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The participation of *Reynoutria japonica* HOUTT. in phytocoenoes growing in the Upper Silesian Industrial Region

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Abstract: Phytosociological relevés made in towns of the Upper Silesian Industrial District (Poland) in *Reynoutria*-dominated phytocoenoses which develop on ruderal sites were classified by numerical methods. On the basis of numerical classification the phytosociological tables were constructed. The Principal Component Analysis (PCA) of species abundance data was used to show the floristic diversity of all the data set.
For all the relevés, the mean number of species, Shannon-Wiener diversity index and the number of species from *Molinio-Arrhenatheretea*, *Artemisietea*, *Stellarietea mediae* classes and *Convolvuletalia sepium* order were calculated. In order to show the habitat preferences of species for all relevés mean Ellenberg's indicator values were calculated taking into account presence of species. In order to find the interset correlation of species data set with the above mentioned characteristics, a Kendall rank correlation (τ) was used.

Keywords: ruderal communities, invasive plant, anthropogenic sites, Silesian Upland (Poland).

Introduction

Natural range of *Reynoutria japonica* Houtt. is limited to south-eastern Asia (Japan and northern China). During two centuries this species has been spread into Europe, Canada, USA, New Zealand and Australia. It was introduced mainly as an ornamental species but in some countries it was used during reclamation (CONOLLY 1977, BAILEY 1999). In Polish Flora knotweed has status of permanently established alien species (kenophyte) ZAJĄC et al. (1998).

The *Reynoutria japonica* prefers mesophilous, weakly sodden places, with different amount of dust, slag, pieces of breaks, concrete, alkaline reaction and with different nitrogen, potassium and calcium content (ŚWIĘS 1994). In phytosociological literature phytocoenoses with *Reynoutria japonica* are classified in different way.

FIJAŁKOWSKI (1978) described from nitrophilous sites *Polygonetum cuspidati* and grouped it into the *Sambuco-Salicion* alliance and the *Epilobietea angustifolii* class. BRANDES (1981) who examined patches with *Reynoutria japonica* in Germany those growing on railway areas put into *Reynoutria japonica*-[*Arction*] derivate community, and those which cover river banks into *Reynoutria japonica*-[*Aegopodion*] derivate community. BRZEG (1983, 1989a), RUTKOWSKI (1993) classify *Reynoutria japonica* phytocoenoses as nitrophilous communities from the *Galio-Calystegietalia* order and the *Lapsano-Geranion robertiani* (BRZEG 1983) alliance or the *Calystegion sepium* RUTKOWSKI (1993) alliance. BRZEG (1989b) placed ruderal phytocoenoses with *Polygonum cuspidatum* into the *Agropyretalia intermedii-repentis* order and the *Convolvulo-Agropyrion* alliance. KOPECKÝ, HEJNÝ (1990), VIŠŇÁK (1986, 1996), UHERČÍKOVÁ (1991) consider phytocoenoses with knotweed only as a community and include it into *Galio-Urticetea* class. ŚWIĘS (1994) grouped phytocoenoses with *Reynoutria japonica* into *Reynoutrietum japonicae* association and pointed out the intermediate position of the association between the *Alliarion* and the *Arction* alliances.

ADLER (1993) described from unmowned sites *Polygonum cuspidatum-Glechometalia* derivate community with the participation in their floristic composition species from *Glechometalia* order, forest species from *Querco-Fagetea* class and meadow from the *Molinio-Arrhenatheretea* class. In sites, which are regularly mown developed: *Polygonum cuspidatum-Artemisietea* derivate community with ruderal species; floristically poor *Polygonum cuspidatum-Arrhenatheretalia* derivate community with participation of wet meadow species and *Polygonum cuspidatum-Glechometalia* phytocoenoses (*Arrhenatherum elatius* - form).

Reynoutria japonica was found in the forest communities of the Silesian Upland – *Ficario-Ulmetum minoris* and *Tilio-Carpinetum* (SENDEK 1974, CELIŃSKI et al. 1978, CABAŁA 1990). *Reynoutria japonica* was also found on roads and forest pathways in the Murckowski Forest (Katowice, Silesian Upland) (CHMURA 2003).

The aims of paper:
1. to show the floristic diversity of phytocoenoses with *Reynoutria japonica* in some geomorphological units of the Silesian Upland,
2. to show connections between *Reynoutria japonica* and species from different phytosociological units,
3. to determine the position of phytocoenoses within phytosociological scheme.

Materials and methods

The field investigations on anthropogenic vegetation were carried out in the towns of the Upper Silesian Industrial District (Poland) during 1996-2004 years. They represent such geomorphological units of Silesian Upland (GILEWSKA 1972) as: The Dąbrowska Basin: (Będzin, Dąbrowa Górnicza, Psary, Sosnowiec), the Bytomsko-Katowicki Plateau (Bytom, Czeladź, Katowice, Ruda Śląska, Siemianowice Śl., Świętochłowice), The Tarnowicki Plateau (Piekary, Tarnowskie Góry).

There were made 48 phytosociological relevés with the use of BRAUN-BLANQUET (1964) method in phytocoenoses where *Reynoutria japonica* occurred.

For all the relevés, the mean number of species, Shannon-Wiener diversity index and the number of species from *Molinio-Arrhenatheretea*, *Artemisietea*, *Stellarietea mediae* classes and *Convolvuletalia sepium* order were calculated.

In order to show the habitat preferences of species for all relevés mean Ellenberg's indicator values were calculated (N, F, L, R) taking into account presence of species.

To show the floristic differentiation of all the data set the Principal Component Analysis (PCA, GAUCH 1986; JONGMAN et al. 1995; CANOCO package, ter BRAAK & ŠMILAUER 2002) with log x + 1 transformation of species abundance data was used for ordination.

To show the interset correlation of species data set with the above-mentioned characteristics, a Kendall rank correlation (τ) was used.

The collected material was classified by numerical methods (cluster analysis) (PIELOU 1984). The minimum variance clustering (Ward's method or sum-of-squares cluster) was applied. As a similarity measure the Euclidean distance was used. The dendrograms were constructed by using the MVSP 3.12 c Multivariate statistical Package Kovach (1985-2000). The full floristic list was taken into account. These analyses were made separately for each geomorphological unit (for The Dąbrowska Basin, The Bytomsko-Katowicki Plateau and for the Tarnowicki Plateau).

Next on the basis of above-mentioned results the phytosociological tables were arranged (table 1 for Tarnowicki Plateau; table 2 for towns of the Dąbrowska Basin and table 3 for the towns which belong to Bytomsko-Katowicki Plateau).

The names of vascular flora follow MIREK et al. (2002). The association of species into syntaxonomic groups was based on BRZEG & WOJTERSKA (2001).

Results

The phytocoenoses with the *Reynoutria japonica* in the Dąbrowska Basin (Tab. 1.)

The phytocoenoses with *Reynoutria japonica* frequently occur in the Dąbrowska Basin and are confined mainly to anthropogenic sites such as: road verges, areas adjacent to urban park or human estates. They occurred in sunny places, rarely are observed on steep slopes, very frequently skeletal soils. In the investigated area they contact with phytocoenoses which were often dominated by species with wide ecological amplitude: *Urtica dioica, Calamagrostis epigejos, Solidago canadensis, Rubus caesius, Cirsium arvense.* Some patches develop also near xerothermic grasslands from the *Festuco-Brometea* class. Most species, which develop under canopy of *Reynoutria japonica*, are half-shade or moderate light (ZARZYCKI 1984).

The community with *Reynoutria japonica* is floristically poor. The mean number of species in the relevé is 16. In their floristic composition prevail meadow and ruderal species from the *Artemisietea* and *Molinio-Arrhenatheretea* classes. In some patches higher participation have nitrophilous plants from the *Convolvuletalia sepium* order. In other phytocoenoses differential species from the *Dauco-Melilotenion* suballiance occurred.

The *Reynoutria japonica* patches in the Bytomsko-Katowicki Plateau (Tab. 2.)

In the phytosociological table from the Bytomsko-Katowicki Plateau two groups of relevés can be distinguished. The first group comprises phytocoenoses (no 1-20) which cover mainly industrial wastelands, railway areas and road verges. There are presented in patches ruderal species from the *Dauco-Melilotenion* suballiance and species from the *Convolvulo-Agropyrion* alliance. There were recorded also segetal and ruderal species from the *Stellarietea mediae* class, however they occur with low frequency and abundance. In some phytocenoses *Deschampsia caespitosa* occurs with higher abundance what can be connected with improper water and air conditions in the soils. The character species of *Convolvuletalia sepium* which number is comparable to phytocoenoses of the second group generally occur with lower frequency and abundance. Relevés (no 19-20) were made on the hill, which in the past was covered by arable fields and meadows. As a result of cessation of their management nowadays they are fallows, which are covered by *Elymo-Rubetum caesii, Convolvulo-Brometum* and nitrophilous plant communities with *Helianthus tuberosus, Solidago gigantea*.

Second group of relevés (no 21-29) comprises phytocoenoses with significant participation of nithrophilous plants from *Convolvuletalia sepium* order. There occur also fresh meadow species from the *Molinio-Arrhenatheretea* order. In higher c_1 layer apart from a dominant very frequently occurs *Sambucus nigra.* Other trees were recorded in the lower layer. The specific facies creates in some

patches *Chelidonium majus*. These phytocoenoses are confined to roadsides and edges of human quarters. In their vicinity nitrophilous plant community - *Agropyro repentis-Aegopodietum podagrariae* was recorded very frequently.

The phytocoenoses with *Reynoutria japonica* on the Tarnowicki Plateau (Tab. 3.)

Phytocoenoses were recorded on urban wastelands and along road verges. These sites vary in reference to slopes and aspects. They contact in the investigated area with ruderal communities from the *Artemisietea* class (*Solidago canadensis*-community, *Calamagrostis epigejos*-community), nitrophilous plant communities from the *Convolvuletalia sepium* order *Agropyro-Aegopodietum, Urtico-Convolvuletum, Chaerophylletum aromatici,* communities from the *Convolvulo-Agropyrion* (*Elymo-Rubetum caesii*) alliance and phytocoenoses of trampled places from the *Trifolio-Plantaginetalia* order (*Lolio-Plantaginetum*). In their floristic composition species of above-mentioned units very frequently take position of dominants.

Discussion

Such features as rate of growth, vegetative reproduction, wide tolerance in reference to soil conditions, accumulation of persistent stem litter, strong overshadow of the soil enables *Reynoutria japonica* to colonize variety of habitats from natural to anthropogenic ones (BRZEG 1989a, ADLER 1993; BEERLING et al. 1994). There are also responsible for its strong expansive ability. It invades plant communities (in this case ruderal communities and phytocoenoses of abandoned fields and meadows) and can change existing specific species combination. In most cases knotweed very quickly takes position of a dominant. These results confirmed also research conducted on other invasive species such as *Bunias orientalis, Helianthus tuberosus* (unpublished authors' data).

The species composition of *Reynoutria*-dominated phytocoenoses is significantly differentiated. Only few species occur with higher frequency and abundance. Very frequently there are species, which can get used to shade or have wide ecological amplitude (*Aegopodium podagraria, Cirisum arvense, Elymus repens*). There occur also many occasionals in the tables. Taking into account both the number of species from different phytosociological units and their frequency species from *Onopordetalia acanthii* order and nitrophilous species from the *Convolvuletalia sepium* order were recorded more frequently.

The similar results were also obtained by PCA (Fig. 1). The first axis separates species of fertile, nitrophilous places (mostly species of the *Convolvuletalia sepium* order) from the species connected with mesophilous places (meadow species from the *Molinio-Arrhenatheretea* class and ruderal from the *Stellarietea mediae* classes). It is negatively correlated with the number of meadow species and ruderal and segetal plants from the *Stellarietea mediae* class.

The second axis is positively correlated with number of species (it separates phytocoenoses rich in species from the poorer ones) and the Shanon-Wiener index.

It shows significant correlation with the number of meadow plants and species connected with trampled places from the *Molinio-Arrhenatheretea* class.

Summary

Our results confirmed MATUSZKIEWICZ (2001) suggestions that alien species very frequently do not create specific and repeatable species combination, which can be considered as a separate plant association.

So it can be only distinguish facies with alien species in a given plant community or aggregations of alien species with associations to higher syntaxonomical units. Phytocoenoses of the investigated areas have intermediate position between plant communities of the *Onopordetalia acanthii* order and plant communities from the *Convolvuletalia sepium* order.

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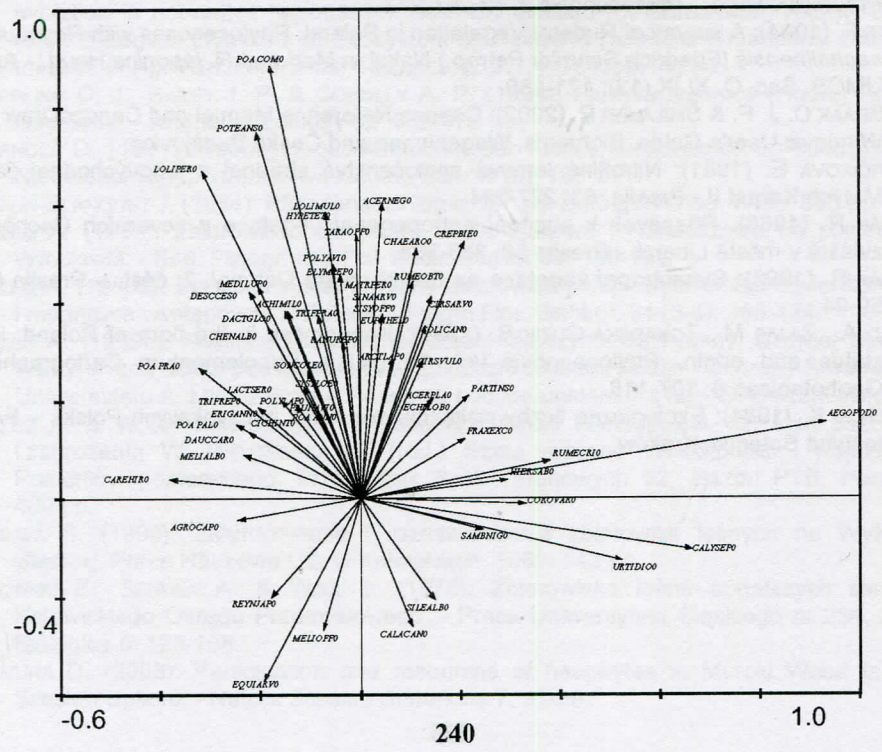
Fig. 1. Ordination of species (PCA with log x + 1 transformed species data).
Distribution of species

Species abbreviations (first 4 letters of the genus name, 3 letters of species name). Acer neg – *Acer negundo;* Acer pla - *Acer platanoides;* Achi mil – *Achillea millefolium;* Aego pod – *Aegopodium podagraria;* Agro cap – *Agrostis capillaris*; Arct lap – *Arctium lappae*, Cala can – *Calamagrostis canescens;* Caly sep - *Calystegia sepium*; Care hir – *Carex hirta*; Chae aro – *Chaerophyllum aromaticum* Chen alb – *Chenopodium album*; Cich int – *Cichorium intybus;* Cirs arv - *Cirsium arvense*; Cirs vul – *Cirsium vulgare*, Coro var - *Coronilla varia*; Crep bie - *Crepis biennis;* Dact glo - *Dactylis glomerata*; Dauc car - *Daucus carota*; Desc caes - *Deschampsia caespitosa*; Echi lob – *Echinocystis lotaba;* Elym rep – *Elymus repens*; Equi arv - *Equisetum arvense*; Erig ann – *Erigeron annuus*; Euph hel – *Euphorbia helioscopia*; Frax exc – *Fraxinus excelsior;* Hier sab - *Hieracium sabaudum*; Hype tet – *Hypericum tetrapterum;* Medi lup – *Medicago lupulina;* Meli alb – *Melilotus albus;* Meli off – *Melilotus officinalis;* Lact ser – *Lactuca serriola;* Loli mul – *Lolium multiflorum;* Loli per - *Lolium perenne;* Matr per – *Matricaria maritima* subsp. *inodora;* Part ins – *Partenocissus inserta;* Poa ann – Poa annua; Poa com – *Poa compressa;* Poa pal – *Poa palustris*; Poa pra – Poa pratensis; Poly avi – *Polygonum aviculare; Poly lap – Polygonum lapatifolium* Pote ans - *Potentilla anserina;* Prun avi – *Padus avium;* Ranu rep – *Ranunculus repens;* Reyn jap – *Reynoutia japonica;* Rume cri – *Rumex crispus;* Rume obt – *Rumex obusifolium;* Samb nig – *Sambucus nigra;* Sile alb – *Silene alba* (*Melandrium album*); Sina arv – *Sinapis arvensis;* Sisi loe – *Sisymbrium Loeselii*, Sisy off – *Sisymbrium officinale;* Sol can – *Solidago canadensis;* Sonc ole- *Sonchus oleraceus;* Tara off – *Taraxacum officinale;* Trif pra – *Trifolium pratense*; Trif rep – *Trifolium repens;* Tuss far – *Tussilago farfara;* Urti dio – *Urtica dioica*



Tab. 1. Phytocoenoses with *Reynoutria japonica* in the Dąbrowska Basin.

																	CONSTANCY DEGREE	COEFFICIENT COVER
Succesive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Number of relevé in the table&		1	2	15	10	9	8	3	7	6	5	14	12	13	4	11		
Field relevé number		086*	302*	75	217*	102	289*	061*	382*	18	22	281*	114	185	192	21		
Date (day)		1	29	26	11	27	26	26	27	21	3	24	19	18	20	9		
monath		7	8	7	8	8	8	6	8	7	8	8	9	6	9	9		
year		98	98	96	98	96	98	98	99	0	0	98	96	1	1	2		
Town		DG	Sos	DG	Sos	B	DG	Ps	DG	Sos	Sos	DG	DG	DG	Sos	Sos		
Exposure					N	SW		S			N							
Inclination [^{0}]					15	15		15			5							
Cover of the herb layer c1 [%]		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
Cover of the herb layer c2 [%]		70	90	30	20	20	20	10	10	10	10	30	10	20	10	20		
Cover of moss layer d [%]													10					
Area of relevé [m^2]		50	30	25	48	8	25	15	25	30	30	8	12	25	25	25		
Number of species in the relevé		11	11	23	18	13	17	19	23	17	17	15	11	18	13	14		
Reynoutria japonica	c1	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	V	8750
Reynoutria japonica	c2	.	.	.	.	.	.	.	.	.	.	.	.	+	1.1	1.1	I	70
Ch: *Convolvuletalia sepium*		.	.															
Solidago canadensis	c2	.	+.2	1.2	+	1.1	+	+	1.1	1.1	+	.	.	.	.	.	III	150
Aegopodium podagraria	c2	4.3	5.5	1.2	.	.	.	1.1	.	.	.	.	.	.	.	.	II	1067

Calystegia sepium	c2	+	2.1	.	.	+	1.1	.	.	.	.	.	.	.	.	.	II	157

Sporadic species: *Alliaria petiolata* 4; *Aster x salignus* 15 (1.1); *Chaerophyllum aromaticum* 1, 3; *Echinocystis lobata* 3; *Epilobium hirsutum* 5r; *Eupatorium cannabinum* 8; *Galeopsis bifida* 4; *Galium aparine* 4, 7 (1.1), 9; *Geum urbanum* 7, 9; *Helianthus tuberosus* 8; *Heracleum sphondylium* 7 (1.1); *Stachys palustris* 14;

Ch: *Artemisietea+ Onopordetalia acanthii^*

Elymus repens	c2	+.2	1.2	1.2	1.2	1.1	2.2	1.2	1.2	+	.	+.2	.	1.2	+.2	1.2	V	397
Artemisia vulgaris	c2	+	1.1	+.2	+	+.2	1.1	+	+	+	+	1.1	.	.	+	+	V	133
*Rubus caesius^*	c2	1.1	.	.	1.1	.	.	.	.	.	.	.	1.1	.	.	2.2	II	217
*Daucus carota^*	c2	.	.	.	.	1.1	.	+	+	+	+	.	.	.	.	.	II	47
*Convolvulus arvensis^*	c2	1.1	.	.	.	.	.	.	.	.	.	+	.	.	+	+	II	43
Cirsium arvense	c2	.	+	+.2	.	+	+	.	.	.	.	+	.	+	.	.	II	20
*Equisetum arvense^*	c2	.	.	.	+	+	.	+	.	.	+	.	.	.	+	+	II	20

Sporadic species: *Arctium lappa^* 9; *A. tomentosum^* 8, 9; *Bromus inermis^* 4 (1.1), 15; *Cichorium intybus^* 8; *Cirsium vulgare^* 6; *Erigeron annuus 8*; *Euphorbia esula^* 15; *Medicago lupulina^* 8, 10; *Melandrium album^* 1, 14; *Melilotus alba^* 10, 13; *M. officinalis^ 5*; *Oenothera biennis^* s. s. 8; *Pastinaca sativa^* 10; *Rumex obtusifolius 3* (1.2); *Tanacetum vulgare^* 13; *Tussilago farfara^* 8, 14 (1.1); *Urtica dioica* 1, 4 (1.2), 7 (1.1);

Ch*: Molinio-Arrhenatheretea+Trifolio-Plantaginetalia**

*Carex hirta**	c2							+.2	+		+	+.2	+	1.2	1.2	.	III	83
Dactylis glomerata	c2	.	+.2	1.2	.	.	.	.	.	.	.	2.2	+.2	1.2	.	1.2	II	223
Poa pratensis	c2	.	.	2.2	1.2	.	.	.	.	+.2	.	+.2	1.1	.	.	.	II	190
*Lolium perenne**	c2	.	.	1.2	.	.	.	.	.	1.2	+	1.1	.	.	.	.	II	103

Agrostis gigantea	c2	.	.	.	+	.	+	.	.	.	.	.	+	1.2	.	.	II	43
*Potentilla anserina**	c2	.	.	1.2	.	.	+	.	+	.	.	.	.	+	.	.	II	43
Ranunculus repens	c2	.	.	.	.	.	+	1.1	+	+	.	.	.	.	.	.	II	43
Achillea millefolium	c2	.	.	+.2	.	.	.	+	+	.	+	.	.	.	.	+	II	17

Sporadic species: *Arrhenatherum elatius* 7 (1.2), 14; *Crepis biennis* 3, 6, 9; *Deschampsia caespitosa* 3 (2.2); *Festuca pratensis* 13; *F. rubra* s. s. 4, 10, 15; *Geranium pratense* 12; *Holcus lanatus* 13; *Juncus inflexus* 13; *Lathyrus pratensis* 12; *Lotus corniculatus* 12; *Phleum pratense** 11; *Pimpinella major* 7; *Poa trivialis* 7; *Potentilla reptans** 13; *Rumex crispus* 2; *Taraxacum officinale*3, 8, 9 (1.2); *Trifolium pratense* 11; *T. repens* 10; *Valeriana officinalis* 5 (1.1); *Vicia cracca* 10, 13, 15;

Ch: *Stellarietea mediae*

Chenopodium album	c2	.	.	.	.	.	+	.	.	r	+	.	r	.	.	.	II	8

Sporadic species : *Atriplex patula* 6; *Conyza canadensis* 9, 10, 11; *Fallopia convolvulus* 3; *Lactuca serriola* 6; *Oxalis stricta* 7, 9, 10; *Sonchus asper* 9, 14; *S. oleraceus* 6, 9r; *Stellaria media* 8, 11; *Viola arvensis* 10r;

Others

Poa compressa	c2	.	.	2.2	.	.	+.2	.	1.1	+	+	+.2	.	+	.	.	III	167
Calamagrostis epigejos	c2	.	+.2	1.2	1.2	1.2	.	.	+	.	.	.	.	+.2	.	.	II	110

Sporadic species: *Acer negundo* 3, 9r; *Bromus carinatus* 11 (1.2); *Cerasus avium* 9; *Coronilla varia* 1; *Hieracium sabaudum* 2, 5r; *Hypericum tetrapterum* 3; *Knautia arvensis* 10; *Lolium multiflorum* 3; *Malus domestica* 4; *Medicago sativa* 15; *Padus serotina* 4; *Phalaris arundinacea* 12 (1.2); *Poa annua* 9; *Poa sp.* 7; *Polygonum amphibium* 6; *P. aviculare* 6; *P. lapathifolium* subsp. *lapathifolium* 8; *Populus tremula* 10; *Prunus domestica* 4; *Robinia pseudacacia* 9; *Sambucus nigra* 9;

&order of relevés according to results of dendrogram

Abbreviations of towns: B - Będzin, DG - Dąbrowa Górnicza, Sos - Sosonowiec, Ps- Psary

Tab. 2. Phytocoenoses with *Reynoutria japonica* in the Bytomsko-Katowicki Plateau.

																														CONSTANCY DEGREE	COEFFICIENT COVER
Successive no. of relevé		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		
No. of rel. in the dendrogram		24	26	9	10	18	6	5	7	17	16	8	19	20	23	15	22	21	28	27	14	13	11	12	25	1	2	3	4	29		
Field relevé number		35	76	60	147	131	125	43	19	167	286	105	213	299	316	165	586	558	113	68	122	88	23	26	53	1	56	2	2	128		
Date (day)		19	26	22	12	9	4	19	15	2	2	2	29	10	11	2	20	23	26	9	30	3	6	17	22	1	22	2	5	5		
month		7	7	7	8	8	8	7	7	6	8	8	6	8	8	6	9	8	6	7	7	7	7	6	7	8	7	8	9	8		
year		99	99	99	99	99	99	99	99	0	0	99	0	0	0	0	1	1	3	3	1	99	2	2	99	2	99	2	98	2		
Town		Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Kat	Byt	Czel	Czel	Kat	Św	Św	Kat	RŚ	Kat	Si	Kat	Si		
Exposure		W	S	NE	E	SE	NW			W	N	W		S	E	NE	NE	NE				NE			SW		NE					
Inclination [°]		10	3	5	5	5	35			10	5	5		5	5	10	3	5				3			10		20					
Cover of the herb l. c1 [%]		90	80	90	95	100	100	100	90	100	100	95	100	100	100	100	100	100	100	100	100	90	100	90	90	75	90	100	100	95		
Cover of the herb l. c2 [%]		10	10	10	10	10	10	10	10	5	10	5	10	10	5	10	5	5	20	10	20	30	20	10	30	40	30	20	20	20		
Relevé area [m^2]		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	25	25	20	20	25	24	15	25	20	28	30	28		
No. of species in relevé		11	10	9	11	10	11	10	9	8	6	10	8	8	11	9	7	11	16	17	23	10	8	10	11	11	11	9	16	16		
Reynoutria japonica	c1	5.5	4.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	4.4	4.5	4.4	5.5	5.5	5.5	5.5	V	8405
Reynoutria japonica	c2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	1.1	.	1.1	.	+	.	.	II	41
Ch: *Convolvuletalia sepium*																																
Aegopodium podagraria	c2	.	1.2	.	1.2	.	.	.	.	1.3	.	.	.	.	.	.	.	.	.	+	.	.	2.2	+	1.2	2.2	2.2	2.2	+	+	III	317
Calystegia sepium	c2	1.1	.	.	.	.	+	1.1	1.1	.	.	.	.	.	+	.	.	.	.	.	.	1.1	.	1.1	+.2	2.2	1.1	+	2.1	2.2	III	291
Solidago canadensis	c2	.	.	+.2	+.2	+.2	+	1.2	.	.	.	.	1.1	.	+	+	.	.	.	+	+	+.2	.	+	.	+	+	+	+	+	III	60

Helianthus tuberosus	c2	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	1.1	2.2	+	.	.	.	.	.	+	1.3	.	II	102
Solidago gigantea	c2	.	.	.	.	.	.	.	.	.	.	+.2	.	1.1	.	.	.	.	2.2	+	.	.	.	.	+	.	.	+	.	.	II	84

Sporadic species: *Aster x salignus* 21, 26; *Chelidonium majus* 22r, 29 (2.2); *Echinocystis lobata* 7, 12, 15 (1.2), 27; Eupatorium cannabinum 12, 29 (1.1); *Galeopsis bifida* 29 (1.1); *G. tetrahit* 29(1.1); <u>*Galium aparine* 3, 5 (1.2), 9, 10, 11;</u> *Stachys palustris* 17.

Ch: *Artemisietea + Onopordetalia acanthii^*

Artemisia vulgaris	c2	+	.	.	.	.	.	1.1	.	+	1.2	+	+	1.1	+	+.2	+	+	.	+	+	.	.	.	2.2	+	+	.	+	1.1	IV	152
Urtica dioica	c2	1.1	1.2	.	.	.	1.1	1.1	.	.	1.1	.	.	.	.	.	.	.	.	.	+	1.1	+	1.1	1.2	+	1.1	+	+	.	III	164
Elymus repens	c2	.	.	+	.	+.2	+.2	.	1.2	.	.	+	1.1	1.1	.	.	.	1.1	1.1	+	1.2	1.2	+	+	.	.	+.2	+	.	.	III	136
Convolvulus arvensis	c2	+	+.2	+.2	+	.	.	.	.	.	.	+	+	+	.	.	.	.	.	+	+	.	+	.	.	.	+	+	.	.	III	21
Tanacetum vulgare	c2	.	.	.	.	+.2	+	.	.	+.2	+	.	1.1	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	41
Equisetum arvense	c2	+	.	+.2	+	.	.	.	.	.	.	.	.	.	.	1.1	.	.	.	.	.	.	.	.	+.2	.	.	.	+	.	II	26

Sporadic species: *Arctium tomentosum^* 1, 2(1.2), 6, 27; *Bromus inermis^* 6, 8(1.1), 11, 19 (1.2), 27 (1.2); *Cirsium arvense* 14, 15, 19, 26, 29; *Euphorbia esula^* 19; *Medicago lupulina^* 20; *Melandrium album^* 4, 17, 24, 29; *Melilotus officinalis^* 1, 3, 4, 21(1.2); *Oenothera biennis ^* 29; *Pastinaca sativa^* 3(1.2), 4, 11, 20, 25; *Rubus caesius^* 2, 18(2.2), 19 (2.2); *Rumex obtusifolius* 2; *Saponaria officinalis^* 19.

Ch: *Molinio-Arrhenatheretea+Trifolio-Plantaginetalia**

Arrhenatherum elatius	c2	.	.	.	1.2	.	.	+.2	.	.	.	.	.	.	.	.	.	.	+	.	+.2	2.3	+.2	+	.	.	.	.	.	.	II	86
Taraxacum officinale	c2	.	.	.	.	1.2	.	+.2	.	+.2	.	.	+.2	.	+.2	.	.	.	.	.	+.2	.	.	.	.	.	1.2	+	.	.	II	45
Vicia cracca	c2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.	+	+.2	.	.	.	.	.	II	10

Sporadic species: *Achillea millefolium* 13, 17, 20, 26; *Agrostis gigantea* 27,28; *Carex hirta** 16, *Crepis biennis* 26, 27, 28; *Dactylis glomerata* 11(1.2), 18, 21, 27, 28; *Deschampsia caespitosa*16 (1.2), 17 (1.2),18 (1.1); *Festuca arundinacea* 18; *Holcus lanatus* 17; *Lolium perenne** 18, 20; *Phleum pratense** 10; *Poa palustris* 17, 18, 20; *P. pratensis* 1(1.2), 8, 9(1.2), 10(1.2), 13(1.2); *P. trivialis* 3(1.1), 14(1.2), 28(1.2); *Potentilla anserina** 20; *Trifolium repens** 20.

Ch: *Stellarietea mediae*

Fallopia convolvulus c2 . . 1.1 . + 1.1 +.2 + ... | . . . +.2 . . . . 1.1 II 59

Sporadic species: *Apera spica-venti* 18; *Atriplex nitens* 14; *A. patula* 29 (1.1); *Conyza canadensis* 1 (1.1), 4, 8; *Erysimum cheiranthoides* 29; *E. peplus* 14; *Lathyrus tuberosus* 18, 19; *Oxalis stricta* 28; *Sisymbrium loeselii* 20r; *Stellaria media* 1, 5, 6, 7.

Others

Calamagrostis epigejos c2 +.2 . . . 1.2 . . . . + 1.1 1.1 + 1.1 . +.2 | . + . . +.2 . . . +.2 II 81

Sporadic species: *Acer campestre* 23; *A. platanoides* 29; *A. pseudoplatanus* 19, 23; *Agrostis capillaris* 16 (1.2), 17, 18; *Calamagrostis canescens* 2, 4, 24(1.2); *Campanula rapunculoides* 2, 5, 8; *Cerastium arvense* 18; *Fraxinus excelsior* 19, 20, 23, 28, 29; *Lycopersicon esculentum* 25, 29; *Poa compressa* 18, 20 (1.1), 27 (1.1), 29; *Polygonum aviculare* 20; *Quercus petraea* 23; *Robinia pseudoacacia* 29; *Rubus idaeus* 22; *Sambucus nigra* c_2 23 (2.2), c_1 4, 16, 22 (1.1), 23 (1.1), 29 (1.2); *Scrophularia nodosa* 28 r; *Symphoricarpos albus* 9.

& order of relevés according to results of dendrogram

Abbreviations of towns: Byt-Bytom, Czel - Czeladź, Kat - Katowice, RŚ - Ruda Śląska, Św- Świętochłowice, Si - Siemanowice Śl.

Tab. 3. Phytocoenoses with *Reynoutria japonica* in the Tarnowicki Plateau.

Successive number of relevé in in the table		1	2	3	4		
Number of relevé in the dendrogram&		4	3	1	2		
Field number of relevé		153	99	154	171		
Date (day / month)		14. 07	21.07	19.07	13.08		
year		2004	2003	2004	2001		
Town		Piek	TG	Piek	Piek		
Exposure		E		N	S		
Inclination [^{0}]		1		25	10		
Cover of the herb layer c1 [%]		40	100	100	100		
Cover of the herb layer c2 [%]		10	20	50	30		
Cover of the moss layer d [%]		+			+		
Relevé area [m^2]		25	27	25	30		
Number of species in relevé		21	10	9	20		
Reynoutria japonica	c1	3.3	5.5	5.5	5.5	4	7500
Reynoutria japonica	c2	.	+	.	.	1	12
Ch: *Convolvuletalia sepium*							
Aegopodium podagraria	c2	1.1	2.2	3.3	2.2	4	1938
Solidago canadensis	c2	+.2	1.1	.	+	3	150
Calystegia sepium	c2	.	.	1.1	1.1	2	250
Sporadic species: *Chaerophyllum aromaticum 1* (3.3); *Echinocystis lobata* 3(1.1); *Galium aparine*3 (1.1);							
Ch: *Artemisietea+ Onopordetalia acanthii^*							
Agropyron repens	c2	1.1	+.2	1.1	1.2	4	388
Urtica dioica	c2	1.1	1.1	1.1	+	4	388
Cirsium arvense	c2	.	+	+.2	+	3	38
*Convolvulus arvensis^*	c2	+	+	.	+	3	38
Sporadic species: *Arctium lappa^* 4; *Artemisia vulgaris* 4; *Cirsium vulgare* 4; *Medicago lupulina^* 1; *Rumex obtusifolius* 4; *Tanacetum vulgare^* 2 (1.1);							
Ch: *Molinio-Arrhenatheretea+ Trifolio-Plantaginetalia**							
Taraxacum officinale	c2	+	.	.	+	2	25
Sporadic species: *Achillea millefolium* 4; *Crepis biennis* 4; *Dactylis glomerata*1 (1.1); *Festuca rubra* s. s. 4; *Lolium perenne** 1; *Potentilla anserina** 1; *Ranunculus repens** 4; *Trifolium pratense1*							
Ch: *Stellarietea mediae*							

NUMBER OF OCCURRENCE

COEFFICIENT COVER

Sporadic species: *Chenopodium album* 1 *Euphorbia helioscopia* 1, *Matricaria maritima* subsp. *inodora* 1, *Sinapis arvensis* 1 (1.1); *Sisymbrium officinale* 1

Others

Poa compressa	c2	+	.	.	+	2	25

Sporadic species: *Acer negundo* 4; *A. platanoides* 1r; *A. pseudoplatanus* 2 (1.1); *Calamagrostis epigejos* 2; *Parthenocissus inserata 4*; *Polygonum aviculare* 1 (1.1); *Sambucus nigra 3*(1.1);

^ order of relevés according to results of dendrogram
Abbreviations of towns:Piek - Piekary Śląskie, TG - Tarnowskie Góry;