TYPHETUM LAXMANNII (UBRIZSY 1961) NEDELCU 1968 – THE NEW PLANT ASSOCIATION IN POLAND

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ABSTRACT

Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 is a plant association new to Poland, built by an expansive kenophyte – *Typha laxmannii* Lepech. This paper presents the general distribution of both, the species and the association, paying particular attention to the area of Europe and Poland where, in recent years, many new locations as well as an increasing participation in vegetation cover have been observed. The habitat preferences of Typhetum laxmannii, the floristic composition of the association and its geographical differentiation within the occupied area are described. The current distribution of the association in Poland is presented on the cartogram map 10×10 km and possible expansion routes are suggested.

KEY WORDS: Typhetum laxmannii, anthropogenic habitats, rush communities, numerical analysis, kenophytes, distribution, Poland.

INTRODUCTION

The occurrence and expansion of the plant species in areas where they have not been present before (in many cases far away from their native range) are not an extraordinary phenomenon in a biotic world and are mainly connected with the direct influence of human activity. The alien species appear mostly incidentally, so their status in regional floras is ephemerophyta (Kornaś 1981). However, there are species with high adaptive potential, which can, in a relatively short time, adjust to new ecological conditions and afterwards expand or even invade new areas and habitats. In some cases the expanding alien species play an important role in the composition of native associations or build their own, xenospontanic phytocenoses (Faliński 1969). Only a few non-native species build their own plant communities in the territory of Poland. As an example for wetland habitats could serve *Elodea canadensis* Mchix. building the association Elodeetum canadensis (Ping. 1953) Pass. 1964, *Acorus calamus* L. creating the rush association Acoretum calami Kobendza 1948 and some other plants making a relatively significant contribution to native vegetation (Matuszkeiwicz 2001). This group of alien species also includes a plant which is one of the newest elements in the Polish flora – *Typha laxmannii* Lepech. building recently the new anthropogenic plant association Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968.

THE GENERAL DISTRIBUTION OF *TYPHA LAXMANNII* LEPECH.

Typha laxmannii is a species belonging to the Euro-Siberian sub-element. In Asia its locations are known from the Chinese provinces of Heilongjiang, Jilin, Jiangsu, Liaoning, Heibei, Henan, Shanxi, Shangdong, Qinghai, Gansu, Sichuan, municipalities of Ningxia, Xinjiang and Inner-Mongolia, as well as from Pakistan, Afghanistan, Tajikistan, Mongolia, Azerbaijan, Kazakhstan, Siberia, Mid-Ural Mts., Iran, Turkey (Fiala, Jankovská 1968 and there cited lit.; Klokov, Volkova 1988; Yu-Long Feng pers. comm.).

In Europe, the status of the species is uncertain. According to some authors, it most likely occurs naturally in Bulgaria, Romania, Ukraine and in the south-western part of Russia (Cook 1980; Prokubin 1987; Schmalhausen 1897). Others suggest that the species had been unintentionally introduced to Mediterranean regions of Europe from Asia with rice cultivation (Stojanov, Stefanov 1948; Ubrizsy 1961), and afterwards began its expansion north- and westwards. Currently, *Typha laxmannii* is quite broadly di-

stributed in the Czech Republic and Slovakia, e.g. in Košice surroundings, in Beskid Niski Mts. and in the Slovakian Carst area (Fiala, Jankovská 1968; Čvančara, Šourková 1973; Dostál 1978; Rozloznik 1998). The species has also been observed in Germany (Oberdorfer 1990; Haeupler, Muer 2000), Hungary (Fekete et al. 1997), Slovenia (Kaligarič and Jogan 1996), France (Guinochet, de Vilmorin 1978; Bissardon 2000), in northern and central Italy (Pignatti 1982; Morisi 1998, 2001; Ori, Alagna 2004), Croatia (Topic, Ozimec 2001), and Greece (Halacsy 1902; Hayek 1932-1933; Sarika et al. 2005). In Ukraine *Typha laxmannii* occurs in the coastal area of the Black Sea and northwards alongside the Dniestr river basin in artificial canals (Balashev, Parakhonskaja 1977).

In the area of Poland *Typha laxmannii* has been known since 1988, but the first published information about its appearance is included in the work of Czylok, Baryła (2003), and the distribution of the species was presented by Baryła et al. (2005). Until now, the locations of *Typha laxmannii* have been reported from Opole Silesia (Nowak 2004); Upper Silesia (Baryła et al. 2005; Woch 2005), Western Carpathians (Baryła et al. 2005; Beczała et al. 2005) and from the Małopolska Upland and Sandomierz Basin (Baryła et al. 2005). During the field studies conducted by the authors of this paper, four new localities of *Typha laxmannii* were found (they are listed below in the Typhetum laxmannii register). Presently, in the area of Poland, 29 locations of the species are known, and it is possible to find other new localities in near future. The current distribution map of *Typha laxmannii* in Poland using the ATPOL grid squares 10×10 km is presented in Figure 1.

THE CHARACTERISTICS AND DISTRIBUTION OF TYPHETUM LAXMANNII

At first the community with the dominance of *Typha laxmannii* was described in syntaxonomical classification as a subassociation – Scirpeto-Phragmitetum subass. typhosum laxmannii Ubrizsy 1961 (Nedelcu 1967). Later phytosociological analysis allowed the rank of the community to be raised to an autonomous association – Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 (Nedelcu 1968, 1969). In southern and eastern Romania, Typhetum laxmannii occurs on watersides of rivers and reservoirs and also in rice fields, which are occasionally flooded to the maximum depth of 10-15 cm, e.g. in spring. During the summer and autumn, the habitats remain moist or dry (Nedelcu 1969; Popescu et al. 1969). In the Czech Republic and Slovakia the association has been noticed in riverside habitats, channels and fish-ponds as well as in artificial excavations like sand or gravel-pits and in quarries (Ot'ahel'ová et all 2001). The basic physic-chemical characteristic of the waters was given for the flooded areas of the Dudu and Ipel rivers. The water pH index oscillates between (7.05) 7.10 and 8.30 (Nedelcu 1968; Hrivnák 2004). In such conditions the characteristic species is dominant, covering 50-80% of the community patch area and it occurs

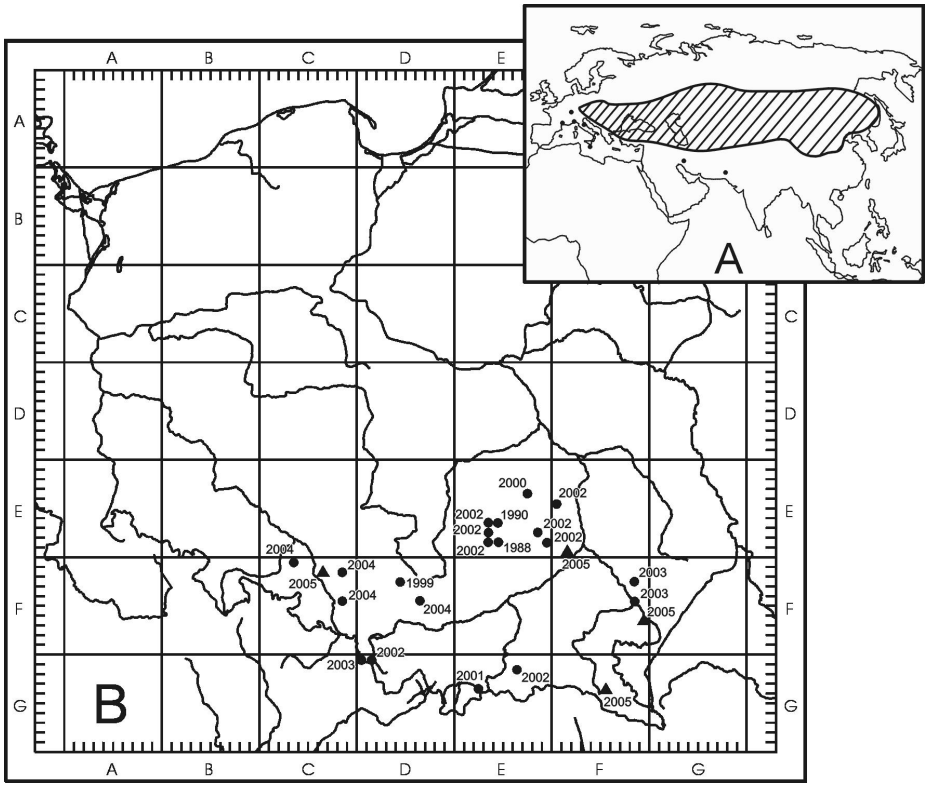

Fig. 1. Distribution map of *Typha laxmannii* Lepech. A – the general range according to Fiala, Jankovská (1968) – supplemented; B – local range in Poland, in ATPOL grid 10×10 km according to Baryła et all (2005) – changed and supplemented. ▲ – new locations. The locations are accompanied by the year of discovery.

TABLE 1. Typhetum laxmannii (Ubrizsy 1961) Nedelcu in Poland.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Constancy
Localization	Grze	Wys	Zgo	Klim	Zgo	Gór	Zach	Zach	Kow	Kow	SO	SO	Kot	LT	LT	KŚ	KŚ	Wie	Pig	Wie	Wie	Wie	Wie	
day	21	14	27	9	27	13	14	14	14	14	24	7	13	13	28	4	13	19	5	14	14	14	14	
Date month	9	8	7	6	7	8	9	9	9	9	7	8	8	8	7	8	8	6	9	9	9	9	9	
year	2004	2005	2005	2005	2005	2005	2004	2004	2004	2004	2004	2005	2005	2005	2004	2004	2005	2004	2003	2004	2004	2004	2004	
Cover of b (%)	–	–	–	–	5	–	–	–	–	–	–	–	–	–	15	5	5	–	–	–	–	–	–	
Cover of c (%)	40	50	60	75	50	90	70	75	85	90	85	85	70	85	85	80	80	70	80	90	90	90	90	
Cover of mosses “d” (%)	3	5	60	–	–	–	10	10	3	40	20	15	–	–	–	5	5	3	8	50	3	3	20	
Area of record (m^2)	10	50	15	30	9	50	10	30	6	15	50	50	50	50	50	50	50	150	100	30	15	70	15	
Number of species	6	8	9	6	12	7	7	11	17	19	19	17	13	18	20	14	19	10	18	7	11	10	9	
Ch. Ass. Typhetum laxmannii																								
Typha laxmannii	**3**	**4**	**4**	**5**	**4**	**5**	**5**	**3**	**5**	**2**	**4**	**4**	**3**	**4**	**3**	**4**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	V
Ch. All. Phragmition	.	+	1	.	+	+	+	1	.	.	.		1	.	.	r	+	+	2	.	.	+	.	III
Eleocharis palustris	.	.	.	.	1	+	.	.	+	.	1	+	1	+	.	.	.	.	1	+	.	.	.	II
Phragmites australis	.	.	+	+	.	.	.	2	.	.	.	+	.	+	+	+	+	.	.	.	.	.	.	II
Typha angustifolia	.	.	+	+	+	1	.	.	+	1	+	1	1	+	+	.	+	.	.	.	.	.	.	III
Typha latifolia																								
Ch. Cl. Phragmitetea et O. Phragmitetalia																								
Alisma plantago-aquatica	.	+	1	+	+	.	+	2	+	.	.	r	+	.	.	+	+	.	.	.	.	.	.	III
Schoenoplectus tabernaemontanii	.	.	.	.	.	+	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	I
Ch. Cl. Isoëto-Nanojuncetea																								
Centaurium pulchellum	.	.	.	.	.	.	.	.	+	+	r	+	.	.	.	+	+	.	.	.	.	+	.	II
Juncus bufonius	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	+	.	.	.	.	.	.	I
Plantago intermedia	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	+	.	.	.	.	+	.	II
Ch. Cl. Molinio-Arrhenatheretea																								
Daucus carota	.	.	.	.	.	.	.	.	+	+	.	.	.	.	r	.	.	.	.	.	+	.	.	I
Equisetum palustre	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	I
Juncus compressus	.	.	.	.	.	.	+	+	.	.	.	+	1	+	+	.	.	.	+	.	.	+	.	II
Juncus inflexus	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Lythrum salicaria	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	I
Ch.Cl. Scheuchzerio-Caricetea nigrae																								
Juncus alpino-articulatus	.	.	.	.	.	.	+	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Juncus articulatus	2	2	1	1	.	+	.	.	.	+	1	1	1	1	2	+	1	.	+	+	+	+	+	IV
Ch.Cl. Salicetea purpureae																								
Salix alba “c”	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	II
Salix purpurea “c”	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	+	+	+	+	+	.	.	II
Salix vimminalis “b”	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	I
Ch.Cl. Artemisietea vulgaris																								
Epilobium hirsutum	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.	II

TABLE 1. Cont.

Epilobium montanum	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	I
Epilobium parviflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	I
Other species																								
Alopecurus aequalis	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	+	.	.	.	.	.	.	I
Bidens tripartita	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	+	.	+	.	.	.	.	I
Calamagrostis epigeios	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	+	.	.	+	+	.	.	.	II
Chara sp.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	+	+	.	I
Epilobium adenocaulon	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	+	I
Lycopus europaeus	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	+	.	.	.	.	II
Marchantia polymorpha “d”	.	.	.	.	.	.	.	.	.	+	+	1	.	.	.	1	1	.	.	.	.	.	.	II
Salix caprea “c”	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	I
Tussilago farfara	.	.	.	.	.	.	.	.	1	3	r	+	.	1	1	.	+	+	.	.	+	.	.	II

Sporadic species: Ch. Cl. Phragmitetea: *Poa palustris* 19(+), 23(+); *Schoenoplectus lacustris* 22(+), 23(+); Ch. Cl. Isoëto-Nanojuncetea: *Carex demissa* 18(+); *Carex viridula* 8(+), 2(+); *Cyperus fuscus* 19(+); Ch. Cl. Molinio-Arrhenatheretea: *Achillea millefolium* 14(+), 15(+); *Agrostis stolonifera* 19(+); *Deschampsia caespitosa* 11(+); *Juncus effusus* 5(+); *Leontodon autumnalis* 8(+); *Lotus corniculatus* 9(+), 10(+); *Myosotis palustris* 11(+), 12(+); *Plantago lanceolata* 9(+); *Plantago maior* 10(+); *Prunella vulgaris* 14(1), 15(+); *Ranunculus repens* 3(+); *Rumex crispus* 9(+); *Taraxacum officinale* s. l. 7(+); *Trifolium repens* 9(+), 10(+); Ch.Cl. Scheuchzerio-Caricetea nigrae: *Carex flava* 11(+), 12(+); *Epipactis palustris* 18(+); *Veronica scutellata* 19(+); Ch.Cl. Salicetea purpureae: *Salix purpurea* “b” 5(1), 15(2); *Salix vimminalis* “c” 6(+), 13(+); Ch.Cl. Artemisietea vulgaris: *Cirsium arvense* 23(+); *Melilotus albus* 10(+); *Tanacetum vulgare* 5(+); Inne: *Agrostis vulgaris* 10(+); *Brachyactis ciliata* 9(2), 10(2); *Brachytecium rutabulum* “d” 11(1), 12(2); *Bryum bicolor* 7(1); *Bryum pseudotriquetrum* 18(+); *Bryum* sp. 10(2), 21(+), 23(2); *Calliergonella cuspidata* 8(1), 19(1); *Cratodon purpureus* 9(+), 10(1), 22(+); *Drepanocladus polycarpos* 3(4), 8(1); *Epilobium adnatum* 5(+); *Equisetum variegatum* 18(1), 20(+); *Mentha* sp. 9(+); *Odontites rubra* 19(+); *Poa compressa* 9(+), 21(+); *Polygonum hydropiper* 15(+); *Puccinelia distans* 8(+), 9(+); *Salix aurita* “c” 13(+); *Salix caprea* 17(1); *Salix cinerea* “c” 11(+); *Salix pentandra* “c” 18(+), 21(+); *Solidago graminifolia* 11(+).

Locality of the relevés: 1 – chalk-pit Skały near Grzegorzowice, SE from Kielce; 2 – chalk-pit Kożuszne near Wysoczany village (N from Komańcza); 3, 5 – out of work sand pit, NE part of the Zgoda village near Jarosław; 4 – excavationes in E part of Klimontów near Sandomierz; 6 – marl quarry, Górażdże near Opole; 7, 8 – out of work quarry, Zachełmie near Kielce; 9, 10 – still in operation chalk-pit, Kowala near Kielce; 11, 12 – out of work marl quarry in Strzelce Opolskie; 13 – sand pit in Kotlarnia near Opole; 14, 15 – basalt quarry in Ligota Tułowicka near Opole; 16, 17 – marl quarry in Kamień Śląski near Opole; 18, 19, 20, 21, 22, 23 – marl quarry, W from Wierzbica near Radom; 19 – sand pit in Pigany near Sieniawa.

in the company of several rush taxa originating mostly from the neighbouring associations. However, only *Typha laxmannii* reaches the cover index above 1% (Popescu et al. 1969). Nevertheless, within the patches of the association several rush species (e.g. *Typha latifolia*, *T. angustifolia*, *Lythrum salicaria*, *Phragmites australis* and *Glyceria maxima*) have a significant constancy index (Ot’ahel’ová et all 2001; Hrivnák 2004).

The general distribution of the Typhetum laxmannii association is similar to that of the characteristic species. In Europe phytocenoses of *Typha laxmannii* have been reported from Romania (Nedelcu 1968), Slovakia (Ot’ahel’ová et all 2001), Hungary (Hrivnák 2004), the Czech Republic (Šumberová et. al. 2001; Guth 2002; Chytrý, Rafajová 2003), Ukraine (Popova 2003), and Malta (Devillers-Terschuren 2001).

METHODS

In 2002-2005 field studies were conducted in well known and potential habitats of *Typha laxmannii*. The authors were concentrated mainly on sand or gravel-pits and quarries in southern Poland. Altogether 23 known locations have been checked (in some cases we have consulted with the authors of these findings). The stations, in which *Typha laxmannii* have formed homogenous patches with other plants, were documented in phytosociological relevés using the Braun-Blanquet method (Pawłowski 1977). The relevé area depended on the area of the homogenous patches of the community. Relevés were numerically classified using the binary scale (absence or presence of the species) and the cover scale of the given species. The similarity index was calculated using the Jaccard formula for the binary data and Rozicka for the ratio scale data. Similarity matrixes were grouped using the method of an unweighted pair-group average (UPGMA) (Sneath, Sokal 1973).

The nomenclature of species follows Mirek et al. (2002) – vascular plants and Ochyra et al. (2003) – mosses. The names of plant communities were taken mainly in accordance with Matuszkiewicz (2001).

In the location list presented below the following data were given: the nearest town or village, a short habitat description and the number of the ATPOL grid square 10×10 km according to Zając (1978).

All the specimens of *Typha laxmannii* collected during the field studies were deposited in the Herbarium of the Jagiellonian University in Krakow (KRA) as well as in the Herbarium of the Biosystematics Department of Opole University (OPUN).

TABLE 2. Quantitative participation of characteristic, differential and sporadic species in the patches of Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 in Poland.

Species	Number of relevés – 23									
	Cover ratio							Constancy		Cover index
	5	**4**	**3**	**2**	**1**	**+**	**r**			
Ch. Ass. Typhetum laxamannii										
Typha laxmannii	10	8	4	1	.	.	.	V	100	6706
Differential species										
Juncus articulatus	.	.	.	3	7	8	.	IV	78	398
Eleocharis palustris	.	.	.	1	3	7	1	III	52	157
Typha latifolia	.	.	.	.	4	8	.	III	52	104
Alisma plantago-aquatica	.	.	.	1	1	8	1	III	48	115
Phragmites australis	.	.	.	.	4	5	.	II	39	98
Tussilago farfara	.	.	1	.	3	4	1	II	39	237
Typha angustifolia	.	.	.	1	.	7	.	II	35	91
Juncus compressus	.	.	.	.	1	7	.	II	35	37
Accompanying species										
Lycopus europaeus	.	.	.	.	.	8	.	II	35	17
Salix purpurea "c"	.	.	.	.	.	7	.	II	30	15
Epilobium hirsutum	.	.	.	.	.	7	.	II	30	15
Centaurium pulchellum	.	.	.	.	.	6	1	II	30	13
Plantago intermedia	.	.	.	.	.	6	.	II	26	13
Marchantia polymorpha "d"	.	.	.	.	3	2	.	II	22	69
Salix alba "c"	.	.	.	.	.	5	.	II	22	11
Calamagrostis epigeios	.	.	.	.	.	5	.	II	22	11
Chara sp.	.	1	.	.	.	3	.	I	17	278
Juncus alpino-articulatus	.	.	.	.	1	3	.	I	17	28
Alopecurus aequalis	.	.	.	.	1	3	.	I	17	28
Bidens tripartita	.	.	.	.	2	2	.	I	17	48
Epilobium adenocaulon	.	.	.	.	.	4	.	I	17	8
Daucus carota	.	.	.	.	.	3	1	I	17	7

RESULTS

The habitat of Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 in Poland

The association of Laxmann reed is an easily distinguishable plant community of rush of medium height. The most suitable habitat conditions for the development of this association occur in the bottom of mineral excavations with shallow waters where the water level fluctuates between 0 and 0,4 m. The significant majority of the phytocoenoses were found in wet shore zones of artificial reservoirs, hollows in the ground and drainage ditches with an unstable water level fluctuating during the year. The highest water level takes place in spring, and in mid-summer the area dries up. The periodic dryness seems not to be harmful to the association and it is similar to the dryness occurring in the habitats of *Typha laxmannii* in the area of its natural range (e.g. Asia and south-east Europe) as well as to cultivation management on rice fields. The Typhetum laxmannii association in Poland occupies eutrophic habitats with a low content of organic matter – this is analogous to its natural habitats within the river valleys. In most cases, the solum consists of lime, marl or mud pulp (in quarries) or sandy soil (in sand pits and ditches).

The association of Laxmann reed develops in open areas with a high insolation rate. The development of the shrub layer results in an increase in shading which causes a decrease in the density and cover rate of the species. In thick shrubs or high rushes the species occurs rather sporadically and it is characterized by a small population size.

The phytocoenotic relations and distribution of the association

During the field studies in southern Poland the authors have found 14 locations of *Typha laxmannii* where the species builds its own association – Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968. The phytosociological characteristic of the association is presented in the tables (Table 1 and 2). On the other known stations, the populations of Laxmann reed are very small, they often consist of only several individuals being an additional component of different plant communities from Phragmitetea R.Tx. Et Prsg 1942 or Charetea (Fukarek 1961) Krausch 1964 classes.

The researched phytocoenoses of Typhetum laxmannii differ from each other in species richness. Between 6 to 20 species occur in the patches of Typhaetum laxmannii associacion and the average species richness within the relevés is 12. The characteristic feature of the phytocoenoses is the evident dominance of *Typha laxmannii* and, additionally, the occurrence of species from the following classes: Phragmitetea, Molinio-Arrhenatheretea, Isoëto-Nanojuncetea, Salicetea purpurae and Bidentetea tripartiti. Altogether in the patches of the studied association 80 species were observed. Eight of them are differential species, but only four (*Juncus articulatus*, *Eleocharis palustris*, *Typha latifolia* and *Alisma plantago-aquatica*) occur with a constancy rate higher than 50% and a cover index from 398 to 104 (Table 2). In some cases, in oligotrophic conditions with little organic matter (e.g. on the bare and wet bottom of marl quarry in Wierzbica where the most numerous population of *Typha laxmannii* in Poland have developed) the

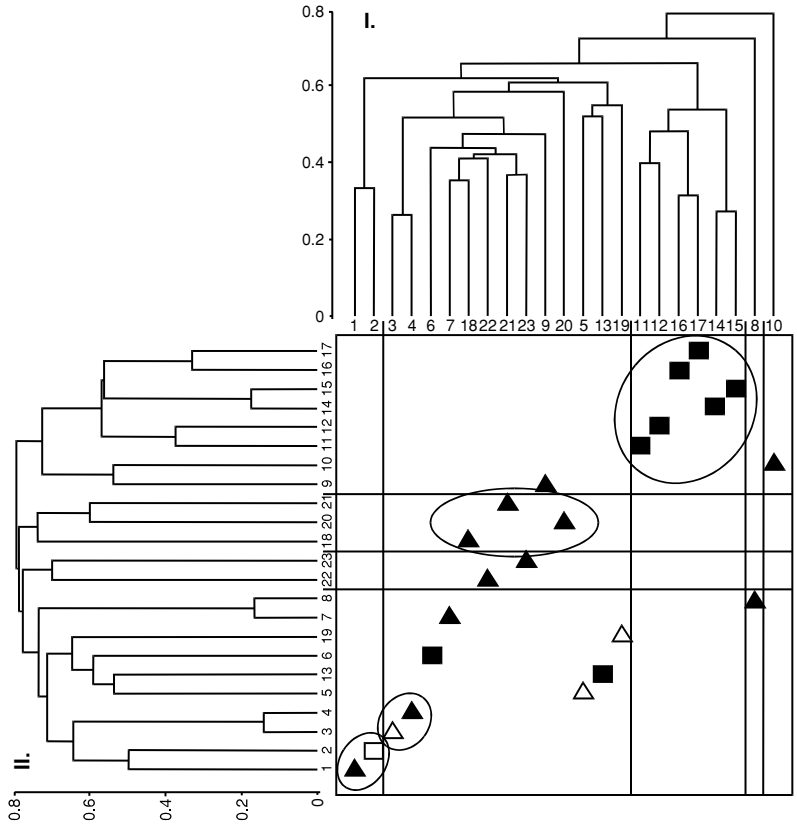

Fig. 2. Classification and dispersion diagram of phytosociological relevés done in the patches of Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 within the area of Poland. Dendrogram were constructed on the basis of: I – quantitative data (Braun-Blanquet abundance degrees: r, +, 1, 2, 3, 4, 5 recalculated as: 0.1, 0.5, 1, 2, 3, 4, 5); II – qualitative data (0; 1). The numbers on dendrogram follows the relevés numbers in phytosociological table and are grouped regarding the units of geographical division of Poland indicated by the symbols: ▲ – Małopolska Upland; ■ – Opole Silesia; ❑ – Beskid Niski Mts.; △ – Sandomierska Basin

Laxmann reed has built the mono-species assemblages showing its easily distinguishable pioneer character.

Analysing the dispersion diagram (Fig. 2), which was created using the species of significant constancy rate (occurring at least in three relevés in the table), it is noticeable that the relevés create several groups. This is because of the similar species composition of the community patches caused by the edaphic conditions or the geographic localization of the relevés. Remarkably different are the phytocoenoses in Opole Silesia (relevés number 11, 12, 14, 15, 16, 17) and in Małopolska Upland (relevés number 18, 20, 21). The floristic composition is directly influenced by the soil conditions, mainly the bedrock substratum in excavations (marl, limestone, sand, gravel or other minerals) as well as by the hydrological and drainage circumstances. When the edaphic conditions are similar, even populations occurring in different parts of Poland indicate similar floristic structure, e.g. relevés number 1, 2 and 3, 4. The first pair refers to the populations in the Małopolska Upland and Beskid Niski Mts., whereas the second one refers to the Małopolska Upland and Sandomierz Basin.

Listing of localities

The listing includes the date of distribution of Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 in Poland (Fig. 3). The localities are given in the ATPOL grid (Zając 1978). Capital letters indicate squares in length 100-kms and numbers denote squares 10-kms in length.

CF: 03 – basalt quarry in Ligota Tułowicka; 16 – marl quarries in Kamień Śląski and in Górażdże; 18 – marl quarry in Strzelce Opolskie; 48 – sand pit in Kotlarnia.

DF: 24 – sand pit in Kuźnica Warężyńska near Dąbrowa Górnicza; 46 – the artificial channel of the Jaworznik stream, ca. 2-3 km N from Trzebinia.

EE: 37 – marl quarry, ca. 0,5-1 km NW from Wierzbica; 64 – chalk-pit, Zachełmie near Zagnańsk; 78 – chalk-pit, Skały near Grzegorzowice; 84 – chalk-pit, Kowala, Kowala-Sobków; 91 – excavation, E part of Klimontów near Sandomierz.

FF: 48 – sand pit near San old river-bed, Pigany near Sieniawa; 69 – sand pit, NE part of the Zgoda village near Jarosław.

FG: 35 – chalk-pit Kożuszne near Wysoczany village (N from Komańcza).

The syntaxonomic position of the community

Class: Phragmitetea R.Tx. et Prsg 1942
Order: Phragmitetalia Koch 1926
Alliance: Phragmition Koch 1926
Association: Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968

CONCLUSIONS

In the area of Poland, Typhetum laxmannii association presently develops almost exclusively in habitats signifi-

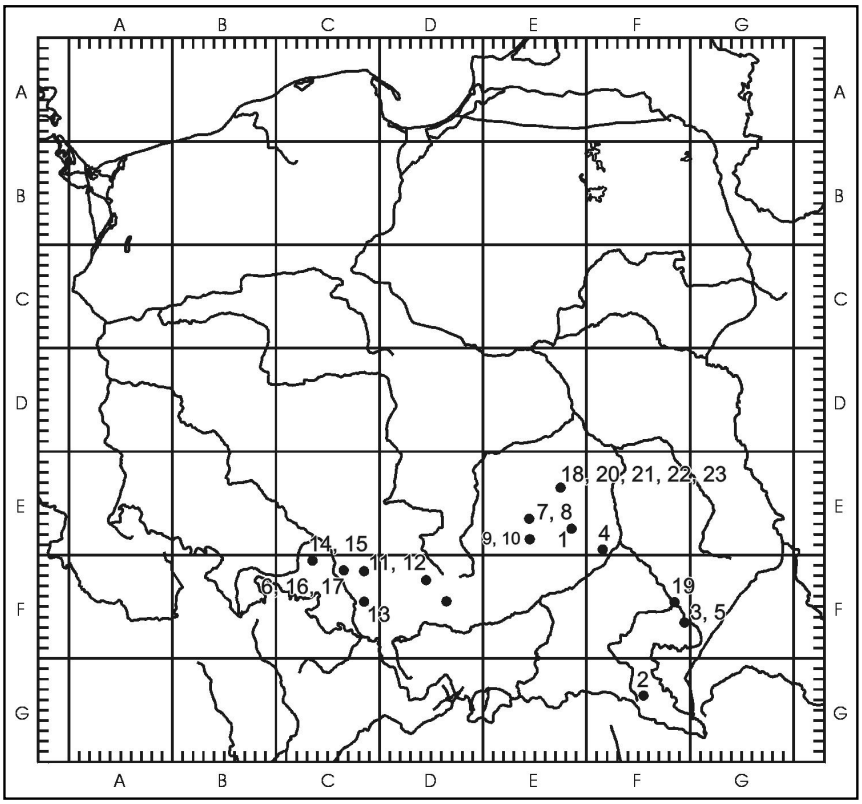

Fig. 3. Distribution of the Typhetum laxmannii (Ubrizsy 1961) Nedelcu 1968 association in Poland (the locations are accompanied by the number of relevé in the phytosociological table – Table 1).

cantly influenced by man. The most suitable conditions for this community occur in different kinds of mineral excavations, especially quarries and sand pits. The community prefers the shore zone of water reservoirs and wet places in drainage ditches and shallow pools. A similar situation is observed in the other countries of Central Europe, e.g. in Slovakia *Typha laxmannii* was noticed in anthropogenic habitats with almost the same differential species (Ot'ahel'ová et al. 2001) as in Poland. In Romania, alongside the Dudu river where the association was first described, the patches of the association consist of almost 30% of the species occurring in our country. Other transitional species coming from other communities (in the majority of the species of sporadic character in the diagnostic table – see Nedelcu 1968) are absent in Polish patches of this association because of their different habitat preferences or their geographical range.

It is worth noticing that the conditions occurring in anthropogenic habitats (e.g. quarries and sand pits) where the studied species was found in Poland have many similar features to those existing in natural or semi-natural habitats in the native range of this association. Taking into account the frequency of occurrence of quarries and sand pits in the area of Poland it seems to be very probable that the potential range of the Typhetum laxmannii association will cover the whole southern part of Poland. It may even appear in northern Poland where the climatic conditions are also suitable for *Typha laxmannii*. The confirmation of this hypothesis is a significant increase of reported locations of the studied species in recent years. It is connected with fast spreading from the area of south-eastern Europe and indicates the expansive character of Laxmann reed. The synergic effect of climate warming and mining activities can cause the spread of Typhetum laxmannii into semi-natural and natural ecosystems all over central Europe, which could have serious consequences for their biodiversity.

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