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Occurrence and distribution of *Potamogeton* hybrids (Potamogetonaceae) in Poland

With 8 Maps

Summary

Based on herbarium specimens eight *Potamogeton* hybrids have been identified in Poland. Each of *P. x nericus*, *P. x olivaceus* and *P. x sparganiiifolius* have been found only in one station in Poland. *P. x fluitans*, *P. x salicifolius* and *P. x undulatus* are more frequent. The most frequent among *Potamogeton* hybrids occurring in Poland are *P. x angustifolius* and *P. x nitens*. All taxa described are rare in Poland having sporadic distribution in Europe. Notes on morphology, variation, similar taxa, distribution and habitat description of all *Potamogeton* hybrids occurring in Poland are given. Detailed lists of localities in Poland of all *Potamogeton* hybrids are also presented. The distribution of *Potamogeton* hybrids in Poland together with information on the distribution from the others European countries should be used to construct general distribution maps of these taxa.

1 Introduction

For more than one century hybridisation in the genus *Potamogeton* is recognised, but this phenomenon might be rarer than firstly regarded (FERNALD 1932). The known centres of *Potamogeton* hybridisation are Great Britain, Denmark, Sweden, and Japan (WIEGLEB 1988). In mainland Europe hybrids are not so frequent. The importance of hybridisation in the genus does not lie in the number of hybrids recorded, but in the capacity of hybrids to

Zusammenfassung

Vorkommen und Verbreitung von *Potamogeton*-Hybriden (Potamogetonaceae) in Polen

An Hand von Herbarbelegen wurden in Polen acht *Potamogeton*-Hybriden nachgewiesen. *Potamogeton x nericus*, *P. x olivaceus* und *P. x sparganiiifolius* wurden an je nur einem Fundort festgestellt. Hingegen sind *P. x fluitans*, *P. x salicifolius* und *P. x undulatus* häufiger zu beobachten. Von den in Polen auftretenden *Potamogeton*-Hybriden sind *P. x angustifolius* und *P. x nitens* am häufigsten. Alle hier beschriebenen Sippen sind selten in Polen und sporadisch in Europa verbreitet. Zu den hier betrachteten, in Polen vorkommenden *Potamogeton*-Hybriden werden Angaben gemacht zu Morphologie, Variabilität, zu verwandten Taxa, zur Verbreitung und zu ihren Habitaten. Gleichzeitig werden Fundortlisten dieser *Potamogeton*-Hybriden in Polen vorgelegt. Diese Angaben sollten mit Informationen zur Kenntnis der Verbreitung in anderen europäischen Ländern genutzt werden, um generelle Verbreitungskarten dieser Taxa zu erarbeiten.

persist and spread vegetatively once they are established (DANDY 1975). The recognition of *Potamogeton* hybrids is based on morphological and anatomical studies, the sterility of putative hybrids (PRESTON 1995), an investigation of the phenolic chemistry (HAYNES & WILLIAMS 1975) and the isozyme studies (HOLLINGSWORTH et al. 1995a, b). In total, 50 well established *Potamogeton* hybrids are recognised and approximately 20 probable hybrids require further study, involving experimental crossing (WIEGLEB & KAPLAN 1998).

The distribution of *Potamogeton* hybrids is accidental. Hybrids occur in stations where the generative individuals of parent species hybridised and where niches for colonisation by a new taxon exist. Information on the general distribution of *Potamogeton* hybrids found in the current literature is still fragmentary and outdated. There are no maps illustrating the total ranges of *Potamogeton* hybrids. The aim of this paper is (1) to identify the number of *Potamogeton* hybrids occurring in Poland; (2) to establish information on their distribution and also (3) to compile information on the taxonomy and habitat of these taxa in Poland.

2 Materials and methods

The study is based on herbarium material from the whole of Poland and also on the field investigations carried out during August 2000 and September 2001. Material (approximately 5000 vouchers) from the following herbaria was revised: BDPA, BIL, BYDG, DRAPN, GDMA, KRA, KRAM, KTC, KTU, LBL, LOD, OLS, PBMA, POZ, SLTC, SMOK, SOSN, SZCZ, SZUB, TRN, UGDA, WA, WSRL, WSRP (abbreviations according to MIREK et al. 1997). The nomenclature of taxa follows WIEGLEB & KAPLAN (1998). Taxa descriptions are based on specimens observations and information from the literature (PRESTON 1995). The characters of the taxa described are arranged in the following order: name, citation, important synonyms (only those ones used in revised herbaria labels), stem, submerged leaves: lamina – size, colour, shape, venation, the length of petiole (if present), intermediate leaves (if present) – short characterisation, floating leaves (if present): lamina – size, colour, shape, venation, the length of petiole, stipules: the length and short characterisation, inflorescences: the length and characteristic of peduncles and spikes, the number of flowers and carpels, fruits, variation, similar taxa, habitat (based on the author's own observation and information from herbaria labels), general distribution (based on HAGSTROEM 1916; DANDY 1975; PRESTON 1995), distribution in Poland and detailed list of localities in Poland. The distribution of *Potamogeton* hybrids is based exclusively on the localities of herbarium specimens. The distribution maps of *Potamogeton* hybrids are given in the 10 × 10-km ATPOL (Distribution Atlas of Vascular Plants in Poland) grid square system (ZAJĄC 1978). The detailed lists of localities for all hybrids are arranged according to the same system. Capital letters indicate 100-km squares in the ATPOL grid square system and the numbers denote

10-km quadrates. Identification of selected specimens of rare hybrids has been confirmed by Z. KAPLAN, Průhonice, Czech Republic (*P. x olivaceus*, *P. x salicifolius*, *P. x undulatus*) and G. WIEGLEB, Cottbus, Germany (*P. x nericius*).

3 Results

3.1 *Potamogeton x angustifolius* J.PRESL in BERCHT. & J. PRESL, Rostlinář 1, fasc. Žábnjkowité 19. 1821, pro sp.

[*P. gramineus* x *P. lucens*]

= *P. zizii* MERT. & W.D.J.KOCH, Röhrlings Deutschl. Fl. ed. 3. 1: 845. 1823, pro syn. („Zizii”)

Stem terete, sparingly to richly branched. Submerged leaves at the base of the stem often reduced to phyllodes, otherwise with the lamina, sessile or with the short petiole (often at the base of the stem sessile, at the upper part petiolate), (30–) 50–130 mm long, (8.5–) 10–25(–30) mm wide, 3.8–7 times as long as wide, on the stem and main branches longer and wider than on the short branches, translucent, glossy yellowish green (sometimes with a pinkish tinge), green or dark olive-green, narrowly elliptical, often recurved, gradually tapering or abruptly narrowed to the base, acute to obtuse and usually mucronate at the apex, denticulate and undulate at the margin, midrib bordered on each side by a narrow band of lacunae, the lateral veins 4–5(–6) on each side, the secondary veins frequent, ascending. Petioles – if present – up to 3(–7) mm long. Floating leaves not seen, but at the apical part of the stem often occur “semi-floating” leaves with conspicuous petioles. Stipules (10–)20–45(–55) mm long, rigid, persistent, green when fresh, olive-green or brownish green when dry, veins inconspicuous when dry, 2 much more prominent than the others, forming strong ribs, sometimes narrowly winged. Peduncles 30–150(–290) mm long, terete, slightly broader than the stem. Spikes cylindrical, 20–50 mm long in flower, contiguous. Flowers numerous, with (3–)4 carpels. Fruits not seen.

Variation: considerable, some individuals clearly intermediate between the parent species, the others resemble *P. lucens*. In comparison with this taxon description given by PRESTON (1995) individuals occurring in Poland

are quite alike but its lack floating leaves and fruits.

Similar taxa:

P. lucens – all leaves with short but easy differentiated petioles, midrib not bordered by lacunae, stipules with distinctly winged ribs at least half of the length of the stipule, floating leaves always absent.

P. gramineus – submerged leaves all sessile, with 3–4 lateral veins on each side of the midrib, stipules with unwinged ribs, floating leaves, if present, opaque, coriaceous.

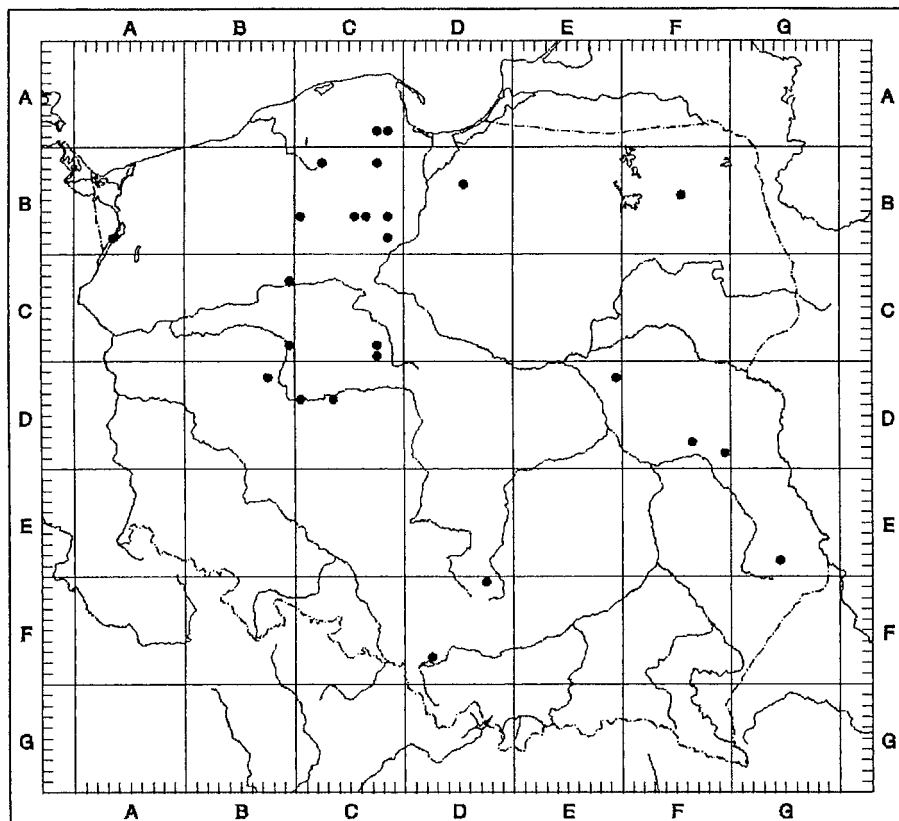
Habitat: standing, mesotrophic water often with *P. gramineus*; thrives in less calcareous waters than *P. lucens*.

General distribution: one of the most frequent *Potamogeton* hybrids widely distributed in mainland Europe, recorded also from Great Britain and Russia (Siberia) (DANDY 1975).

Distribution in Poland: occurs most often at the eastern part of the Pomorskie Lakeland (Pojezierze Pomorskie): in Bory Tucholskie and the Kaszubskie Lakeland, less frequently in Greater Poland (Wielkopolska). Elsewhere in Poland the distribution is dispersed (Map 1).

Detailed list of localities in Poland:

AB: 83 – Szczecin, leg. E. CWIKLIŃSKI 1959 (LOD). BC: 29 – Kopcze lake, leg. J. DZIEDZIC 1963 (POZ) and unnamed lake in Brzostowski Forest, leg. Z. WÓJCIKÓWNA 1938 (POZ); 89 – between Bolechowo and Glebocezek, leg. F. KRAWIEC 1929 (POZ) and Kamińskie lake near Bolechowo, leg. J. URBAŃSKI 1929 (POZ). BD: 17 – Rosnowskie lake, leg. H. PRZYBYŚLAWSKA 1971 (POZ). CA: 87 – Garcze lake, leg. I. DAMBSKA 1955 (POZ); 88 – Sitno lake, leg. I. DAMBSKA 1959 (POZ). CB: 12 – Duża Boruja lake, leg. A. SOKOŁOWSKI 1961 (BIL); 17 – Nowy Barkoczyn, leg. C. LÜTZOW 1886 (TRN); 60 –



Map 1
Distribution of *Potamogeton x angustifolius* PRESL in Poland

Olszanowskie lake near Bincz, leg. W. ŻUKOWSKI 1960 (POZ); 65 – Zdręczno lake, leg. M. CEYNOWA 1968 (TRN); 66 – Kłoczek, leg. M. CEYNOWA 1968 (TRN); 68 – Piaseczno lake, leg. W. GRÜTTER 1888 (TRN). CC: 87 – Przyjezierze, Ostrowskie lake, leg. W. GUGNACKA 1971 (TRN); 97 – Przyjezierze, Ostrowskie lake near Wójcińskie lake, leg. W. GUGNACKA 1971 (TRN). CD: 30 – Zaniemyśl, Miejskie lake, leg. J. URBAŃSKI 1929 (LBL) and Raczyńskie lake, leg. R. GOLDYN 1971 (POZ); 33 – Raszewy, leg. A. CZARNA 1996 (POZ). DB: 35 – Dzieżgoń, leg. R. LUDWIG 1886 (TRN). DF: 07 – Biała Błotna, leg. A. SENDEK 1980 (KTU); 72 – Wola, leg. R. ROZMUS 1958 (KRAM). ED: 19 – Pustelnik, leg. I. DĄBBSKA 1964 (POZ). FB: 45 – “Preussen: Lyck” [=Ełk], leg. C. SANIO 1872 (TRN). FD: 76 – Talczyn near Kock, leg. D. FIJAŁKOWSKI 1965 (LBL); 89 – pond “Siemień”, leg. F. KRAWIEC 1931 (POZ). GE: 84 – Miączyn, leg. D. FIJAŁKOWSKI 1951 (LBL).

3.2 *Potamogeton x fluitans* ROTH, Tent. Fl. Germ. 1: 72 1788, pro sp.

[*P. lucens* x *P. natans*]

Stem terete, unbranched to sparingly branched. Submerged leaves at the base of the stem reduced or partly reduced to phyllodes, otherwise with the lamina, 85–200 mm long, 4–21 mm wide, 4.5–35 times as long as wide, semi-translucent, dark green to olive-green, lanceolate to narrowly elliptical, gradually tapering to the cuneate, petiolate base, acute and usually mucronate at the apex, entire or very obscurely denticulate at the margin, midrib not bordered by a lacunae, the lateral veins (1)3–6 on each side, the secondary veins frequent, all ascending or more or less transverse near the margin. Petioles 25–70 mm long. Floating leaves petiolate, the lamina 80–120 mm long, 40–55 mm wide, 2–3 times as long as wide, opaque, subcoriaceous, olive-green, or brownish green, elliptical to oblong-elliptical, cuneate at the base, acute to obtuse at the apex and often apiculate, the lateral veins 5–7 on each side, the secondary veins are obscure, ascending across the entire width or more or less transverse near the margin, petioles 50–70 (–90) mm long. Stipules 55–90 mm long, rigid, translucent, veins conspicuous when dry, 2 much more prominent than the others, forming often narrowly winged ridges. Peduncles 60–95 mm long, terete. Spikes cylindrical, 20–60 mm long in flower, conti-

guous. Flowers numerous, with (4–)5 carpels. Fruits not seen.

Variation: the most variable character is the shape of the leaves. The lamina of the submerged leaves could be very narrow (up to 4 mm wide) or wider (close to lamina of *P. lucens*). Floating leaves (if present) look like the leaves of *P. nodosus* but are subcoriaceous. The dimensions of quantitative characters are contained in partitions given by PRESTON (1995), but narrower submerged leaves were observed.

Similar taxa

P. natans – all submerged leaves reduced to phyllodes, petioles of floating leaves with discoloured section between the petiole and the lamina, stipules with unwinged ribs.

P. nodosus – floating leaves, if present, coriaceous, submerged leaves petiolate, never reduced to phyllodes, in the cross-section of the stem interlacunar bundles absent, O-endodermis.

P. x sparganiifolius – starting from the base of the stem to the upper parts the submerged leaves gradually but fluently tend to be wider – from phyllodes through linear or ribbon-like leaves to semi-floating, narrowly elliptical leaves with well formed lamina, stipules with unwinged ribs

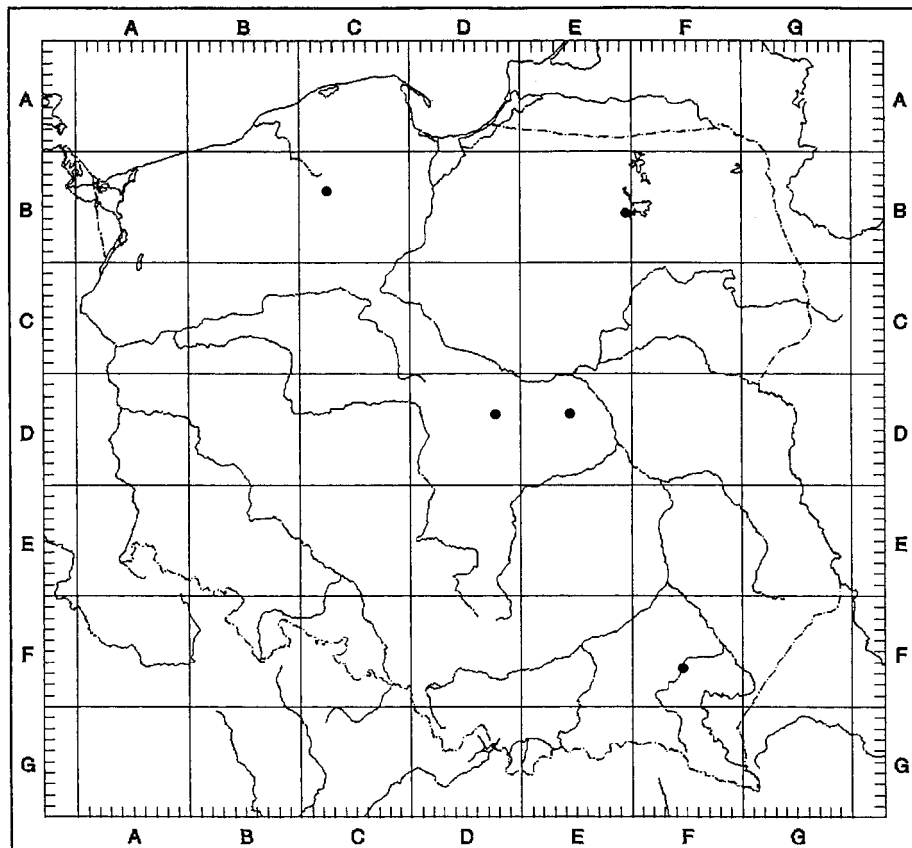
Habitat: flowing (rivers, canals), mesotrophic water.

General distribution: widespread but sporadically distributed in Europe occurring in Austria, Denmark, Germany, Russia, Netherlands, Sweden and Great Britain (DANDY 1975).

Distribution in Poland: known from five, unconnected stations (Map 2) in Western Pomerania (Pomorze Zachodnie), the Mazurskie Lakeland (Pojezierze Mazurskie), Central Poland and the Sandomierska Valley (Kotlina Sandomierska).

Detailed list of localities in Poland:

CB: 32 – Chocina River near Zielona Chocina, leg. K. TOBOLSKI, S. LISOWSKI, F. SZAFRAŃSKI 1968 (POZ). DD: 37 – Bzura River near Sobota, leg. K. DRYMMER 1894 (WA). EB: 59 – Stara Ukta, Krutynia River, leg. M. ŚRODA 1986 (OLS). ED: 34 – Brwinów, leg. M. RUCIŃSKA 1963 (WA). FF: 64 – Mrówka River near Rzeszów, leg. JEMIOŁA ?, (KRA).



Map 2
Distribution of *Potamogeton x fluitans* ROTH in Poland

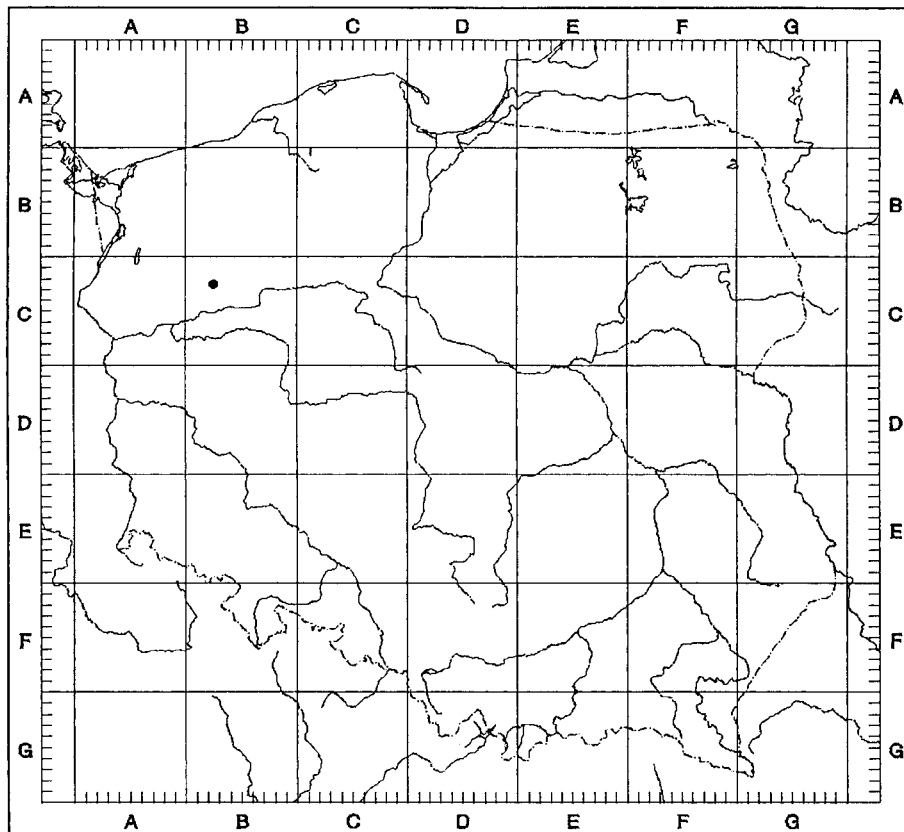
3.3 *Potamogeton x nericius* HAGSTR., Kungl. Sven. Vetenskapsakad. Handl. 55(5): 145. 1916

[*P. alpinus* x *P. gramineus*]

Stem terete, unbranched or sparingly branched. Submerged leaves sessile, (50–)58–150(–155) mm long, (7–)8–13 mm wide, (7–)11–15(–18) times as long as wide, oblong-elliptical to narrowly elliptical, translucent, greenish or brown-green when dry, gradually tapering to a cuneate base, acute at the apex, entire or obscurely and remotely denticulate and undulate at the margin, midrib bordered on each side by a narrow band of lacunae, the lateral veins 4–8 on each side, the secondary veins frequent, ascending in the centre of the leaf and more or less transverse towards the margins. Floating leaves with

the lamina 70–90 mm long, 10–20 mm wide, 3.2–5 times as long as wide, opaque, subcoriaceous, green, reddish brown when dry, elliptic, gradually tapering to a cuneate base, narrowly rounded or subacute at the apex, the lateral veins 4–6 on each side, the secondary veins numerous but obscure, ascending. Petioles to 10 mm long, shorter than the lamina. Stipules (6.5–)15–30 mm long, hyaline, with a reddish tinge when dry; fugacious, present only on the apical leaves, veins inconspicuous when dry. Peduncles 40–62 mm long, terete, as thick as the stem. Spikes cylindrical, 12–17 mm long in flower, contiguous. Flowers numerous, with 4 carpels. Fruits not seen.

Variation: heterogenic population; some individuals unbranched with broad, long (up to 150 mm) leaves, the others branched with



Map 3
Distribution of *Potamogeton x nericius* HAGSTR. in Poland

narrowly elliptic leaves and those individuals remaining *P. gramineus*. In comparison with this taxon description given by PRESTON (1995) individuals occur in Poland have longer submerged and floating leaves.

Similar taxa

P. gramineus – stem usually richly branched, the leaf apex mucronate, margin of the young leaves denticulate, stipules persistent.

P. alpinus – stem unbranched, the leaf apex obtuse, sometimes narrowly hooded, plant with a strong reddish tinge when dried.

Habitat: flowing (river), eutrophic but clear water.

General distribution: very rare *Potamogeton* hybrid, known from Iceland and Sweden (HAGSTROEM 1916), Great Britain, France and Norway (PRESTON 1995), Denmark and Germany (WIEGLEB, pers. com.).

Distribution in Poland: known only from the middle part of the river Drawa in the northern Poland (Map 3). – BC: 22 – the station discovered by M. KRASKA in 1999 (POZ).

Notes: the specimens from the Drawa River have been determined as *P. x nericius* for their intermediate appearance between *P. alpinus* and *P. gramineus*. However, because of high morphological variation and overall similarity of both putative parents, the exact identification of this hybrid should be confirmed by molecular methods, for example isozymes studies.

3.4 *Potamogeton x nitens* WEBER, Suppl. Fl. Holsat. 5. 1787

[*P. gramineus* x *P. perfoliatus*]

Stem terete, sparingly to richly branched. Submerged leaves sessile, 40–110 mm long, 7–15 mm wide, 5–7 times as long as

wide, longer and wider on the stem and main branches, semi-translucent, yellowish to brownish-green, sometimes with a reddish tinge along the midrib and lateral veins, broadly elliptical to ovate-oblong, often recurved, abruptly narrowed to a rounded or semi-amplexicaul base, usually acute and mucronate at the apex, sometimes obtuse, narrowly hooded, denticulate at the margin but the teeth fugacious, often lost on the older leaves, midrib bordered by a narrow band of lacunae, the lateral veins 3–8 on each side, the secondary veins frequent, irregular. Floating leaves with the lamina, 22–45 mm long, 7–13 mm wide, 3.1–3.7 times as long as wide, semi-translucent, pale green to brownish-green, elliptical to broadly elliptical, tapering to a cuneate base, acute or apiculate at the apex, the lateral veins 5–8 on each side, the secondary veins irregular. Petioles 12–30 mm long, shorter than the lamina. Stipules 10–20 (–25) mm long, subpersistent, sometimes as the fibrous remnants on the older leaves, opaque, veins inconspicuous when dry, 2 much more prominent than the others but not forming ribs. Peduncles 45–80 mm long, terete. Spikes cylindrical, 5–20 mm long in flower, contiguous. Flowers numerous, with (4–)5 carpels. Fruits not seen.

Variation: very variable; most individuals more or less intermediate between parent species. Leaves and stipules on the stem and main branches usually resemble *P. perfoliatus* while leaves and stipules on short branches resemble *P. gramineus*. In comparison with this taxon description given by PRESTON (1995) individuals occurring in Poland have a little smaller floating leaves.

Similar taxa:

P. gramineus – leaves lanceolate with a cuneate base, the lateral veins 3–4 on each side of the midrib, floating leaves, if present, opaque, coriaceous.

P. perfoliatus – amplexicaul leaf base, stipules fugacious, present only on young leaves, floating leaves always absent.

P. x salicifolius – stipules with narrowly winged ribs.

Habitat: Meso- and eutrophic lakes with muddy or sandy bottom.

General distribution: widely distributed in Europe (DANDY 1975), reported also by

DANDY (1975) from temperate Asia, but it could be misidentification because of difficult delimitation to *P. nipponicus* MAKINO (WIEGLEB, personal comm.).

Distribution in Poland: frequently occurs in north-western Poland, with isolated stations in Masuria (Mazury) and in the Łęczyńsko-Włodawskie Lakeland (Map 4).

Detailed list of localities in Poland:

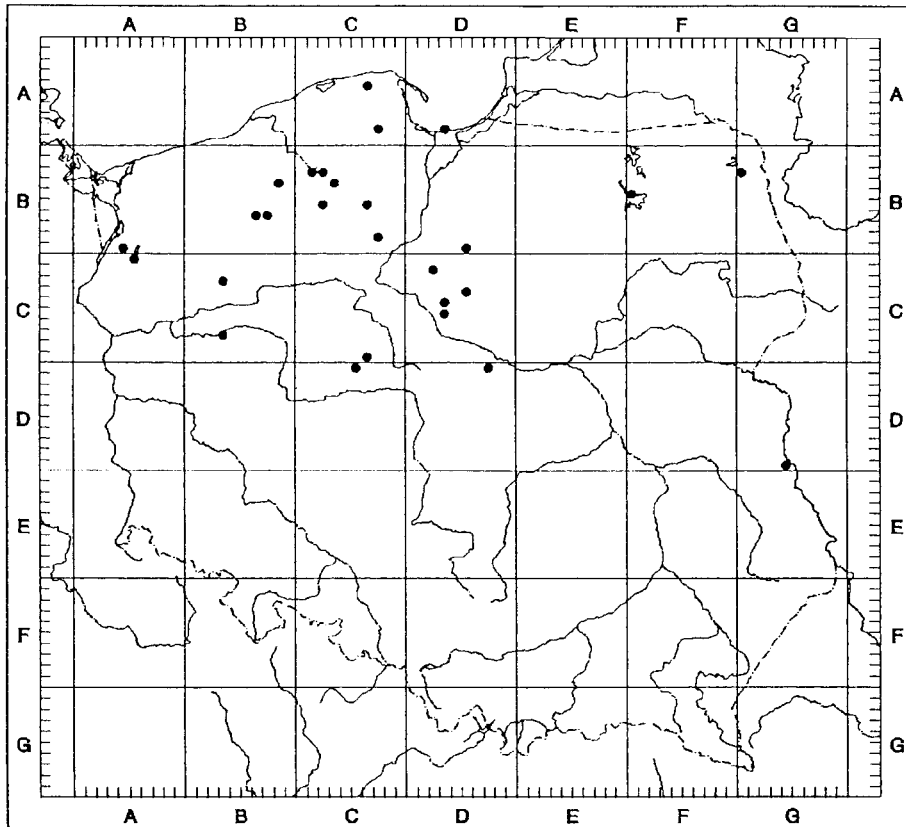
AB: 94 – Glinno lake, leg. F. CELIŃSKI 1961 (POZ). AC: 05 – Miedwie lake, leg. I. DĄBSKA 1965 (POZ). BB: 38 – Grębosz lake, leg. F. ROMEZ 1906 (TRN); 66 – Silnowo lake, leg. W. ŻUKOWSKI 1957 (POZ); 67 – Sarcze lake near Przyjezierze, leg. W. ŻUKOWSKI 1958 (POZ). BC: 23 – Szczuczarsz lake, leg. J. KUJAWA-PAWLACZYK 1994 (DRAPN); 73 – Śremskie lake, leg. I. DĄBSKA 1955 (POZ). CA: 87 – Choczewo lake, leg. P. GRAEBNER 1895 (TRN); 87 – Klasztorne lake, leg. H. KLINGGRAEFF 1884 (TRN). CB: 21 – between lake Piaszno and Piaszczynek, leg. K. TOBOŁOSKI, S. LISOWSKI, F. SZAFRAŃSKI 1966 (POZ); 22 – Piaszno lake, leg. K. TOBOŁOSKI, S. LISOWSKI, F. SZAFRAŃSKI 1966 (POZ) and Borzyszkowskie lake, leg. K. TOBOŁOSKI, S. LISOWSKI, F. SZAFRAŃSKI 1966 (POZ); 33 – Laska, leg. M. KORCZYŃSKI 1993 (BYDG); 52 – Polnickie lake, leg. I. DĄBSKA, 1954 (POZ); 56 – Ostrowite lake, leg. R. BORYS 1969 (POZ); 87 – Błędzkie lake, leg. HOHENFELDT 1885 (TRN). CC: 96 – Szydłowiec, leg. W. ŻUKOWSKI 1960 (POZ) and Budziszawskie lake near Grębcze, leg. J. CHMIEL 1984 (POZ). CD: 05 – Powidzkie lake, leg. W. ŻUKOWSKI 1978 (POZ). DA: 83 – Izbiska-Jantar, leg. H. PREUP 1905 (TRN). DB: 95 – Łąkorek lake, leg. I. DĄBSKA 1939 (POZ). DC: 12 – Zgniłka near Wąbrzeźno, leg. I. DĄBSKA 1961 (POZ); 35 – Wielgie lake, leg. A. ZALEWSKI 1889 (WA); 43 – Moszczonno lake, leg. A. ZALEWSKI 1891 (WA); 53 – Brzeźno, leg. A. ZALEWSKI 1890 (WA). DD: 07 – Zdwońskie lake, leg. Z. GŁOWACKI 1983 (WSRP). FB: 40 – Mikołajskie lake, leg. I. DĄBSKA 1963 (POZ). GB: 20 – Serwy lake, leg. A. SOKOŁOWSKI 1972 (BIL). GD: 94 – Białe lake near Okuminka, leg. D. FIJAŁKOWSKI 1960 (LBL).

3.5 *Potamogeton x olivaceus* BAAGÖE ex

G. FISCH., Ber. Bayer. Bot. Ges. 11: 33. 1907

[*P. alpinus* x *P. crispus*]

Stem slender, compressed, with a shallow, longitudinal groove running down the broader sides, unbranched or very sparingly branched. Submerged leaves sessile, (37–)45–65 (–78) mm long, 3–10 mm wide, (5–)8–15 times as long as wide, semi-translucent, olive-



Map 4
Distribution of *Potamogeton x nitens* WEBER in Poland

green, linear to narrowly oblong, tapering to a cuneate or rounded base, rounded or subacute at the apex, undulate, entire or obscurely denticulate especially towards the apex, midrib bordered by a band of lacunae, the lateral veins 2–3 on each side, the secondary veins frequent, ascending in the centre of the leaf, ascending, transverse or wavy towards the margin. Floating leaves not seen. Stipules 8–13 mm long, delicate, hyaline, semi-transparent, with a slight reddish tinge, fugacious – present only on the upper leaves, veins inconspicuous when dry, 2 much more prominent than the others but not forming ribs. Peduncles 7–40 mm long, slightly compressed, as thick as the stem. Spikes cylindrical, 4–6 mm long in flower, contiguous. Flowers (7–)10–20, with 4 carpels. Fruits not seen.

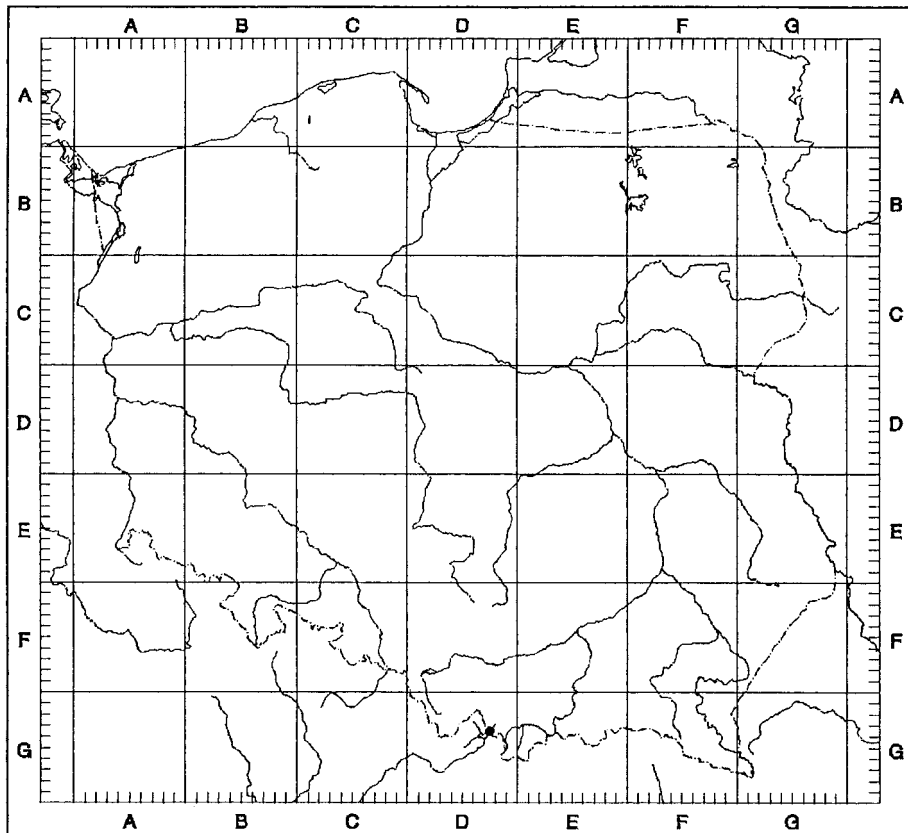
Variation: a little variable; the most variable character is the shape of submerged leaves, from linear with a cuneate base and entire margin to oblong with rounded base and denticulate and undulate margin. In comparison with this taxon description given by PRESTON (1995) individuals occurring in Poland have smaller (shorter and narrower) submerged leaves.

Similar taxa:

P. crispus – the margin of leaf undulate and serrate with tooth visible by a naked eye, only 2 lateral veins on each side running close to the leaf margin.

P. alpinus – stem terete, 4–7 lateral veins on each side of the midrib, plant with a strong reddish tinge when dried.

P. x undulatus – richly branched at the upper part of the stem, leaves often recurved, 2–4 lateral veins on each side of the midrib.



Map 5

Distribution of *Potamogeton x olivaceus* BAADOE ex G. FISCH. in Poland

Habitat: Standing (ox-bow), eutrophic water with muddy bottom.

General distribution: known only from stations in Great Britain and in Denmark (DANDY 1975).

Distribution in Poland: single locality is known, the ox-bow of the River Czarna Orawa near Jablonka in southern Poland (Map. 5). – DG: 37 – discovered by M. and J. GUZIK in 1966 (KRAM). Not rediscovered in the station during a field investigation carried by the author in August 2001, only one parent species – *P. crispus* thrives there.

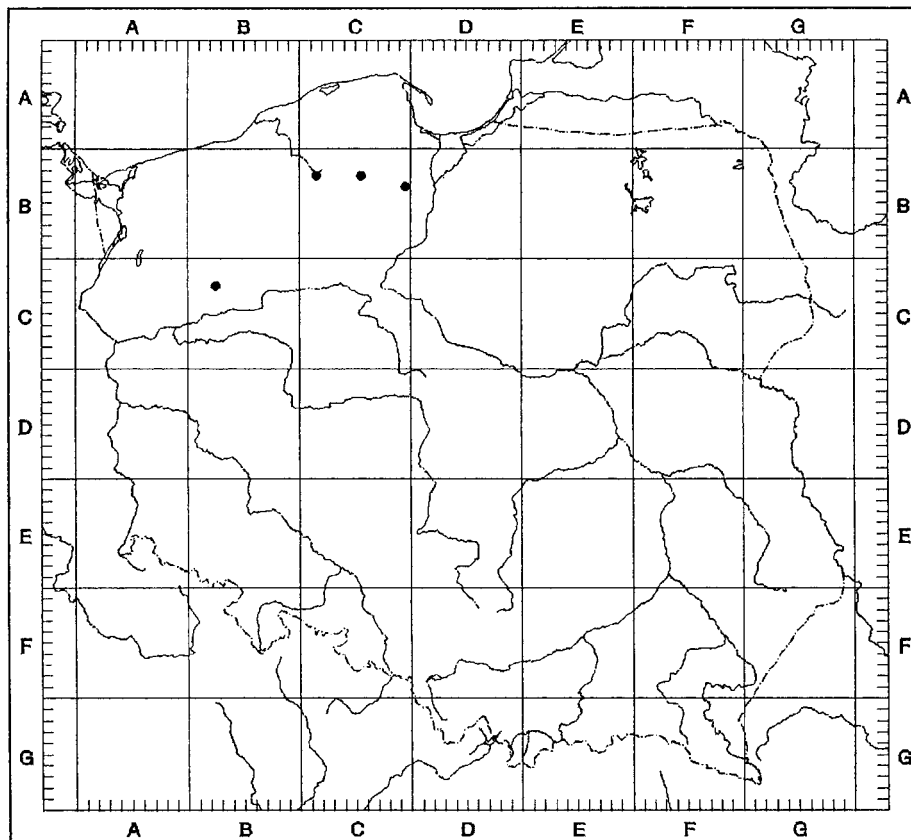
3.6 *Potamogeton x salicifolius* WOLFG. in SCHULT. & SCHULT.f., Mant. 3: 355. 1827, pro sp.

[*P. lucens* x *P. perfoliatus*]

P. x decipiens NOLTE ex W. D. J. KOCH, Syn. Fl. Germ. Helv. Ed. 2. 7779. 1844

P. salignus FRYER in HIERN, Victoria Hist. Devon. 1: 129. 1906.

Stem terete, sparingly to richly branched. Submerged leaves sessile, 50–110 mm long, 20–40 mm wide, 2.5–2.7 times as long as wide, semi-translucent, yellowish green to dark green, along the veins sometimes with a reddish tinge, narrowly lanceolate, oblong or elliptical, rounded to semi-amplexicaul at the base, acute or rounded and apiculate at the apex, denticulate and undulate at the margin, midrib bordered by a narrow band of lacunae, the lateral veins 4–8 on each side, the secondary veins frequent, conspicuous, more or less ascending in the centre of the leaf, more or less transverse towards the margin. Floating leaves absent. Stipules 18–60 mm long, flexible or rigid, semi-translucent, hyaline, sometimes with a reddish tinge, semi-per-



Map 6
Distribution of *Potamogeton x salicifolius* WOLFG. in Poland

sistent, veins inconspicuous when dry, 2 much more prominent than the others forming weak or strong ribs, sometimes winged up to $\frac{3}{4}$ of their length. Inflorescences not seen.

Variation: extremely variable; a part of the individuals morphologically resemble *P. perfoliatus* – having unbranched stem, short, elliptical leaves with a semi-amplexicaul base, rounded at the apex, stipules are delicate, with unwinged ribs, other individuals are morphologically closer to *P. lucens* – having branched stem, narrowly lanceolate leaves with a cuneate base (seldom on very short petioles) and acute apex, stipules rigid, persistent, with winged ribs. In comparison with this taxon description given by PRESTON (1995) individuals occur in Poland were seen only in vegetative stage.

Similar taxa:

P. lucens – all submerged leaves on short but well differentiated petioles, all secondary veins ascending.

P. alpinus – stem unbranched, with a strong reddish tinge when dried, stipules hyaline, delicate, fugacious.

P. perfoliatus – amplexicaul leaf base.

P. x nitens – stipules short, with unwinged ribs. Sometimes differentiation between these two hybrids based only on morphology is not possible.

Habitat: mesotrophic, standing (lakes) waters.

General distribution: widely but sporadically distributed in Europe (DANDY 1975).

Distribution in Poland: hybrid known from four stations in north-western Poland (Map 6).

Detailed list of localities in Poland:

BC: 22 – Ostrowieckie lake, leg. *J. KUJAWA-PAWLACZYK* 1994 (DRAPN). CB: 21 – Gwiazda lake, leg. *W. GRÜTTER* 1891 (TRN); 25 – Wdzydze lake near island “Ostrów Mały”, leg. *F. SZAFRAŃSKI, K. TOBOLSKI* 1966 (POZ); 39 – Wierzyca river near Starogard Gdański, leg. *KLINSMANN* 1852 (TRN).

**3.7 *Potamogeton x sparganiifolius* LAEST. ex FR.,
Novit. Fl. Succ. Mant. 1: 9. 1832
(„sparganifolius”)**

[*P. gramineus x P. natans*]

Stem terete, slender, sparingly branched. Submerged leaves at the base of the stem reduced to phyllodes, otherwise with the lamina, 12–380 mm long, 2–5 mm wide, 15–70 times as long as wide, semi-translucent or opaque, pale green or dark green, linear, ribbon-like very gradually tapering to the cuneate base, some sessile, some petiolate, acute or acuminate at the apex, entire, midrib bordered by a narrow band of lacunae, the lateral veins 1–3 on each side, the secondary veins frequent, ascending in the centre of the leaf, more or less transverse near the margin, petioles up to 55 mm long. Semi-floating leaves petiolate, the lamina 65–80 mm long, 8–15 mm wide, 5–8 times as long as wide, semi-opaque, subcoriaceous, pale green to dark green, lanceolate to narrowly elliptical, cuneate at the base, acute or acuminate at the apex, the lateral veins 4–6 on each side, the secondary veins frequent, ascending in the centre of the leaf, more or less transverse near the margin, petioles 140–220 mm long. Floating leaves not seen. Stipules 17–95 mm long, semi-translucent, persistent, greenish after dry, veins conspicuous when dry, 2 much more prominent than the others, forming unwinged ribs. Peduncles 30–120 mm long, slender, terete. Spikes cylindrical, 25–45 mm long in flower, contiguous. Flowers numerous, with 4 carpels. Fruits not seen.

Variation: in the one known population not variable. In comparison with this taxon description given by *PRESTON* (1995) individuals occur in Poland have shorter and narrower submerged leaves.

Similar taxa:

P. natans – all submerged leaves reduced to phyllodes, petioles of floating leaves with discoloured section between the petiole and the lamina, stipules with unwinged ribs, floating leaves forming by one plants with similar length and wide.

P. x fluitans – stipules with narrowly winged ribs, the apex of submerged leaves often mucronate.

Habitat: flowing (river), eutrophic but clear water.

General distribution: frequent in Scandinavia, recorded also in Great Britain, the Netherlands, Russia (Siberia) and Germany (*DANDY* 1975).

Distribution in Poland: known only from the middle part of the River Drawa in northern Poland (Map 7). – BC: 22 – the station discovered by *M. KRASKA* in 1999 (POZ).

**3.8 *Potamogeton x undulatus* WOLFG. in SCHULT.
& SCHULT.f., Mant. 3: 360. 1827, pro sp.**

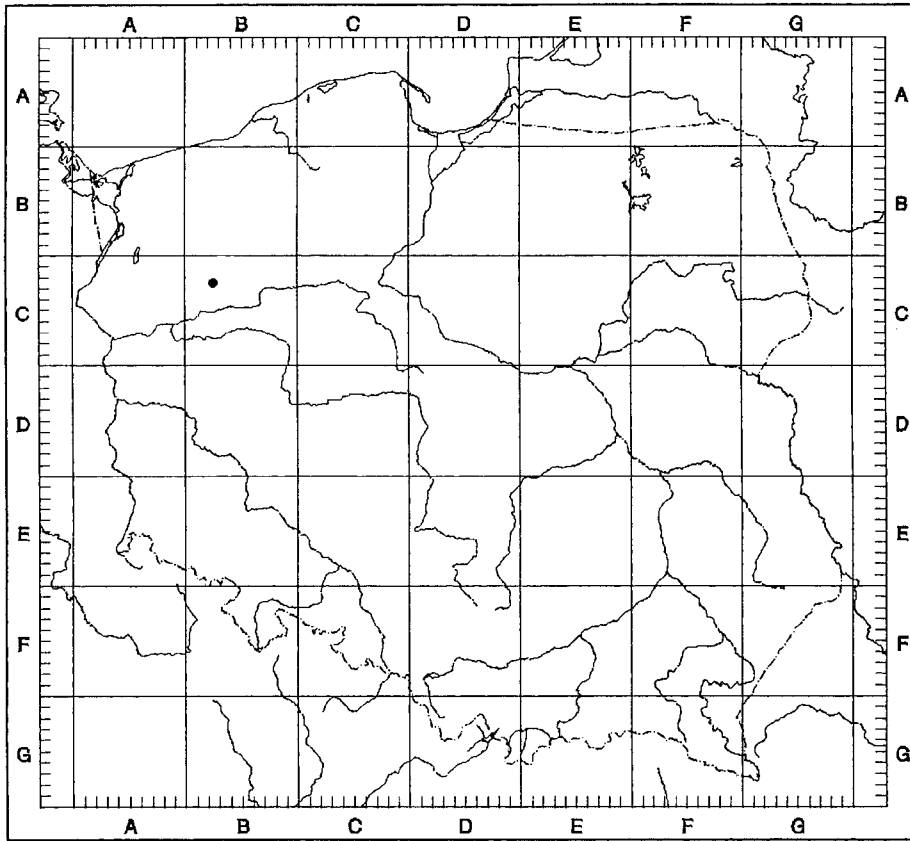
[*P. crispus x P. praelongus*]

Stem slightly compressed, with a shallow, longitudinal groove running down the broader sides, the apical part richly branched. Submerged leaves sessile, 45–100 mm long, 12–22 mm wide, 3.75–4.5 times as long as wide, semi-translucent, olive-green or dark green, oblong, auriculate or semi-amplexicaul at the base, obtuse or subacute at the apex, sometimes very narrowly hooded, the margin undulate and entire or obscurely toothed towards the apex, midrib bordered by a narrow band of lacunae, the lateral veins 2–4 on each side, the secondary veins ascending in the centre of the leaf, more or less ascending, transverse or wavy near the margin. Floating leaves absent. Stipules 12–20 mm long, semi-translucent, hyaline, semi-persistent, veins conspicuous when dry, 2 much more prominent than the others but not forming ribs. Peduncles 30–50 mm long, as thick as the stem. Stipules cylindrical, 7.5–15 mm long in flower, contiguous. Flowers 10–15, with 4 carpels. Fruits not seen.

Variation: not very variable, in most cases intermediate between the parent species.

Similar taxa:

P. praelongus – stem terete, 5–9 lateral veins on each side of the midrib, the leaf apex markedly



Map 7
Distribution of *Potamogeton x sparganiifolius* LAEST. ex FR. in Poland

hooded splitting along the midrib after being pressed during drying.

P. alpinus – (if floating leaves absent) – stem terete, 4–7 lateral veins on each side, plant with a strong reddish tinge when dried.

P. x olivaceus – the lateral veins 2–3 on each side, leaf base often cuneate, stem unbranched or very sparingly branched.

Habitat: standing (lakes), mesotrophic waters.

General distribution: rare hybrid recorded in Great Britain, Denmark, Russia (DANDY 1975) and Germany (WIEGLEB & HERR 1984).

Distribution in Poland: known from three isolated stations: one in northern and two in Central Poland (Map 8). Not rediscovered in Lake Wysoka during a field investigation car-

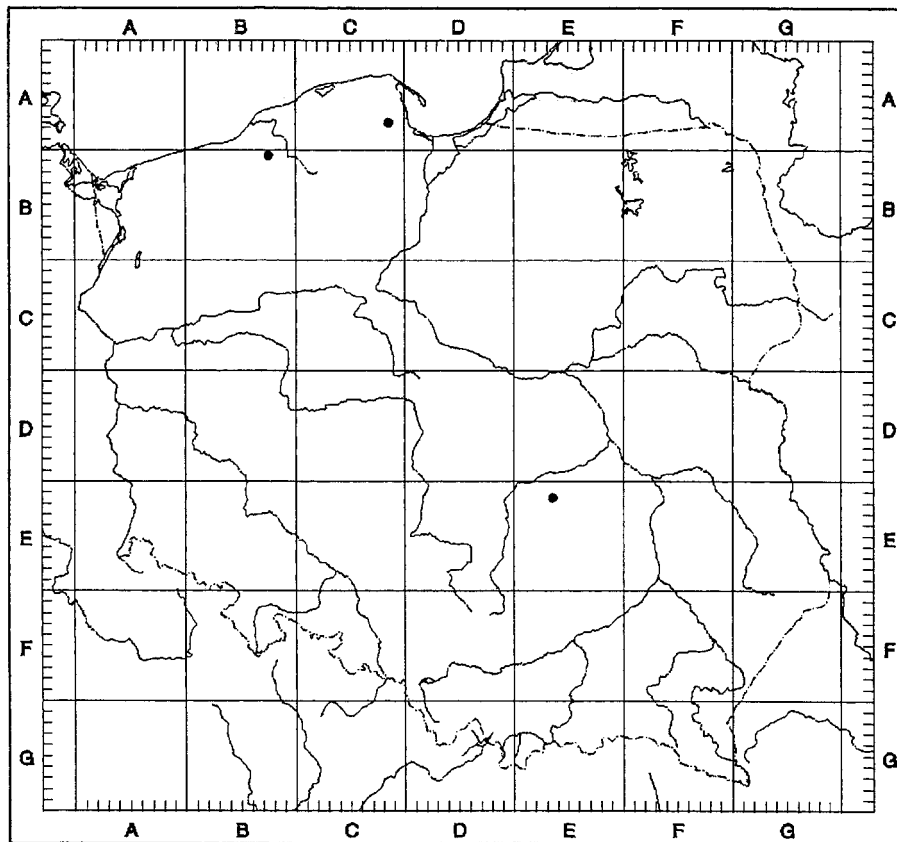
ried by the author in August 2001, only the parent species – *P. crispus* and *P. praelongus* thrive there.

Detailed list of localities in Poland:

BB: 07 – Nidno lake, leg. A. BADOWER 1964 (POZ).
CA: 79 – Wysockie lake near Osowa, leg. C. LÜTZOW 1895 (TRN). EE: 13 – pond near Drzewica, leg. A. EISMOND 1884 (WA).

4 Conclusion

Among approximately 5 000 herbarium specimens with *Potamogeton* taxa collected in Poland, 78 vouchers belong to eight *Potamogeton* hybrids. This leads to the conclusion that hybridisation within this genus is a rare phenomenon in Poland. The most common hybrids



Map 8
Distribution of *Potamogeton x undulatus* WOLFG. in Poland

are *P. x angustifolius* and *P. x nitens*; *P. x fluitans*, *P. x salicifolius* and *P. x undulatus* are much rarer and each of *P. x nericius*, *P. x olivaceus* and *P. x sparganiiifolius* are known only from one station in Poland. The frequency of appearance in Poland and in Europe is comparable but *P. x fluitans*, *P. x salicifolius* and *P. x undulatus* seem to be rarer in Poland than in other European countries. The distributions of *Potamogeton* hybrids in Poland together with information on the distribution from the others European countries should be used to construct general distribution maps of these taxa.

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