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NEW DISTRIBUTIONAL DATA ON BRYOPHYTES OF POLAND AND SLOVAKIA, 11

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Abstract. This work presents a list of localities for the following species: *Anastrophyllum michauxii*, *Campylopus flexuosus*, *C. pyriformis*, *Diplophyllum obtusifolium*, *Fuscocephaloziopsis catenulata*, *Orthodicranum tauricum*, *Porella cordaeana* and *Ricciocarpos natans*.

1. ***Anastrophyllum michauxii*** (F. Weber) H. Buch

Author: P. Górski

Slovakia: MGRS 34UDV4754, Belianske Tatra Mts, Východné Belianske Tatry, Babia dolina valley (upper part of Babilovská dolina valley), decaying log near stream, 49.24766°N, 20.27452°E, alt. 970 m above sea level (a.s.l.), 49.24674°N, 20.27365°E, alt. 990 m a.s.l., 49.24363°N, 20.27266°E, alt. 1060 m a.s.l., *leg*., *det*. P. Górski, 29.07.2016 (POZNB 2229, 2302, 2309).

Anastrophyllum michauxii is an epixylic species that is relatively rare in the Tatra Mountains. In the entire area of this massive, 47 localities where *A. michauxii* is found have been recorded within an altitude range of 900–1575 m a.s.l. (Górski & Váňa 2014, Górski 2016a, b). This study presents a further three localities where this plant is found in the Belianske Tatra Mountains, where 10 localities have previously been recorded (Duda & Váňa 1984, Górski & Váňa 2014).

2. ***Campylopus flexuosus*** (Hedw.) Brid.

Authors: M. Staniaszek-Kik, E. Stefańska-Krzaczek

ATMOS Ec-72: SW Poland, Silesian Lowlands (Nizina Śląska), forest section 71d of the Brzeg For-

est Inspectorate, Lubsza Sub-district, 50.9712°N, 17.5168°E, on the mineral soil in a young close canopy Scots pine stand (*Pinus sylvestris*, 18 years old), *leg*. E. Stefańska-Krzaczek, 18.08.2015, *det*. M. Staniaszek-Kik (LOD).

A few dozen years ago, *Campylopus flexuosus* was still considered a rare species in Poland (Szafran 1957), and for a dozen or so years, there has been a considerable increase in records of its occurrence (Stebel 2007, 2015, Fojcik 2017, Smoczyk 2017). The species spreads by forming numerous propagules (flagella) (Stebel 2007). Most of the localities where the moss is found are concentrated in southern Poland (Rusińska 1995, Stebel 2007, 2015, 2016, Fojcik 2017). *Campylopus flexuosus* prefers acid substrates (Żarnowiec & Stebel 2014). It occurs mainly in forest communities and overgrows moist peat, mineral soil, humus and even decaying wood (Smith 2004, Fojcik 2017). This moss also prefers anthropogenic habitats (paths, roadsides), including young spruce and pine tree forests. Until now, in the Silesian Lowlands this species has only been recorded in the "Prądy" nature reserve (Stebel 2007).

3. ***Campylopus pyriformis*** (Schultz) Brid.

Authors: M. Staniaszek-Kik, E. Stefańska-Krzaczek

ATMOS Ec-62: SW Poland, Silesian Lowlands, forest section 79f of the Brzeg Forest Inspectorate, Lubsza Sub-district, 50.9637°N, 17.4755°E, on the mineral soil covered with lichens *Placynthiella icmalea* and *P. oligotropha* in a young open canopy Scots pine stand (*Pinus sylvestris*, 4 years old), *leg*. E. Stefańska-Krzaczek, 5.08.2015, *det*. M. Staniaszek-Kik (LOD).

Campylopus pyriformis is a protected species that is included on the Red List (Żarnowiec et al. 2004). It occurs mainly on bare soil in peat ecosystems. These are often transformed dry ecosystems (Wilhelm 2015, Rosadziński & Staniaszek-Kik 2016, Smoczyk 2016). Less frequently, this moss overgrows sandy soils in forests or moors (Lisowski et al. 2000).

4. ***Diplophyllum obtusifolium*** (Hook.) Dumort.

Author: P. Górski

Slovakia: MGRS 34UDV2252, High Tatra Mts, Tichá dolina valley, at the mouth of Licierov žľab, sandy slope near stream, 49.21610°N, 19.94072°E, alt. 1219 m a.s.l., *leg*., *det*. P. Górski, 25.10.2017 (POZNB 2477); MGRS 34UDV2048, Western Tatra Mts, Hlina valley, lower part, near unmarked path in spruce forest, 49.18233°N, 19.90395°E, alt. 1159 m a.s.l., *leg*., *det*. P. Górski, 24.10.2017 (POZNB 2478); MGRS 34UDV1844, Western Tatra Mts, at the mouth of Kamienistá dolina valley, sandy slope near ground road, *Plagiothecio-Piceetum*, 49.14375°N, 19.88548°E, 49.14319°N, 19.88592°E, alt. 1006 m a.s.l., *leg*., *det*. P. Górski, 22.10.2017 (POZNB 2479, 2482); MGRS 34UDV2150, Western Tatra Mts, Tichá dolina valley, Nižná Nochavica, unmarked path above chata Tábor (west from Tichý potok stream), 49.19958°N, 19.91900°E, alt. 1185 m a.s.l., *leg*., *det*. P. Górski, 25.10.2017 (POZNB 2480).

In the entire area of the Tatra Mountains, 28 localities of *Diplophyllum obtusifolium* have been recorded within an altitude range of 820–1600 m a.s.l. (Górski & Váňa 2014). The liverwort occurs on sandy slopes along roads and tourist paths, mostly in the forest zone of the massive. According to my own observations, *D. obtusifolium* occurs much more frequently in the Tatra Mountains than is evident from published data. Three of the four presented localities are in the Slovakian part of the Western Tatra Mountains, where only four localities have been recorded previously (Duda 1955, Duda & Váňa 1980, Górski & Váňa 2014). It is worth noting that in this area, intensive forest management generates many habitats suitable for *D. obtusifolium*. Synanthropic localities of this plant are also known in the Polish part of the Western Tatras (Górski 2009).

5. ***Fuscocephaloziopsis catenulata*** (Huebener) Váňa et L. Söderstr. [=*Cephalozia catenulata* (Huebener) Lindb.]

Author: P. Górski

ATMOS Af-86: NE Poland, Borecka Primeval Forest (Puszcza Borecka), Warmia-Masuria Province, Gołdap county, „Struga Żytkiejmska" nature reserve, 54.35055°N, 22.62586°E, decaying log in spruce forest on peat (*Sphagno girgensohnii-Piceetum* association), *leg*., *det*. P. Górski, 17.09.2016 (POZNB).

Fuscocephaloziopsis catenulata is a rare epixylic species found in near-natural forests close to primeval forest (Cieśliński et al. 1996). Detailed information about the distribution of this species in Poland is presented in Górski & Romański (2016). The new locality is also in the north-eastern part of the country and is situated near the Polish-Russian border. From this area, *F. catenulata* has been reported in Puszcza Borecka, Puszcza Augustowska (Wigry National Park), and Puszcza Białowieska Primeval Forest (see Górski & Romański 2016 and literature cited therein).

6. ***Orthodicranum tauricum*** (Sapjegin) Smirnova

Authors: M. Staniaszek-Kik, E. Stefańska-Krzaczek

ATMOS Ec-72: SW Poland, Silesian Lowlands, forest section 294g of the Brzeg Forest Inspectorate, Lubsza Sub-district, 50.9162°N, 17.57283°E, on the humus in a young open canopy Scots pine stand (*Pinus sylvestris*, 4 years old), *leg*. E. Stefańska-Krzaczek, 17.07.2015, *det*. M. Staniaszek-Kik (LOD); ATMOS Ec-62: SW Poland, Silesian Lowlands, forest section 294c of the Brzeg Forest Inspectorate, Lubsza Sub-district, 50.9163°N, 17.5711°E, on the base of

a tree trunk in a mature Scots pine stand (*Pinus sylvestris*, 108 years old), *leg*. E. Stefańska-Krzaczek, 17.07.2015, *det*. M. Staniaszek-Kik, (LOD); ATMOS Dd-68: Central Poland, Łódź voivodeship, Wzniesienia Łódzkie foothills, Wzniesienia Łódzkie Landscape Park, "Górna Mrożyca" Landscape-Nature Protected Complex (Zespół Przyrodniczo Krajobrazowy „Górna Mrożyca"), 51.8274°N, 19.7618°E, on the trunk of *Alnus glutinosa* near a small river *leg., det*. M. Staniaszek-Kik, 20.04.2011 (LOD).

Orthodicranum tauricum is a species that mainly occurs on the bark of deciduous trees. It is fairly frequently found on logs and stumps, and less commonly on rocky substrates and in terrestrial habitats (Stebel et al. 2012a, b). The moss mainly occurs in different types of forest communities, but recently it has also been found in urban centres (Stebel et al. 2012a, b, Fudali & Żołnierz 2017). New localities in the Silesian Lowlands have been identified in managed Scots pine forest. *Orthodicranum tauricum* populations have been reported in thinned four-year-old tree stands, as well as in a stand that is over a hundred years old. Localities in the Silesian Lowlands as well as in Central Poland are recent successive records of this species in these regions of the country (Stebel et al. 2012a, Fudali & Podlaska 2016).

7. ***Porella cordaeana*** (Huebener) Moore

Authors: P. Górski, G. Domian

ATMOS Ba-94: NW Poland, West Pomerania, West Pomerania Province, Gryfino county, Bukowa Primeval Forest (Puszcza Bukowa), 53.29622°N, 14.69139°E, on stone near stream, *leg*. G. Domian, 13.02.2016, *det*. P. Górski (KRAM, POZNB).

Porella cordaeana is a relatively common species in mountainous areas (Carpathians, Sudety Mountains) but is rare in north-western Poland. After 2000, in West Pomerania *P. cordaeana* has been collected only twice (Rusińska et al. 2009, Górski 2013). The presented locality is the first one in the large forest complex (Puszcza Bukowa Primeval Forest) near Szczecin.

8. ***Ricciocarpos natans*** (L.) Corda

Authors: P. Pawlikowski, S. Kłosowski

ATMOS Bd-03: N Poland, Vistula river valley, Żuławy Wiślane (the Vistula Delta area) region, Pomeranian Province, Nowy Dwór Gdański county, Stegna commune, Wiślano-Zalewowy canal between the settlements of Stare Babki and Kolonia Orłowo, 54.231455°N, 19.045242°E, pH = 7.49, conductivity (EC) = 1635 μS cm^{-1}, water depth 0.5–1.5 m, scattered individuals and small aggregations in *Phragmitetum australis* (Gams 1927) Schmale 1939 and *Lemno minoris-Salvinietum natantis* (Slavnić 1956) Korneck 1959 with dominant *Salvinia natans* and accompanying *Hydrocharis morsus-ranae*, *not*. P. Pawlikowski, S. Kłosowski, 1.09.2009; N Poland, Nowy Dwór Gdański commune, canal in the settlement of Cyganek, 54.225266°N, 19.079224°E, pH = 7.33, EC = 1559 μS cm^{-1}, water depth 0.9 m, small aggregations in *Lemno minoris-Salvinietum natantis* with dominant *Salvinia natans* and accompanying *Ceratophyllum demersum* and *Lemna minor* as well as in *Glycerietum maximae* Hueck 1931, *not*. P. Pawlikowski, S. Kłosowski, 1.09.2009; N Poland, Nowy Dwór Gdański commune, Tuga river in the town of Nowy Dwór Gdański, 54.209796°N, 19.118726°E, pH = 7.64, EC = 873 μS cm^{-1}, water depth 0.65 m, scattered individuals in *Lemno minoris-Salvinietum natantis,* with dominant *Salvinia natans* and accompanying *Hydrocharis morsus-ranae* and *Nuphar lutea*, *not*. P. Pawlikowski, S. Kłosowski, 1.09.2009; ATMOS Bd-05: N Poland, Vistula river valley, Żuławy Wiślane (the Vistula Delta area) region, Warmia-Masuria Province, Elbląg county, Elbląg commune, Bielnik Drugi settlement, canal tributary from the south to the Kanał Elbląski (Jagielloński) canal, 54.190540°N, 19.327983°E, pH = 7.61, EC = 886 μS cm^{-1}, water depth 1.1 m, scattered individuals in *Lemno minoris-Salvinietum natantis* with dominant *Salvinia natans* and accompanying *Myriophyllum verticillatum*, *Potamogeton natans* and *Lemna trisulca*, *not*. P. Pawlikowski, S. Kłosowski, 1.09.2009; ATMOS Ca-62: W Poland, Odra river valley, Freienwald Valley (Kotlina Freienwaldzka) region, West Pomeranian Province, Myślibórz county, Boleszkowice commune, "Porzecze" landscape-nature protected area, artificial water body (probably former peat-cutting area), 52.672963°N, 14.470367°E, pH = 7.48, EC = 575 μS cm^{-1}, water depth ca 1.2 m, scattered individuals and small groups in *Lemno minoris-Salvinietum natantis* with dominant *Spirodela polyrhiza* and accompanying *Salvinia natans* and *Ceratophyllum submersum*, *not*. P. Pawlikowski, S. Kłosowski, 16.09.2014; ATMOS Ca-73: W Poland, Odra river valley, Warta River Mouth National Park (Park Narodowy Ujście Warty), Freienwald Valley region, Lubusz Province, Gorzów county, Kostrzyn n. Odrą commune, remnant oxbow lake north from the Kostrzyn n. Odrą – Słońsk road, by the level crossing, 52.57331°N, 14.64604°E, pH = 7.29, EC = 632 μS cm^{-1}, water depth ca 0.6 m, scattered individuals and small groups in *Lemno minoris-Salvinietum natantis* with dominant *Salvinia natans* and accompanying *Lemna trisulca* and *L. minor* and in *Sparganietum erecti* Roll 1938, *leg., det*. P. Pawlikowski, S. Kłosowski, 9.08.2017 (WA); ATMOS Cc-17: N Poland, Vistula river valley, Toruń Valley (Kotlina Toruńska) region, Kujawy-Pomerania Province, Bydgoszcz county, Dąbrowa Chełmińska commune, oxbow Lake in Mozgowina village, 53.16158°N, 18.21574°E, pH = 7.67, EC = 833 μS cm^{-1}, water depth ca 0.75 m, scattered individuals and small groups in *Lemno minoris-Salvinietum natantis* with dominant *Salvinia natans* and accompanying *Ceratophyllum demersum* and

Batrachium circinnatum and in *Sparganietum erecti*, *leg., det*. P. Pawlikowski, S. Kłosowski, 6.08.2017 (WA); ATMOS Da-13: W Poland, Odra river valley, Middle Odra Valley region, Słubice county, Cybinka commune, "Dolina Uradu" area, remnants of the Wężno oxbow lake 3 km W of the settlement of Bieganów, 52.192643°N, 14.718212°E, pH = 7.30, EC = 794 μS cm^{-1}, water depth 0.15 m, scattered individuals in *Lemno minor*-dominated vegetation, *not*. P. Pawlikowski, S. Kłosowski, 17.09.2009; ATMOS Dd-09: C Poland, Vistula river valley, Płock Valley (Kotlina Płocka) region, Mazovia Province, Płock county, Słubice commune, oxbow lake between the villages of Świniary and Nowosiadło, 52.42955°N, 19.91184°E, pH = 7.66, EC = 587 μS cm^{-1}, water depth ca. 0.5 m, scattered individuals in *Lemno minoris-Salvinietum natantis* with dominant *Salvinia natans* and accompanying *Lemna trisulca, L. minor* and *Hydrocharis morsus-ranae*, *leg., det*. P. Pawlikowski, S. Kłosowski, 5.08.2017 (WA); ATMOS Df-92: C Poland, Vistula river valley, Middle Vistula Valley (Dolina Środkowej Wisły) region, Mazovia Province, Kozienice county, Sieciechów commune, Czaple (oxbow) Lake in the village of Sieciechów, 51.542727°N, 21.746128 °E, pH = 7.79, EC = 483 μS cm^{-1}, water depth ca 0.6 m, scattered individuals in *Lemno minoris-Salvinietum natantis* with dominant *Salvinia natans* and accompanying *Nuphar lutea* and *Myriophyllum verticillatum* and *Hydrocharitetum morsus-ranae* (with *Stratiotes aloides* as an dominant), *not*. P. Pawlikowski, 23.08.2009. All water pH and EC measurements were carried out using portable device.

Ricciocarpos natans used to be considered a rare species in Poland (Szweykowski 1968, Karczmarz & Sokołowski 1979, 1981, 1985, Ochyra & Tomaszewicz 1979 and literature cited therein), but recently it has turned out to be much more widespread (Górski 2006, 2010, 2013, 2015 and literature cited therein; Wójciak & Urban 2006, Zubel 2015 and literature cited therein). However, it has not yet been reported from many regions of Poland or is known from scattered localities only. The species usually occurs in smaller water bodies (ponds, canals, ditches, peat-cutting areas, oxbow lakes) and sometimes forms its own *Ricciocarpetum natantis* Segal 1963 em. R.Tx. 1974 association (Matuszkiewicz 2008, Šumberová 2011, Felzines 2012). It is known to frequently co-occur with *Riccia fluitans* in more dystrophic waters (Matuszkiewicz 1981, Šumberová 2011, Felzines 2012). The ten above-mentioned localities from the Vistula (seven localities) and Odra river valleys (three localities), greatly increase knowledge about the distribution of *R. natans* in Poland, and confirm the opinion of Szweykowski (1968) that the species is particularly bound to large river valleys. In contrast with environmental conditions typical for *R. natans* (small, often humus-rich water bodies), the newly discovered populations of the species have developed in rather deep, mineral-rich (sometimes even brackish) waters, usually in oxbow lakes, and predominantly in the *Salvinia natans*-dominated *Lemno minoris-Salvinietum natantis* association. The occurrence of the species in both dystrophic and extremely mineral-rich waters (e.g. Felzines 2012) either confirms that *R. natans* has an extremely large ecological amplitude, or suggests that there could be two separate ecotypes of the species in question.

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