lycietum halimifolii. Tab. 2	11/75	61/76	
Kucharczyk (1990). Av, zp. Anthrisco-Lycietum halimifolii. Tab. 36	9/1, 18/2	97/3	
Kuczyńska i in. (1982). Av, Oaa, EA, zp. Anthrisco-Lycietum halimifolii. Tab. 12	3/4, 4/2. 7/3, 15/6	21/5, 44/1	
Ćwikliński (1974). Av, Oaa, EA, zp. Anthrisco-Lycietum halimifolii. Tab. 24	10/3	68/1, 112/2, 113/4	
Ceynowa (1968). RS, Oaa, EA, zb. Lycium halimifolium. Tab. 34	13/2	39/5, 47/6, 48/4, 95/3, 99/1	
Janecki (1938). RS, Oaa, On, zp. Anthrisco-Lycietum halimifolii. Tab. 10	8/7, 12/2	22/5, 28/8, 29/6, 35/4, 66/10, 70/9, 91/11, 123/3, 116/1	
Sowa (1971). Av, Oaa, EA, zp. Anthrisco-Lycietum halimifolii. Tab. 24	1/16, 5/9, 6/7, 17/3	24/4, 31/14, 32/12, 33/8, 40/1, 42/13, 49/2, 54/11, 58/15, 63/6, 67/10, 69/5	
Anioł-Kwiatkowska (1974). Av, Oaa, EA, zp. Anthrisco-Lycietum halimifolii. Tab. 27	14/9, 20/15	24/4, 25/3, 26/13, 30/14, 38/7, 43/16, 50/18, 52/17, 55/6, 56/9, 57/20, 62/2, 73/11, 79/5, 85/1, 90/8, 92/21, 94/12, 118/10	
Pawlak (1985). Av, Oaa, EA, zp. Lycietum halimifolii. Tab. 68	2/5	93/1, 107/3, 120/2	136/4
Gruszczyńska (1986). Av, Oaa, EA, zb. Lycium halimifolium. Tab. 8	19/2	34/10, 37/9, 41/6, 46/1, 59/3, 65/8, 83/4, 109/7	153/5
Święs, Kucharczyk (1982). RS, Sa, SSn, zp. Anthrisco-Lycietum halimifolii. Tab. 8		76/81	
Kępczyński, Zienkiewicz (1974). Av,Oaa, EA, zb. Lycium halimifolium. Str. 43		119/1	
Fijałkowski (1963). Av, Oaa, EA, zb. Lycium halimifolium. Tab. 1		84/36, 115/35	
Kucharczyk, Kucharczyk (1983). RS, Oaa,SSn, zp. Anthrisco-Lycietum halimifolii. Tab. 7		86/94, 87/96, 100/95	
Wertelnik (1979). Av, Oaa, EA, zp. Anthrisco-Lycietum halimifolii. Tab. 18		89/2, 98/1, 105/3	
Misiewicz (1976). Av, Oaa, EA, zp. Anthrisco-Lycietum halimifolii. Tab. 44		45/2, 71/3, 77/4, 81/1	
Fijałkowski (1967). Ch, Oaa, EA, zp. Anthrisco-Lycietum halimifolii. Tab. 4		72/147, 96/146, 103/144, 124/145, 126/148	
Fijałkowski (1978). Epa, SSn, Sa zp. Anthrisco-Lycietum halimifolii. Tab. 28		27/691, 51/698, 53/696, 74/689, 75/692, 78/697, 82/690, 88/693, 117/695, 125/694	
Święs (1993). Epa, Eaa, zp. Anthrisco-Lycietum halimifolii. Tab. 13		101/275, 106/274	144/273
Ćwikliński (1966). RS, Oaa, EA, zb. Lycium halimifolium. Tab. 3		36/2, 102/10, 104/8, 111/5, 114/1, 121/11, 122/7, 127/6	128/9, 138/3, 139/4
Wojterska (1990). Av, Oaa, EA, zp. Lycietum halimifolii. Tab. 20		60/2, 64/4, 80/7, 108/5, 110/8	134/3, 135/6, 145/1
Święs, Witkowska-Wawer (1988). Epa,Eaa,SSn, zp. Anthrisco-Lycietum halimifolii. Tab. 17			130/379, 131/378, 142/380
Rostański, Gutte (1971). Av, EA, zp. "Lycium halimifolia". Tab. 18			140/9, 154/10, 155/8
Maciejczak (1985). Av, Oaa, On, zp. Lycietum halimifolii. Tab. 57			141/1, 143/2, 146/3
Kępczyński (1975). Av, Oaa, On, zp. Lycietum halimifolii. Tab. 63			129/7, 132/8, 133/9, 137/1, 147/4, 148/5, 149/3, 150/2, 151/10, 152/6

heterogeneity of the *Lycietum barbari* association, it must also be stressed that the main role in it is played by plant species from fairly numerous, definite syntaxonomic groups. These are primarily species recognized as synanthropic ubiquitous and as characteristic of the whole of phytosociological units of the classes *Artemisietea vulgaris, Chenopodietea* and *Molinio-Arrhenatheretea*. Among other syntaxonomic plant groups, comparatively the highest numerical strength falls on species regarded as characteristic of the whole of phytosociological units of the classes *Epilobietea angustifolii, Polygono-Poötea annuae, Trifolio-Geranietea sanguinei* and *Agropyretea intermedii-repentis* and on species found most commonly in forests, shrubs and the thick undergrowth. With regard to lower phytosociological units within classes, the main role in the phytocenosis in question is played by plant species characteristic primarily of alliances *Eu-Arction, Alliarion, Onopordion* and *Sisymbrion*, and to a lesser extent species characteristic of orders *Trifolio fragiferi-Agrostietalia* and *Plantaginetalia majoris*.

In general, the *Lycietum barbari* association, with respect to its general phytosociological and ecological properties, is closer to the vegetation group of the class *Artemisietea vulgaris*, order *Onopordetalia acanthii*, alliance *Eu-Arction*, than to any other vegetation groups. This is mainly indicated by: comparatively the most frequent dominance of species characteristic of the class *Artemisietea vulgaris*, order *Onopordetalia acanthii* and alliance *Eu-Arction*; highly ruderal and thermophilous ecological properties of the *Lycietum barbari* association, characteristic of its higher phytosociological units mentioned above, especially of the alliance *Eu-Arction* and order *Onopordetalia acanthii*.

The *Lycietum barbari* association can, as follows from the data by Ubirzsy (55) and Jurko (19), be identified on the basis of as many as 11 plant species of the characteristic and distinctive species group. These are: *Lycium barbarum, L. ovalifolium, Anthriscus trichosperma, Bromus maximus, B. sterilis, Robinia pseudacacia, Ballota nigra, Elymus repens, Atriplex oblongifolia, Sisymbrium orientale* and *Artemisia pontica*. It appears that out of the named plants only *Lycium barbarum* can be recognized as a characteristic species of the *Lycietum barbari* association formed in domestic stations. Other species, like *Lycium ovalifolium, Anthriscus trichosperma* and *Bromus maximus* do not occur in Polish flora. The species: *Atriplex oblongifolia, Sisymbrium orientale* and *Artemisia pontica* occur very seldom in Poland among various ruderal phytocenoses. Finally, the rest of the species of the group in question like *Robinia pseudacacia, Ballota nigra, Elymus repens* and *Bromus sterilis* are now regarded as characteristic elements of separate ruderal associations: *Chelidonio-Robinietum, Balloto-Chenopodietum, Agropyretum repentis* and *Hordeo-Brometum* (31, 36, 46, 47).

In the studied association *Lycietum barbari*, apart from *Lycium barbarum*, plants that are found most often and in great numbers include (Table 5): *Sambu-*

cus nigra, Descurainia sophia, Chenopodium album, Tanacetum vulgare, Urtica dioica, Artemisia vulgaris, A. absinthium, Ballota nigra, Silene alba, Convolvulus arvensis, Elymus repens, Cirsium arvense, Lolium perenne, Achillea millefolium, Dactylis glomerata, Taraxacum officinale. Most of those species are regarded as characteristic of the commonest ruderal associations at home and abroad (31, 36): *Sambucetum nigrae, Sisymbrietum sophiae, Chenopodietum ruderale, Tanaceto--Artemisietum vulgaris, Potentillo-Artemisietum absinthii, Agropyretum repentis* and *Lolio-Plantaginetum*. The *Lycietum barbari* association is most often found in the neighbourhood of those associations and exhibits various genetic links with them.

General Dynamics

The most significant feature in the succession growth of the phytocenosis with *Lycium barbarum* is the progressive reduction of earlier-settled plants sensitive to the greater and greater overshadowing brought about by the intensely growing shoots of that shrub. It should be added for the sake of accuracy that in phytosociological investigations expanses of communities with *Lycium barbarum* are as a rule omitted that were formed during the two extreme stages of succession development: initial at the begining and the final optimum stage. In the initial growth stage it is an open phytocenosis, abundant with plant species coming from the surrounding plant communities, while in the final forming stage it is compact, chiefly composed of *Lycium barbarum* with a negligible presence of accompanying plant species.

The three variants distinguished in the *Lycietum barbari* association: thick undergrowth, ruderal, and impoverished, do in fact represent highly developed, definite succession development phases of the association's expanse: from the final phase of the initial stage towards the initial phase of the optimal stage. The eventually formed compact thicket with *Lycium barbarum* is very durable and can be driven out of its station only by highly expansive, planted or self-sown species of trees and high shrubs (Fig. 2–7).

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STRESZCZENIE

Badane od kilkudziesięciu lat w Polsce i innych krajach Europy fitocenozy z *Lycium barbarum* (= *L. halimifolium*) nie posiadają dotąd jednoznacznie zdefiniowanej rangi i pozycji w systemie fitosocjologicznym. Charakteryzowane są one w postaci jednego zespołu o nazwach *Lycietum halimifolii* lub *Anthrisco-Lycietum halimifolii*, albo jako bliżej fitosocjologicznie nie określone zbiorowisko z *Lycium halimifolium*.

Wymienione fitocenozy zaliczane są do czterech klas (*Robinio-Lycietea, Artemisietea vulgaris, Epilobietea angustifolii, Querco-Fagetea*), czterech rzędów (*Onopordetalia acanthii, Epilobietalia angustifolii, Sambucetalia* i *Prunetalia*) i do pięciu związków zespołów (*Berberidion, Onopordion, Eu-Arction, Epolobion angustifolii* i *Sambuco-Salicion*).

W niniejszym opracowaniu przedstawiono syntetyczną charakterystykę fitosocjologiczną i ekologiczną fitocenozy z *Lycium barbarum*, uformowanej na stanowiskach z obszaru Polski. Podstawowe materiały fitosocjologiczne i ekologiczne do tych badań stanowiło 155 zdjęć fitosocjologicznych i 10 przebadanych w nich odkrywek glebowych. Wyniki badań przedstawiono na ryc. 1–7 i w tab. 1–6.

Obecnie wykazano, że fitocenozy z *Lycium barbarum*, uformowane na terenie Polski, mogą być ujęte w jednakowym stopniu: albo jako słabo wyodrębniający się zespół o nazwie *Lycietum barbarii* (= *Lycietum halimifolii, Anthrisco-Lycietum halimifolii*), albo jako bliżej fitosocjologicznie nie określone zbiorowisko z *Lycium barbarum*. Wskazuje na to: 1) bardzo uproszczona i niejednorodna struktura florystyczna, zwłaszcza w optymalnym stadium rozwojowym; 2) brak w nich, oprócz *Lycium barbarum*, jakichkolwiek innych gatunków diagnostycznych (charakterystycznych,

wyróżniających); 3) brak w nich jakiejkolwiek tak zwanej swoistej kombinacji gatunków charakterystycznych i wyróżniających; 4) ich na wpół sztuczne pochodzenie. Są to generalne cechy struktury różnego typu zbiorowisk roślin zaroślowych.

Następnie wykazano, że fitocenoz typu zespołu *Lycietum* nie cechuje na obszarze Polski wyraźniejsze zróżnicowanie na trwałe, niższe jednostki fitosocjologiczne. Wyodrębnione w tym dyskusyjnym zespole trzy warianty: ziołoroślowy, ruderalny i zubożały, prawdopodobnie reprezentują główne sukcesyjne jego stadia rozwojowe — począwszy od wyraźnie uformowanego stadium inicjalnego po początkowy etap optymalnego stadium rozwojowego.

W końcu wykazano, że fitocenozy z *Lycium barbarum* prezentują termofilne zaroślowe zbiorowisko roślinne stosunkowo najbardziej charakterystyczne dla klasy *Artemisietea vulgaris*, rzędu *Onopordetalia acanthii* i związku *Eu-Arction*, a wyjątkowo mogą być one zaliczane do innych grup roślinności, głównie z klas *Robinio-Lycietea, Festuco-Brometea* i *Epilobietea angustifolii*.

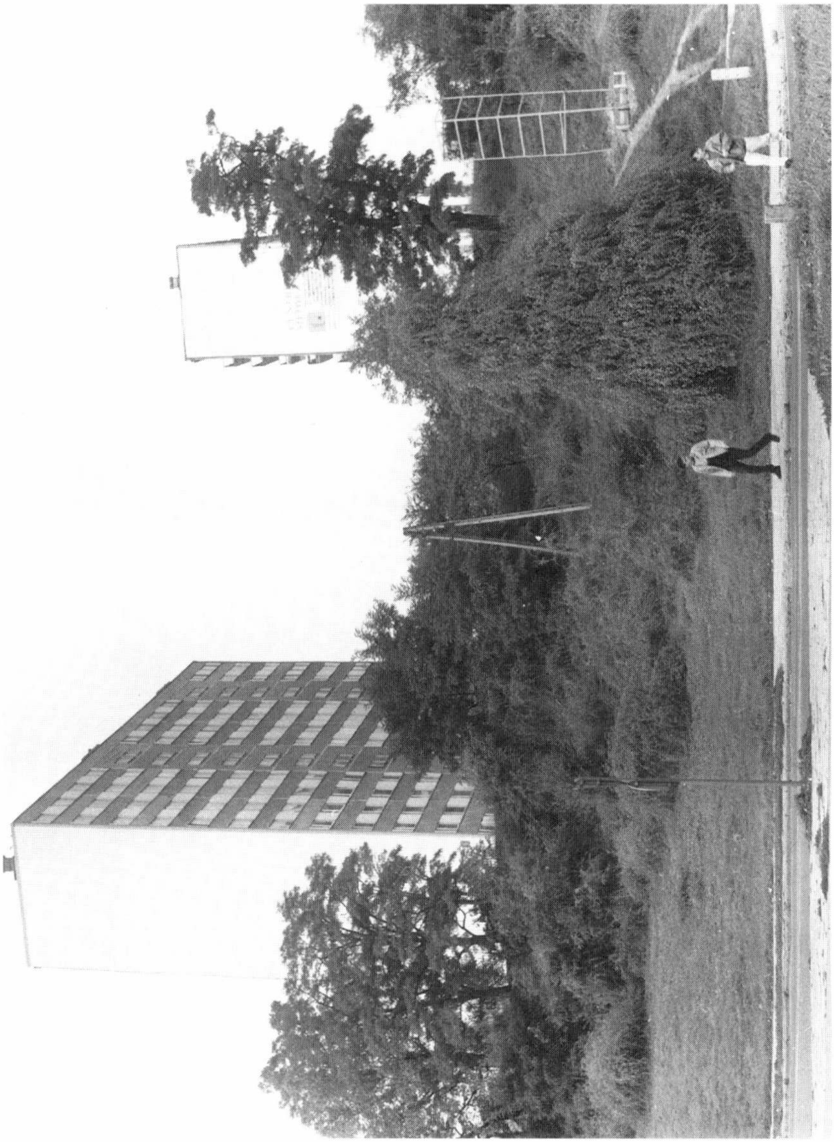

Fig. 2. Lublin, Czechów, the corner of Północna and Kompozytorów Polskich streets. Expanding clumps of planted *Lycium barbarum* on a sloping loess scarp. Bottom right: a 10-meter high garland clump with *Lycium barbarum* growing on a telephone pole

Photo by F. Święs

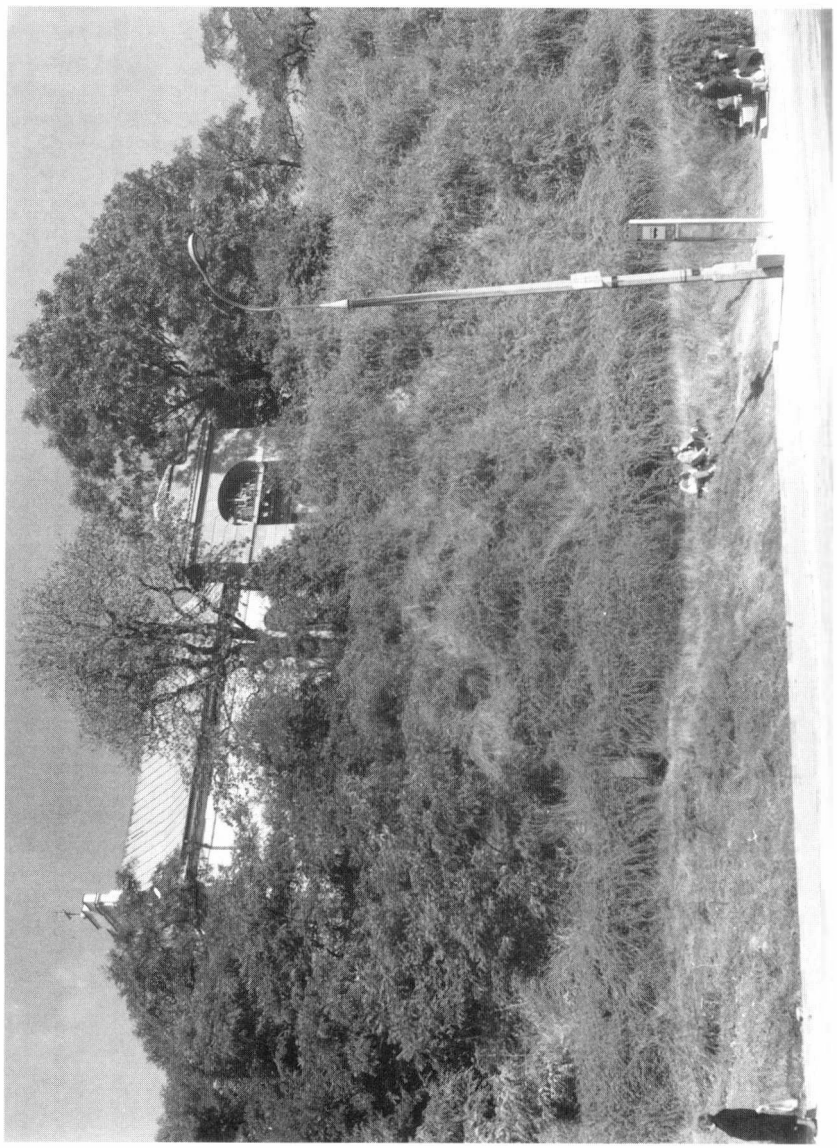

Fig. 3. Lublin. Downtown. Ruska st. A fragment of a several-dozen-are expanse of *Lycietum barbari* association on a steep loess scarp
Photo by F. Święs

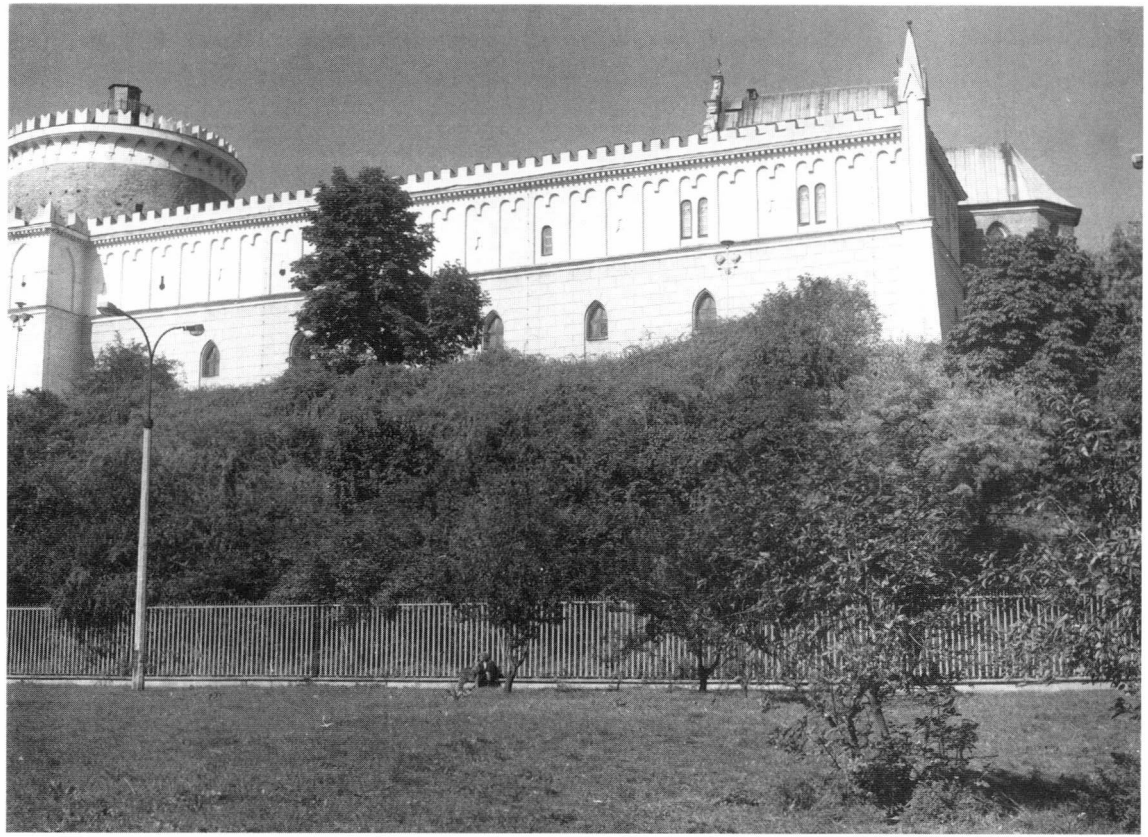

Fig. 4. Lublin, Old Town, at the walls of Lublin Castle. A several-hectare compact expanse of *Lycietum barbari* association on a steep loess scarp

Photo by F. Święs

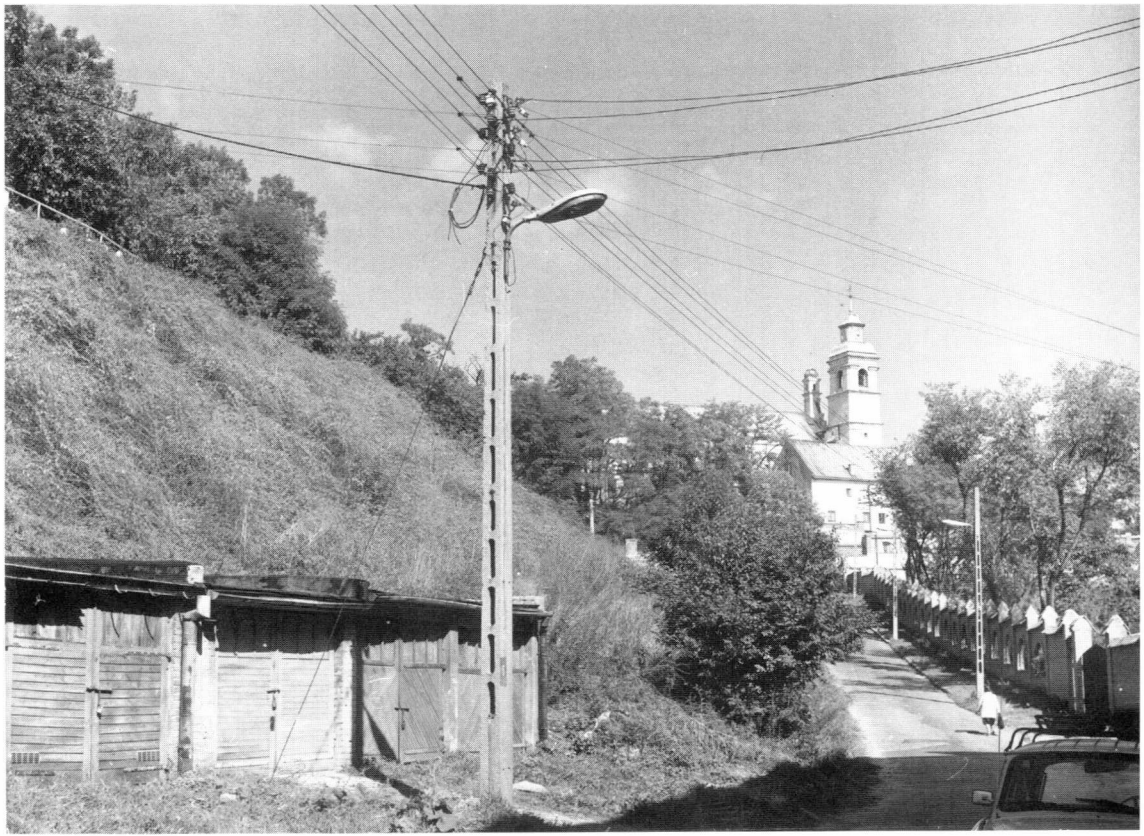

Fig. 5. Lublin, Downtown, Dolna Panny Marii st., on a sloping loess scarp. A fragment of a several-dozen-are expanse of *Lycietum barbari* association being driven out by growing trees and high shrubs

Photo by F. Święs

Fig. 6. Lublin, Dolna Panny Marii st. A community *Lycietum barbari* on a loess scarp

Photo by F. Święs

Fig. 7. Chełm, on the hill at the walls of a *Piarist Cloister*, on a rendzina scarp. Waning expanses of *Lycietum barbari* association among successively expanding trees and high shrubs

Photo by F. Święs