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**THE NEW LOCALITY OF *RANUNCULETUM FLUITANTIS* ALLORGE 1922 PLANT
COMMUNITY AND SPECIES OF RHODOPHYTES IN THE MYŚLIBORKA
STREAM (THE NATURA 2000 SITE „OSTOJA WKRZAŃSKA” PLB 320014)**

**NOWE STANOWISKO ZESPOŁU *RANUNCULETUM FLUITANTIS* ALLORGE
1922 ORAZ RZADKICH GATUNKÓW KRASNOROSTÓW W STRUMIENIU
MYŚLIBORKA (OBSZAR NATURA 2000 „OSTOJA WKRZAŃSKA” PLB 320014)**

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Streszczenie. Opisywane przygraniczne stanowisko zespołu *Ranunculetum fluitantis* Allorge 1922 w strumieniu Myśluborka dokumentuje nową lokalizację siedliska „Nizinne i podgórskie rzeki ze zbiorowiskami włosieniczników *Ranunculion fluitantis* (kod – 3260)” na terenie Pomorza Zachodniego oraz dla obszaru Natura 2000 „Ostoja Wkrzańska” PLB 320014. W wodach strumienia zweryfikowano także obecność stanowisk rzadkich gatunków hydrofitów, takich jak rdestnica błyszcząca *Potamogeton rutilus* oraz słodkowodnych krasnorostów: *Batrachospermum atrum* i *B. gelatinosum*. Występowanie wymienionych taksonów w wodach strumienia wskazuje na oligo- i meztroficzny charakter siedliska, co potwierdziły wyniki analizy hydrochemicznej wód.

Key words: *Batrachospermum atrum*, *Batrachospermum gelatinosum*, nature habitats, new localities, Poland, *Potamogeton nodosus*, *Potamogeton rutilus*, *Ranunculetum fluitantis*, rare plant species, Western Pomerania.

Słowa kluczowe: *Batrachospermum atrum*, *Batrachospermum gelatinosum*, nowe stanowiska, Polska, Pomorze Zachodnie, *Potamogeton nodosus*, *Potamogeton rutilus*, *Ranunculetum fluitantis*, rzadkie gatunki flory, siedliska przyrodnicze.

INTRODUCTION

The *Ranunculetum fluitantis* association of the river water crowfoot and longleaf pondweed Allorge 1922 is one of phytosociological identifiers of the Natural natural habitat “Lowland and submontane rivers with *Ranunculion fluitantis* communities (code – 3260)”, which is protected pursuant to the Regulation of the Minister of the Environment of 13 April 2010, *Journal of Laws* 2010, no. 77, item 510. The phytocoenosis is made up of ecologically specialized hydrophytes rooted at the bottom of flowing waters which occur in clean eutrophic rivers with sandy beds. The examination of the occurrence of this association in Poland to date has shown that it is dispersed all over the country, mostly at upper and middle

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sections of medium-sized and small rivers (Mróz 2012). In West Pomerania, the *Ranunculetum fluitantis* occurs locally in the landside area of the West Oder River (Kowalski and Wróbel 2011), as well as at the lower section of the Płonia River where it occupies large areas with a rapid flow. The new location of this association has a unique nature and it emphasizes the natural value of the Natura 2000 site "Ostoja Wkrzańska" (Wkra River Refuge) PLB 320014 situated on the Wkra Plains in the close vicinity of the Polish-German border. The landscape of the refuge is dominated by pine tree stands with low-moor and high-moor peat bogs, lakes and waterholes with advanced succession of water, marsh and rush plants promoting the nesting and feeding of various bird species. A part of the refuge area was extensively used in past and at present it is distinguished by a mosaic of meadows, pastures and arable lands with mid-field tree stands and damp depressions (Ziarnek and Piątkowska 2010).

MATERIAL AND METHODS

Field research was conducted in the waters of the small Myślíborka stream which is approx. 6 km long. It flows from borderline Lake Myślíborskie Wielkie and falls into Nowowarpieńskie Lake which is a part of the Szczecin Lagoon area (Fig. 1).

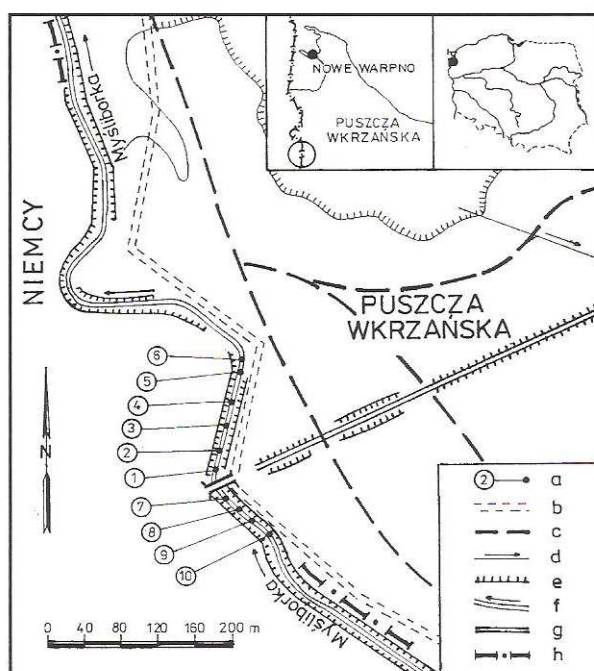


Fig. 1. Location of research sites in the Myślíborka border stream in the area of "Puszcza Wkrzańska" Primeval Forest: a – research sites, b – border patrol road, c – midforest roads, d – ditches, e – slopes, f – stream, g – German-Polish tourist route, h – state boundary

Rys. 1. Lokalizacja stanowisk badawczych w granicznym strumieniu Myślíborka na terenie Puszczy Wkrzańskiej: a – stanowiska badawcze, b – droga patrolowa granicy, c – drogi śródleśne, d – rowy; e – skarpy, f – strumień, g – niemiecko-polska trasa turystyczna, h – granica państwa

The width of the stream at its lower course is max. 2 m. Its flow is limited by steep banks along the entire length. The areas adjacent to the stream are occupied by dense wood complexes of the Ueckermünde Heath (Puszcza Wkrzańska) separated by small enclaves of extensively used semi-natural meadows and pastures. During exploratory research aimed at examining the spread of freshwater red algae in Pomerania which was conducted in the years 2012–2013, the occurrence of aquatic plants which identified protected natural habitats “Lowland and submontane rivers with *Ranunculion fluitantis* communities (code – 3260)”. During the field research, phytosociological documentation was prepared, photographs were taken using the Braun-Blanquet method (Dzwonko 2007), the geographic location of patches of these habitats was demarcated and photographic documentation was prepared. The nomenclature of vascular plants is provided after Mirek et al. (2002), of freshwater red algae after Eloranta et al. (2011), and of plant syntaxons after Matuszkiewicz (2001).

RESULTS AND DISCUSSION

The spread and phytosociological characteristics of the *Ranunculetum fluitantis* association Allorge 1922 in the Myśluborka stream in the area under investigation

The *Ranunculetum fluitantis* association of the river water crowfoot and longleaf pondweed (Fig. 2) in the waters of the Myśluborka stream creates patches dominated by the characteristic species of the association, i.e. longleaf pondweed *Potamogeton nodosus* Poir. (= *Potamogeton fluitans* Roth). The community spreads along a length of approx. 150 m, both on the southern and northern side of the bridge joining the German-Polish tourist route (Fig.1). The *Ranunculetum fluitantis* association occupies approx. 50–60% of the water surface area. At the upper section of the stream, the phytocoenosis does not occur, while at its lower course it appears on a periodic basis.



Fig. 2. Phytocoenosis of *Ranunculetum fluitantis* Allorge 1922 in the Myśluborka stream (phot. W.W.A. Kowalski)

Rys. 2. Płat fitocenozy *Ranunculetum fluitantis* Allorge 1922 w strumieniu Myśluborka (fot. W.W.A. Kowalski)

The species that defines this phytocoenosis in the habitat is a hydrophyte from the nymphaeoides ecological group – longleaf pondweed *Potamogeton nodosus* with characteristic elongated lanceolate leaves on the water surface and immersed leaves with a very distinct reticular veining. It occurs in all patches in the area under investigation in high quantities and with high phytosociological sociability (Table 1, photographs 1–7).

Table.1 Communities of aquatic vegetation in the Myśluborka stream
Tabela 1. Zbiorowiska roślinności wodnej strumienia Myśluborka

Successive number of record Numer kolejny zdjęcia	1	2	3	4	5	6	7	8	9	10
Number of releve on the map Numer zdjęcia na mapie	1	4	10	2	7	3	5	9	8	6
Date: Day/Month/Year Data: dzień/miesiąc/rok	06.07.2013									
Area of rekord [m ²] Powierzchnia zdjęcia [m ²]	5.0	3.0	8.0	3.0	3.0	2.5	5.0	1.0	2.5	2.0
Cover of herb layer c [%] Pokrycie warstwy c [%]	95	95	100	95	95	100	100	85	90	100
Number of species in record Liczba gatunku w zdjęciu	5	5	6	8	8	9	6	7	7	7
Ch. Ass. <i>Ranunculetum fluitantis</i>										
<i>Potamogeton nodosus</i>	4.5	4.5	4.5	2.4	4.5	4.5	3.4	+	.	+
Ch. All. <i>Ranunculion fluitantis</i>										
<i>Sparganium simplex</i>	1.2	1.2	2.2	3.4	1.2	.	.	.	4.3	3.4
<i>Berula erecta</i>	.	.	.	1.2	1.2	+	.	1.2	+	.
<i>Nuphar lutea</i> fo. <i>submersa</i>	.	.	1.1	+	.	1.2	.	.	.	.
Ch. O., Cl. <i>Potametalia</i> , <i>Potametea</i>										
<i>Elodea canadensis</i>	1.2	.	1.2	1.1	3.3	1.2	+	.	+	2.1
<i>Potamogeton rutilus</i>	.	.	.	.	2.3	+	1.2	1.3	+	+
<i>Hydrocharis morsus-ranae</i>	.	.	.	.	.	.	.	4.4	.	.
<i>Potamogeton crispus</i>	.	.	.	.	.	+	.	.	.	.
Ch. O., Cl. <i>Lemnetalia minoris</i> , <i>Lemnetea minoris</i>										
<i>Lemna minor</i>	.	+	.	+	1.2	1.2	1.2	3.3	2.2	1.2
<i>Lemna trisulca</i>	.	.	.	.	.	.	.	.	+	+
<i>Spirodela polyrrhiza</i>	.	.	.	.	.	.	.	+	.	.
Accompanying species										
Gatunki towarzyszące										
<i>Cladophora glomerata</i>	3.4	3.4	4.4	2.3	2.3	3.4	2.3	2.3	3.4	3.4
<i>Batrachospermum atrum</i>	+	1.1	1.2	2.2	1.3	2.1	1.1	+	+	+
<i>Batrachospermum gelatinosum</i>	.	.	.	+	.	.	.	+	.	.
<i>Zygnemales</i> sp. div.	+	.	.	.	+	2.3	3.4	.	.	.
<i>Rumex hydrolapathum</i>	.	+	.	+	.	.	.	.	.	.
<i>Glyceria fluitans</i>	.	.	+	.	.	.	.	.	.	.

Explanations: + – few specimens, . – lack of specimens.
Objaśnienia: + – nieliczne okazy, . – brak okazów.

In terms of taxonomic diversity, this association is quite poor and the number of species and the number of species in the individual patches ranges from 5 to 9. Characteristic species for the *Ranunculetum fluitantis* association which accompany longleaf pondweed *Potamogeton nodosus* patches include mostly the bur-reed *Sparganium simplex*, less frequently cutleaf water parsnip *Berula erecta* and yellow water-lily *Nuphar lutea* fo. *submersa*. Also characteristic taxa of order *Potametalia* and class *Potametea* (Matuszkiewicz 2001) are present, including shetland pondweed *Potamogeton rutilus* – a species classified as critically endangered (CR) in the Polish flora (Kaźmierczakowa and Zarzycki 2001). Their participation is however limited by quite a rapid flow which reaches 0.36–0.37 m · sec⁻¹ with a relatively low water level which does not exceed 50–60 cm during the vegetative season. Also

pleustophyte species appear in the phytocoenosis patches from class *Lemnetea minoris* such as common duckweed *Lemna minor*, less frequently star duckweed *Lemna trisulca* and greater duckweed *Spirodela polyrhiza*.

In Poland, phytocoenoses with the participation of the longleaf pondweed *Potamogeton nodosus* occur in dispersed stands with mostly mineral substrate (Matuszkiewicz 2001), or covered with a small amount of organic substances in still or slow-flowing waters up to a depth of 3 m (Puchalski 2004).

Chemical characteristic of stream water

The condition of the water in the Myślíborek stream, as covered by the monitoring, is presented in the results of chemical analyses performed by the Provincial Inspectorate for Environmental Protection in Szczecin. The water in the Myślíborka stream is characterized by distinctly alkaline pH values (pH 7.8–8.2) and a small content of biogens with their considerable oxygen saturation (Table 2). Hydrochemical parameters allow for classifying the stream ecosystem as a mesotrophic habitat.

Table 2. Hydrochemical parameters of the Myślíborka streams waters
Tabela 2. Parametry hydrochemiczne wód strumienia Myślíborka

Analysed parameters Analizowane wskaźniki	Measurement units Jednostki miary	Research dates – Terminy badań						
		04.02. 2013	09.03. 2013	01.04. 2013	03.06. 2013	01.07. 2013	05.08. 2013	02.09. 2013
Water temperature Temperatura wody	°C	2.9	4.9	8.7	16.8	21.6	20.1	20.8
Colour Barwa	mg Pt/dm	35	40	45	45	45	55	45
Total suspension Zawiesina ogólna	mg/dm	14.0	4.2	7.7	4.8	5.2	3.1	4.1
Reaction pH Odczyn pH	–	7.8	7.8	7.9	7.8	7.9	8.0	8.2
Dissolved oxygen Tlen rozpuszczony	mg O ₂ /dm	10.3	9.5	10.6	8.5	7.7	9.6	10.9
Oxygen saturation of water Nasycenie wód tlenem	%	77.6	74.8	90.7	88.4	86.3	104.2	116.3
BOD ₅ BZT ₅	mg O ₂ /dm	6.3	3.0	3.3	2.8	2.3	2.0	2.0
Total organic karbon Ogólny węgiel organiczny	mg C/dm	19.0	15.9	17.1	16.9	12.6	17.0	16.6
Ammonium nitrogen Azot amonowy	mg N/dm	0.81	0.70	0.58	0.20	0.01	0.06	0.07
Nitrate nitrogen Azot azotanowy	mg N/dm	0.05	0.48	0.24	0.05	0.05	0.05	0.05
Nitrite nitrogen Azot azotynowy	mg N/dm	0.004	0.010	0.009	0.013	0.003	0.001	0.004
Total nitrogen Azot ogólny	mg N/dm	2.50	2.49	2.05	1.71	1.80	1.60	0.92
Phosphates PO ₄ Fosforany PO ₄	mg PO ₄ /dm	0.02	0.05	0.03	0.14	0.13	0.29	0.15
Total phosphorus Fosfor ogólny	mg P/dm	0.13	0.04	0.12	0.15	0.15	0.16	0.12
Conductivity in T 20°C Przewodnictwo w T 20°C	µS/cm	352	315	320	332	337	343	342
Dissolved matter Substancje rozpuszczone	mg/dm	271	272	238	272	239	271	226
Total alkalinity Zasadowość ogólna	mg CaCO ₃ /dm	148	124	128	140	147	157	151
Total water hardness Twardość ogólna wody	mg CaCO ₃ /dm	178	148	154	273	171	189	169
Calcium Wapń	mg Ca/dm	61	52	54	59	56	62	56

Rare flora species occurring in the site under analysis in the water of the Myśluborka stream

The occurrence of rare taxa of vascular and moss plants of freshwater algae *Rhodophyta* were found in the water of the Myśluborka stream – they are very rare in Poland and West Pomerania. They include:

Potamogeton rutilus Wulfen. – the shetland pondweed is a vascular hydrophyte species which is critically endangered in Poland (CR) (Każmierczakowa and Zarzycki 2001). Żukowski and Jackowiak (1995) classify this taxon in West Pomerania and Greater Poland as vulnerable (V). In Poland, shetland pondweed stands are mostly located in Masuria and the Lublin Lakeland. In Pomerania, this species occurs in Kashubia as well as in uncertain stands including the Szczecin Lagoon, Dąbie Lake and Miedwie Lake (Zajac and Zajac 2001).

Batrachospermum atrum (Hudson 1989) Harveij (= *Conferva atra* Hudson 1798, *Batrachospermum tenuissimum* Bory 1823, *B. dillenii* Sirodot 1884, *B. gallaei* Sirodot 1884, *B. angolense* W. West et G.S. West 1897, *Sirodotia angolensis* (W. West et G.S. West 1897) Skuja in Reis 1960).

Batrachospermum atrum – grows on stones in the landside sections of the Myśluborka stream. Thalli of these freshwater algae reach heights of 3–6 cm, they are strongly bushy, irregularly branched, rough, dark green and pointed at branch tips (Fig. 3). Well-formed gonimoblasts occur singly forming irregular papillary protrusions mostly on the central axis of the thalli. According to available data, this species prefers hard water with an alkaline pH value and a low trophic (oligo- and mesotrophic). These characteristics of stream water are confirmed by results of chemical analyses (Table 2). *Batrachospermum atrum* belongs to freshwater red algae which are very rare in Poland (R) (Siemińska et al. 2006), and the site in the Myśluborka stream is the only documented and currently confirmed place of the occurrence of this species in Poland (Kowalski and Kwadrans 2013).

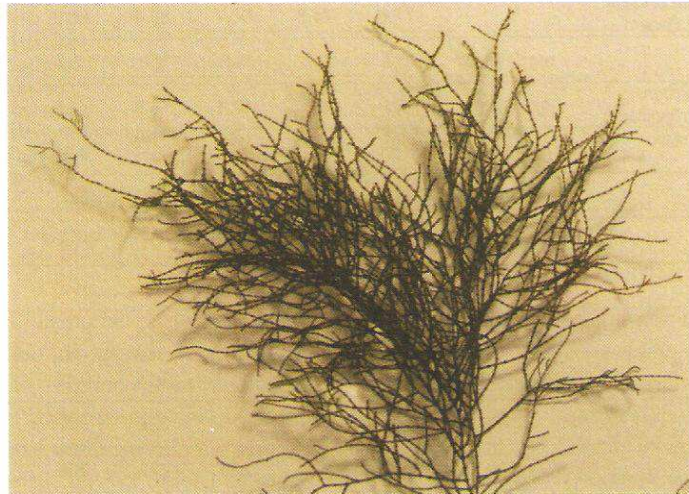


Fig. 3. Macroscopic part of *Batrachospermum atrum* (Hudson 1989) Harveij thallus (phot. W.W.A. Kowalski)

Rys. 3. Makroskopowy fragment plechy *Batrachospermum atrum* (Hudson 1989) Harveij (fot. W.W.A. Kowalski)

Batrachospermum gelatinosum (L.) DC. (= *Batrachospermum moniliforme* Roth 1800, *B. decaisneanum* Sirodot 1884, *B. radians* Sirodot 1884, *B. reginense* Sirodot 1884, *B. corbula* Sirodot 1884, *B. pyramidale* Sirodot 1884, *B. densum* Sirodot 1884, *B. pygmaeum* Sirodot 1884) is known from Pomerania in stands at the place where the watercourse flows out of Lake Lewino in the Goleniów Forest (Puszcza Goleniowska) (Kowalski 1971) and at the stony substrate of the flap on the canal flowing out of the lake in the Tchórzyno Reserve. The site in the Myśluborka stream is the third documented and currently confirmed place of the occurrence of this species in Poland (Kowalski and Kwadrans 2013). These freshwater red algae are spread all over Europe, including also a few stands in Poland, in springs, streams, ditches and even old river beds. This taxon is characterised by high variability both in local growth forms and the thalli colour.

RECAPITULATION

Botanical research on the Myśluborka stream vegetation – a borderline watercourse flowing into the Szczecin Lagoon, have contributed to finding and documenting a new stand of *Ranunculetum fluitantis* association of the river water crowfoot and longleaf pondweed Allorge 1922, which is very rare in West Pomerania and in Poland, which identifies a protected natural site of “Lowland and submontane rivers with *Ranunculion fluitantis* communities (code – 3260)”, which was not previously listed in the Natura 2000 site “Ostoja Wkrzańska” PLB 320014.

Moreover, the presence of rare hydrophyte species was confirmed in the water of the Myśluborka stream, such as longleaf pondweed *Potamogeton rutilus* and freshwater red algae *Batrachospermum atrum* and *B. gelatinosum*.

The results of chemical tests of the Myśluborka stream water have shown their mesotrophic nature and confirmed ecological requires of the plant association which is the physiosociological identifier of the described Natura 2000 site.

REFERENCES

- Dzwonko Z. 2007. Przewodnik do badań fitosocjologicznych. Wydaw. Sorus, Poznań-Kraków.
- Eloranta P., Kwadrans J., Kusel-Fetzmann E. 2011. *Rhodophyta and Phaeophyceae*. Süßwasserflora von Mitteleuropa – Freshwater flora of Central Europe.7. Spektrum Akademischer Verlag, Heidelberg.
- Każmierczakowa R., Zarzycki K. 2001. Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe [Polish Red Data Book of Plants. Pteridohytes and flowering plants]. Instytut Ochrony Przyrody im. W. Szafera, PAN, Kraków. ISBN 83-89648-38-5. [in Polish].
- Kowalski W. 1971. Nowe dla Polski stanowisko *Batrachospermum vagum* Ag. na Pomorzu Szczecińskim. *Fragm. Florist. Geobot.* XVII, 1, 163–169.
- Kowalski W.W.A., Kwadrans J. 2013. *Batrachospermum atrum* (Rhodophyta) – first record in Poland. *Pol. Bot. J.* 58(2), 687–689.
- Kowalski W.W.A., Wróbel M. 2011. *Potamogeton nodosus* Poir.(= *P. fluitans* Roth P.P.) i zbiorowiska pleustofitów w wodach przybrzeżnych Odry Zachodniej pod Szczecinem. *Folia Pomer. Univ. Technol. Stetin., Agric., Aliment., Pisc., Zootech.* 289(19), 75–81.
- Matuszkiewicz W. 2001. Przewodnik do oznaczania zbiorowisk roślinnych Polski. PWN, Warszawa. ISBN 83-01-14342-8.

- Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M. 2002. Krytyczna lista roślin naczyniowych Polski [Flowering plants and pteridophytes of Poland]. A checklist. Instytut Ochrony Przyrody im. W. Szafera, PAN, Kraków. ISBN 83-85444-38-6. [in Polish].
- Mróz W. 2012. Monitoring siedlisk przyrodniczych. Przewodnik metodyczny. Cz. II GIOS, Warszawa. ISBN 978-83-61227-76-2.
- Siemińska J., Bąk M., Dziedzic J., Gąbka M., Gregorowicz P., Mrozińska T., Pelechaty M., Owsiany P.M., Pliński M., Witkowski A. 2006. Czerwona lista glonów w Polsce. [w: Red list of plants and fungi in Poland. Czerwona lista roślin i grzybów Polski]. Ed. Z. Mirek, K. Zarzycki, W. Wojewoda, Z. Szelaąg. Instytut Ochrony Przyrody im. W. Szafera, PAN, Kraków. ISBN 83-89648-38-5.
- Rozporządzenie Ministra Środowiska z dnia 13 kwietnia 2010 r. w sprawie siedlisk przyrodniczych oraz gatunków będących przedmiotem zainteresowania Wspólnoty, a także kryteriów wyboru obszarów kwalifikujących się do uznania lub wyznaczenia jako obszary Natura 2000. DzU z 2010 r., nr 77, poz. 510.
- Zając A., Zając M. 2001. Atlas rozmieszczenia roślin naczyniowych w Polsce [Atlas of Vascular Plants Distribution in Poland]. Prac. Chorol. Komput. Inst. Bot. UJ Kraków.
- Ziarnek K., Piątkowska D. 2010. Wdrażanie europejskiej sieci ekologicznej Natura 2000 na przykładzie województwa zachodniopomorskiego. RDOŚ w Szczecinie, BKP w Szczecinie, Szczecin. ISBN 978-83-926960-4-9.
- Żukowski W., Jackowiak B. 1995. Ginące i zagrożone rośliny naczyniowe Pomorza Zachodniego i Wielkopolski. Prace Zakładu Taksonomii Roślin. Uniw. im Adama Mickiewicza w Poznaniu, Bogucki Wydaw. Nauk., Poznań.

Abstract. Described the border site of *Ranunculetum fluitantis* Allorge 1922 plant association in the Myśluborka stream documents the new location of "Lowland and foothill rivers with batrachion vegetation communities *Ranunculion fluitantis* (code – 3260)" in Western Pomerania and in the Natura 2000 site "Ostoja Wkrzańska" PLB 320014. In waters of the stream verified the presence of rare species of hydrophytes positions such as shiny pondweed *Potamogeton rutilus* and freshwater rhodophytes: *Batrachospermum atrum* and *B. gelatinosum*. The occurrence of these taxa in waters of the stream indicates the oligo-and mesotrophic nature of the habitat which confirmed results of hydrochemical analysis of waters.