NYMPHAEETUM CANDIDAE MILJAN 1933 IN POLAND

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ABSTRACT

This paper presents the distribution, floristic composition and ecological requirements of the water plant community Nymphaeetum candidae Miljan 1933, belonging to the Potametea class. Until present this community has been reported only from north-eastern Poland. During present studies it was stated also in the south-western part of the country. Nymphaeetum candidae is considered to be a rare and endangered plant community in several countries of Central Europe.

KEY WORDS: Nymphaeetum candidae, Potametea class, distribution, phytosociology, endangered association, Poland.

INTRODUCTION

Biodiversity in Poland, measured at the level of species diversity, is among the highest in Central Europe. Also at the level of diversity of plant communities and wildlife habitats it is exceptionally rich, with e.g. well preserved wetlands (Andrzejewski and Weigle 1993). At present natural lakes, and in areas where they are lacking – ponds and oxbow lakes, are the most valuable in terms of preservation of rare and endangered plant communities (Wojtaszek 1989; Szumiec 1995; Spałek 2004, 2005, 2006a, b, 2007). One of the rarest aquatic plant communities in Poland is Nymphaeetum candidae Miljan 1933 (syn.: Potamogetono-Nymphaeetum candidae Hejný 1948 nom. invalid., Nymphaeetum albo-candidae (Hejný 1950) Passarge 1957), belonging to the Potametea class. Phytocoenoses of this community were first described from Estonia (Miljan 1933). Nymphaeetum candidae occurs in various types of shallow (50-150 cm) dystrophic, oligotrophic and mesotrophic (pH 5.0-6.0), stagnating or slowly running waters. Most often it inhabits lakes, oxbow lakes, ponds, channels and river bends of slow streams. This community is noted in many countries of Central Europe (e.g. Miljan 1933; Hejný 1948; Passarge 1957, 1996; Neuhäusl and Neuhäuslova 1965; Weber-Oldecop 1975; Hejný and Husák 1978; Jeckel 1981; Cernohous and Husak 1986; Pott 1995; Schubert et al. 1995; Dierssen 1996; Matuszkiewicz 2005; Balevičiené and Balevičius 2006). The characteristic and dominant species of Nymphaeetum candidae is *Nymphaea candida*. This association is considered to be poor in species and consists of about 1-10 taxa on the average (Miljan 1933; Passarge 1957; Neuhäusl and Neuhäuslova 1965; Hejný and Husák 1978). Species such as *Potamogeton natans*, *Nuphar lutea*, *Batrachium circinatum*, *Juncus bulbosus* and *Utricularia minor* attain a higher constancy index (Miljan 1933; Passarge 1957; 1996; Neuhäusl and Neuhäuslova 1965; Weber-Oldecop 1975; Hejný and Husák 1978; Jeckel 1981; Cernohous and Husak 1986; Pott 1995). Until present only two sub- communities of this association: Nymphaeetum candidae typicum and Nymphaeetum candidae elodeetosum with the occurrence of *Elodea canadensis* and *Potamogeton lucens* (Passarge 1996) have been distinguished.

Nymphaea candida is an Euro-Siberian element of water flora with the western limit of the range on the line of the Rhine (Meusel et al. 1965; Hulten and Fries 1986; Muntendam et al. 1996; Wayda 2000). There is still a great deal of confusion considering its southern limit. Wayda (2000) suggested that *Nymphaea candida* occurs only in north-eastern Poland (Zając and Zając 2001). However, this species has also been reported from Czech Republic (Neuhäusl and Tomsovic 1957; Hejný and Slavik 1997) and from southern regions of Germany (Benkert et al. 1996). In Slovakia *Nymphaea candida* have not been recorded so far. According to Muntendam et al. (1996) and Tutin et al. (2002) *Nymphaea candida* also occurs in eastern France, Switzerland, south-western Romania, Austria, Hungary and former Yugoslavia. This species has been reported several times from the area of Silesia in south-western Poland (Fiek 1881; Schube 1903; Zabawski and Matuła 1973; Kłosow-

ski 2001). Unfortunately, there is no herbarium documentation from stations of this region. Recently there have been conducted studies aimed at identification of distribution of *Nymphaea candida* in some regions of south-western Poland (Nowak and Nowak 2007). Some of the examined specimens had all characters (Muntendam et al. 1996; Kubát 2002) of *Nymphaea candida*.

In Poland phytocoenoses of Nymphaeetum candidae are know mainly from lakes of clean, soft and mesotrophic, rarer – eutrophic waters, oxbow lakes and artificial water reservoirs in northern and eastern part of Poland (Tomaszewicz 1977, 1979; Mamiński 1986; Boiński 1993; Kłosowski and Tomaszewicz 1993; Sugier and Popiołek 1995, 1998). Exceptionally, locations of this community were reported from oxbow lakes of the Oder in Lower Silesia in south-western Poland (Macicka-Pawlik and Wilczyńska 1996). Nymphaeetum candidae occurs in water bodies of mineral and organic substratum. An increase of proportion of calcareous gyttja in sediments causes its retreat from inhabited localities (Kłosowski and Tomaszewicz 1993). In the phytosociological literature the community with domination of *Nymphaea candida* is described also as a variety or a facies within Myriophyllo-Nupharetum (Fijałkowski 1959; Podbielkowski 1968; Krzywański 1974). It was described as an association with *Nymphaea candida* by Hereźniak (1972).

This aquatic plant community is recognized as endangered at both regional and Central European scale (Hejný 1990; Kłosowski and Tomaszewicz 1993, Pott 1995; Schubert et al. 1995; Rennwald 2000).

This paper describes Nymphaeetum candidae community. The phytosociological table is given and floristic composition and ecological requirements of this community are discussed.

METHODS

The fieldwork was conducted during vegetation seasons 2000 and 2007. Nymphaeetum candidae community was studied following the Zurich-Montpellier School of Phytosociology (Braun-Blanquet 1964). Phytosociological nomenclature and syntaxonomical attachment are based on Oberdorfer (1994), Pott (1995) and Matuszkiewicz (2005). Vascular plant species names are given according to Mirek et al. (2002), and bryophytes to Frahm and Frey (1992). Hydrogen ion concentration was measured with Elmetron pH microcomputer CP-315.

RESULTS

During geobotanical investigations carried out in south-western Poland ten new localities of Nymphaeetum candidae were discovered (Fig. 1). Phytocoenoses of this community were formed usually in oxbow lakes of the Odra river – Stare Kolnie, Skorogoszcz, Stobrawa, Wielopole, ponds – Przysiecz, Sowin, Stary Węgliniec, Staw Nowokuźnicki Nature Reserve, Winna Góra and exceptionally in small ponds in forest on the peatbog substratum – Zielonka. Localities in Stary Węgliniec and Zielonka are located in the vicinity of the continuous range of the species, covering south-eastern Germany (Meusel et al. 1965; Benkert et al. 1996). At newly discovered localities in south-western Poland Nymphaeetum candidae developed in transparent, eutrophic or mesotrophic waters, on sand or sand and silt basis, of depth 30-150 cm and pH 6.3-7.5 (Table 1). Phytocoenoses of this community covered areas from ca 50 m^2 up to 1 ha. In most patches this community has one-layer, rarer two-layers structure. In the water surface layer *Nymphaea candida* predominates, with coverage at the level

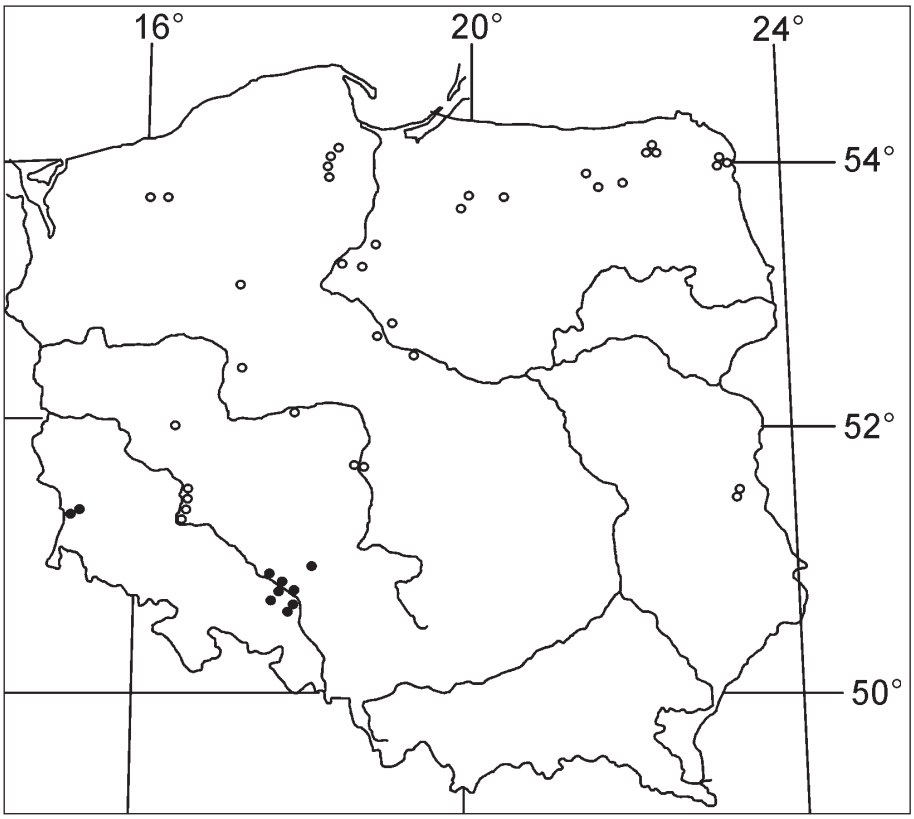

Fig. 1. Localities of Nymphaeetum candidae in Poland. ● – new locality, ○ – locality from the literature.

TABLE 1. The physico-chemical characteristics of water.

Locality	Cl [mg/l]	Electrolytic conductivity [µS/cm^2]	pH H_2O	BOD_5 [mgO_2/l]	O_2 Dissolved oxygen [mg/l]	PO_4 Phosphates [mg/l]	Nitrate nitrogen [mg/l]	Ammonium nitrogen [mg/l]	Nitrite nitrogen [mg/l]
Przysiecz	8.32	89.76	7.1	0.91	4.38	0.11	0.35	0.57	0.014
Skorogoszcz	14.8	118.33	7.2	0.71	6.91	0.02	0.37	0.02	0.002
Sowin	8.23	90.01	7.2	0.98	5.45	0.19	0.42	1.35	0.016
Stare Kolnie	9.12	94.76	7.2	0.84	4.87	0.04	0.52	0.59	0.011
Staw Nowokuźnicki	9.27	89.97	7.1	0.89	6.68	0.13	0.34	1.03	0.016
Stary Węgliniec	9.11	117.24	7.2	0.70	6.98	0.02	0.32	0.03	0.003
Stobrawa	8.12	89.8	7.2	0.94	4.37	0.11	0.37	2.37	0.016
Wielopole	8.45	96.32	7.3	1.04	4.57	0.12	0.41	1.39	0.023
Winna Góra	9.19	96.95	6.9	0.95	4.78	0.10	0.44	0.58	0.017
Zielonka	10.45	96.80	6.3	2.02	5.29	0.12	0.47	0.55	0.013

35-70% (Table 2). In patches from 3 to 11, on average – 6 taxa were recorded. In total, in its phytocoenoses 15 plant species were noted. These patches should be recognised as belonging to the sub-community Nymphaeetum candidae typicum (Passarge 1996). The floristic composition of patches of Nymphaeetum candidae in south-western Poland is usually very similar to phytocoenoses of this community from other areas of Poland (Mamiński 1986; Boiński 1993; Kłosowski and Tomaszewicz 1993; Sugier and Popiołek 1995, 1998) and neighbouring countries (Miljan 1933; Passarge 1957, 1996; Neuhäusl and Neuhäuslova 1965; Weber-Oldecop 1975; Hejný and Husák 1978; Jeckel 1981; Cernohous and Husak 1986). Nymphaeetum candidae usually built a micro-mosaic complex with associations from classes: Potametea (e.g. Potametum natantis) and Utricularietea intermedio-minoris (e.g. Sparganietum minimi). In the processes of natural succession phytocoenoses of Nymphaeetum candidae most often undergo transformation into Scirpetum lacustris, Typhetum latifoliae, Caricetum rostratae, Equisetetum fluviatilis and other rush associations. In the newly found localities in Poland phytocoenoses of Nymphaeetum candidae occurred in a close contact with Caricetum rostratae, Equisetetum fluviatilis and Phragmitetum australis. Naturally, in the case of intensive fish far-

TABLE 2. Nymphaeetum candidae Miljan 1933.

Relevé number		1	2	3	4	5	6	7	8	9	10	C
Date: year		2000	2002	2002	2003	2004	2005	2005	2006	2007	2007	
month		07	08	08	07	08	07	07	08	07	07	
day		04	11	11	23	09	30	18	17	16	18	
Locality		SN	WG	St	So	W	P	SW	Z	S	SK	
Cover of herb layer [%]		65	55	50	60	50	55	50	65	50	70	
Cover of moss layer [%]		–	+	–	–	–	–	–	10	–	–	
Area of relevé [m^2]		80	50	80	50	80	50	80	100	50	100	
Number of species in relevé		8	7	9	3	11	4	8	5	5	4	
Ch. Nymphaeetum candidae												
Nymphaea candida		4	4	3	4	3	3	3	4	3	4	V
Ch. Nymphaeion												
Myriophyllum verticillatum		1	.	.	.	+	1	1	+	2	1	IV
Nuphar lutea		+	.	+	+	+	.	.	.	.	.	II
Polygonum amphibium fo. *natans*		+	.	+	.	+	.	1	.	.	.	II
Potamogeton natans		.	+	.	.	+	.	+	+	.	.	II
Trapa natans		+	.	+	.	1	.	.	.	.	.	II
Ch. Potametalia, Potametea												
Ceratophyllum demersum		+	1	+	.	+	.	+	.	.	.	III
Elodea canadensis		.	.	+	.	+	.	+	.	.	.	II
Potamogeton pectinatus		.	.	.	+	.	.	+	.	+	.	II
Ch. Lemnetea minoris												
Lemna minor		.	+	+	.	+	1	+	.	1	+	IV
Spirodela polyrhiza		+	+	+	.	+	.	.	.	.	+	III
Salvinia natans		+	.	+	.	+	.	.	.	+	.	II
Utricularia vulgaris		.	+	.	.	.	+	.	.	.	.	I
Accompanying species												
Sphagnum fallax	d	.	+	.	.	.	.	.	2	.	.	I
Sparganium minimum		.	+	.	.	.	.	.	+	.	.	I

Explanation: P – Przysiecz; S – Skorogoszcz; SK – Stare Kolnie; SN – Staw Nowokuźnicki Nature Reserve; So – Sowin; St – Stobrawa; SW – Stary Węgliniec; W – Wielopole; WG – Winna Góra; Z – Zielonka; Ch. – characteristic species; C – constancy; d – moss taxa.

ming in fishponds, the rush communities could disappear completely.

A threat for occurrence of Nymphaeetum candidae in Poland is the change of the chemical composition of water, in particular – an increase of its trophicity and hardness, which results in invasion of more expansive communities, especially of Potametum natantis. Conservation measures should comprise preventing eutrophication. During the fieldwork, basic threats to plant communities of the ponds were identified. The most harmful seems to be the restoration of production area of fishponds as a consequence of the program of fish culture intensification. In its result, deteriorating use of ponds is implemented, including regular mowing of the water zone and frequent deepening of ponds. The key factor allowing Nymphaeetum candidae to develop is temporary drying out of the ponds. If the fish farm management caused permanent filling of the pond basin with water, the studied association would probably be endangered. Localities of this association should be a subject of special protection and need to be covered with constant monitoring. The complete phytosociological and habitat characteristic as well as the present distribution of Nymphaeetum candidae in Poland and in the remaining countries of Central Europe, should be a subject of further botanical investigations, as this association is probably more widespread.

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