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New localities of the rare liverwort *Aneura maxima* (Schiffn.) Steph. (Metzgeriales, Marchantiophyta) in Poland (Pieniński National Park, Western Carpathians)

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Abstract — Some new localities of the rare liverwort *Aneura maxima* (Schiffn.) Steph. were found in the Pieniński National Park (Western Carpathians). A detailed list of localities and phytosociological relevés of the stands are presented.

***Aneura maxima* / Central Europe / Marchantiophyta / species range / Western Carpathians**

While working on the liverwort flora of the Pieniny Mts and the Pieniny National Park (Poland, Western Carpathians), some new localities of the rare simple thalloid liverwort *Aneura maxima* (Schiffn.) Steph. were found. Most localities of the species were confined to bog-springs and spring areas (Fig. 1).

Aneura maxima was initially known from Asia and eastern North America. In Europe it was recorded for the first time by Andriessen *et al*. (1995) in Belgium. Subsequently, Sotiaux detected the species in Poland in the Trójmiejski Landscape Park (Gdańsk, northern Poland), and floristic data were published by Schumacker & Vaña (2000). Later, the locality was described by Vanderpoorten *et al*. (2006). Other localities in Poland were published by Buczkowska & Bączkiewicz (2006). To date, *Aneura maxima* has been reported from five localities in Poland, mainly in northern (4 localities) and one in southern Poland, in the Tatra Mts (Western Carpathians). A map of the species geographical distribution was published by Vanderpoorten *et al*. (2006). Nine new localities of *Aneura maxima* in the Pieniny Mts could prove its relatively frequent occurrence in this region.

Aneura maxima is a species characteristic of wet plant communities with several specific bryophyte species. In the Trójmiejski Landscape Park this liverwort species was found in the alderwood forest in accompany of bryophytes [liverwort nomenclature according to Klama (2006), moss nomenclature according to Hill *et al.* (2006)], such as *Lophocolea bidentata* (L.) Dumort., *Rhizomnium punctatum* (Hedw.) T.J. Kop., *Thuidium tamariscinum* (Hedw.) Schimp., and *Trichocolea tomentella* (Ehrh.) Dumort. (Vanderpoorten *et al*., 2006).

The localities in northern Poland (Buczkowska & Bączkiewicz, 2006) are mainly located in the alderwood *Carici elongatae-Alnetum* and marshy spruce

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Fig. 1. Population structure of *A. maxima* (Schiffn.) Steph. from Czerniawa, *Caltha laeta-Cherophyllum hirsutum* com. Photo G. Vončina

forest *Sphagno girgensohnii-Piceetum*, where *Aneura maxima* occurs together with bryophytes such as *Conocephalum conicum* (L.) Dumort., *Pellia epiphylla* (L.) Corda, *P. epiphylla* subsp. *borealis* (Lorb.) Messe, and *Trichocolea tomentella*.

New localities from the Czech Republic and Slovakia were not characterized phytosociologically, only the accompanying bryophyte species were listed (Loskotová, 2006). Most frequenctly, *Aneura maxima* occurred together with *Brachythecium rivulare* Schimp., *Conocephalum conicum*, *Chiloscyphus pallescens* (Ehrh. *ex* Hoffm.) Dumort., *Mnium hornum* Hedw., *Pellia epiphylla, P. neesiana* (Gottsche) Limpr., *Plagiochila asplenioides* (L.) Dumort., *Rhizomnium punctatum* (Hedw.) T.J. Kop., *Rhytidiadelphus squarossus* (Hedw.) Warnst., *Sphagnum capillifolium* (Ehrh.) Hedw., *S. girgensohnii* Russow, *Thuidium tamariscinum*, and *Trichocolea tomentella* (Loskotová, 2006). Vanderpoorten *et al*. (2006) found that the occurrence of *Aneura maxima* was highly correlated with *Chiloscyphus polyanthos* (L.) Corda, *Microlejeunea ulicina* (Taylor) A. Evans, *Pellia neesiana, Plagiochila aspleniodes, P. porelloides* (Torrey *ex* Nees) Lindenb., *Scapania nemorea* (L.) Grolle, *S. scandica* (Arnell & H. Buch) Macvicar, *Amphidium mougeotii* (Schimp.) Schimp., *Dichodontium palustre* (Dicks.) M. Stech, *Fissidens dubius* P. Beauv., and *Hedwigia stellata* Hedenäs.

In the Pieniński National Park the localities of *Aneura maxima* were confined to three types of plant communities: meadow bog-spring *Valeriano-Caricetum flavae,* forest bog-spring *Caltha laeta-Cherophyllum hirsutum* and alderwood forest *Caltho-Alnetum* (Matuszkiewicz, 2001), and accompanied by the

bryophytes *Brachythecium rivulare* (very often), *Bryum pseudotriquetrum* (Hedw.) P. Gaertn. *et al.* var. *pseudotriquetrum, Calliergonella cuspidata* (Hedw.) Loeske, *Climacium dendroides* (Hedw.) F. Weber & D. Mohr, *Conocephalum conicum, C. salebrosum* Szweykowski, Buczkowska & Odrzykoski, *Cratoneuron filicinum* (Hedw.) Spruce, *Fissidens adiantoides* Hedw., *Scorpidium cossoni* (Schimp.) Hedenäs, *Lophocolea bidentata*., *Lophozia obtusa* (Lindb.) A. Evans, *Palustriella commutata* (Hedw.) Ochyra, *P. decipiens* (De Not.) Ochyra, *Plagiochila aspleniodes, Plagiomnium elatum* (Bruch & Schimp.) T.J. Kop., *P. undulatum* (Hedw.) T.J. Kop., and *Rhytidiadelphus squarrosus* (Table 1).

Table 1. Overview of phytosociological relevés of the stands with *Aneura maxima* (Schiffn.) Steph.

GPS position	N 49°25'57.8" E 20°24'46.1"	N 49°24'58.7" E 20°23'43.4"	N 49°25'05.8" E 20°23'49.3"	N 49°24'58.7" E 20°23'38.5"	N 49°25'03.9" E 20°24'26.5"	N 49°25'07.3" E 20°23'28.4"	N 49°25'44.4" E 20°24'51.5"	N 49°25'37.0" E 20°24'03.7"	*Frequence*
Table number of relevé	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Field number of relevé	25	27	29	31	28	30	32	26	
Year	2009	2009	2009	2009	2009	2009	2009	2009	
Month	07	08	08	08	08	08	08	07	
Day	29	01	02	02	02	02	02	29	
Altitude a.s.l.(m)	510	790	780	750	760	780	600	610	
Exposition	E	NW	N	W	SW	NE	NW	N	
Slope (°)	10	5	2	5	5	10	10	5	
The maximum height of plants [cm]	70	130	140	150	120	160	120	130	
The average height of plants [cm]	40	50	60	50	60	60	30	60	
Herb layer cover C %	90	100	100	100	100	100	95	100	
Moss layer cover D %	70	50	50	70	70	30	100	80	
Number of species in relevé	21	20	21	25	27	38	23	21	
Number of moss species in relevé	7	6	4	4	5	6	9	6	
Area [m2]	5	5	5	5	5	5	5	5	
Reaction pH	8,4	7,5	7,3	8,2	7,8	8,2	8,3	–	
Phytosociological affinity	***Caltha laeta-Chaerophyllum hirsutum* com.**				***Valeriano-Caricetum flavae***			***C-A***	
DAll. Adenostylion alliariae									
Chaerophyllum hirsutum	3	2	2	2	–	2	–	1	6
ChAss. Valeriano-Caricetum flavae									
Valeriana simplicifolia	1	1	–	1	–	1	2	1	6

Table 1. Overview of phytosociological relevés of the stands with *Aneura maxima* (Schiffn.) Steph. *(suite)*

Phytosociological affinity	***Caltha laeta-Chaerophyllum hirsutum* com.**				***Valeriano-Caricetum flavae***			***C-A***	
ChO. Caricetalia davallianae									
Carex davalliana	–	–	–	–	–	–	2	–	1
Limprichtia cossoni D	–	–	–	–	–	–	+	–	1
Pinguicula vulgaris	–	–	–	–	–	–	+	–	1
ChO. Caricetalia nigrae									
Carex nigra	–	–	–	–	–	–	1	–	1
ChCl. Scheuchzerio-Caricetea nigrae									
Juncus articulatus	–	–	–	–	1	–	+	–	2
ChAll. Cratoneurion commutati									
Cratoneuron filicinum D	3	2	–	–	–	–	–	–	2
Palustriella commutata D	–	–	–	–	–	–	5	1	2
ChCl. Montio-Cardaminetea									
Palustriella decipens D	+	–	–	–	1	+	–	–	3
Bryum pseudotriquetrum D	–	–	–	–	2	–	1	–	2
Cardamine amara	–	–	–	1	–	–	–	–	1
ChAll. Calthion									
Crepis paludosa	1	1	1	+	–	1	+	+	7
Caltha palustris	2	2	2	1	2	–	–	1	6
Cirsium rivulare	–	–	1	1	–	1	+	–	4
Myosotis palustris	1	–	+	–	–	1	–	–	3
Cirsium oleraceum	–	–	–	–	–	–	–	4	1
Scirpus sylvaticus	–	–	–	–	–	2	–	–	1
ChO. Molinietalia									
Equisetum palustre	+	3	3	+	1	–	–	+	6
Climacium dendroides D	–	–	–	–	–	1	–	–	1
ChAll. Agropyro-Rumicion crispi									
Carex hirta	+	+	+	1	–	–	–	–	4
Mentha longifolia	–	–	–	4	1	+	–	1	4
Juncus inflexus	–	–	+	–	3	–	–	+	3
Lysimachia nummularia	+	–	–	1	–	–	–	–	2
Potentilla reptans	–	–	–	–	+	–	–	–	1
Elymus repens	–	–	–	1	–	–	–	–	1
ChCl. Molinio-Arrhenatheretea									
Lathyrus pratensis	–	+	2	1	–	2	–	–	4
Poa trivialis	–	+	+	+	–	–	–	–	3
Vicia cracca	–	–	+	–	+	+	–	–	3
Cardamine pratensis	–	+	+	–	–	–	–	–	2
Rumex acetosa	–	–	–	–	+	+	–	–	2
Festuca rubra	–	–	–	–	–	1	–	–	1
Leontodon hispidus subsp. hastilis	–	–	–	–	+	–	–	–	1
Poa pratensis	–	–	–	–	–	+	–	–	1

Table 1. Overview of phytosociological relevés of the stands with *Aneura maxima* (Schiffn.) Steph. *(suite)*

Phytosociological affinity	***Caltha laeta-Chaerophyllum hirsutum* com.**				***Valeriano-Caricetum flavae***			***C-A***	
ChAll. Alno-Ulmion									
Plagiomnium undulatum D	1	+	1	2	–	–	–	1	5
Chrysosplenium alternifolium	–	1	–	+	–	–	–	+	3
Festuca gigantea	+	–	–	–	–	–	–	–	1
Stellaria nemorum	–	–	–	–	–	–	–	+	1
ChO. Fagetalia									
Primula elatior	1	–	+	1	–	1	–	–	4
Impatiens noli-tangere	–	+	–	1	–	–	–	+	3
Carex sylvatica	+	–	–	–	–	–	–	+	2
Asarum europaeum	–	–	–	–	–	+	–	–	1
Lysimachia nemorum	–	–	–	–	–	+	–	–	1
Associate species									
Geum rivale	–	2	+	+	2	2	–	+	6
Acer pseudoplatanus C	–	–	–	–	+	+	+	–	3
Carex flacca	–	–	–	–	3	1	2	–	3
Eupatorium cannabinum	+	–	–	–	1	–	+	–	3
Potentilla erecta	–	–	–	–	1	1	+	–	3
Alchemilla sp.	–	+	–	–	–	+	–	–	2
Calamagrostis varia	–	–	–	–	–	+	3	–	2
Carex panicea	–	–	–	–	1	1	–	–	2
Cruciata glabra	–	–	–	–	+	1	–	–	2
Dactylorhiza majalis	–	–	–	–	+	+	–	–	2
Equisetum arvense	–	–	–	1	–	–	+	–	2
Galeopsis speciosa	–	+	–	+	–	–	–	–	2
Veronica chamaedrys	–	–	+	–	–	+	–	–	2
Abies alba (S)	+	–	–	–	–	–	–	–	1
Ajuga reptans	–	–	–	–	+	–	–	–	1
Briza media	–	–	–	–	–	1	–	–	1
Carex paniculata	–	–	–	–	1	–	–	–	1
Dactylis glomerata	–	–	–	–	–	–	–	+	1
Epilobium hirsutum	–	–	–	–	+	–	–	–	1
Equisetum fluviatile	–	–	–	–	–	1	–	–	1
Equisetum sylvaticum	–	–	1	–	–	–	–	–	1
Galium mollugo	–	–	–	–	+	–	–	–	1
Gladiolus imbricatus	–	–	–	–	–	+	–	–	1
Gymnadenia conopsea	–	–	–	–	+	–	–	–	1
Impatiens parviflora	+	–	–	–	–	–	–	–	1
Knautia arvensis	–	–	–	–	–	+	–	–	1
Luzula campestris	–	–	–	–	–	+	–	–	1
Pimpinella major	–	–	–	–	–	+	–	–	1
Rubus hirtus	–	–	–	–	–	–	–	1	1
Rubus idaeus	–	–	–	+	–	–	–	–	1
Stellaria graminea	–	–	+	–	–	–	–	–	1
Trifolium medium	–	–	–	–	–	+	–	–	1
Tussilago farfara	–	–	–	–	–	–	+	–	1
Urtica dioica	–	–	–	+	–	–	–	–	1

Table 1. Overview of phytosociological relevés of the stands with *Aneura maxima* (Schiffn.) Steph. *(suite)*

Phytosociological affinity	*Caltha laeta-Chaerophyllum hirsutum* com.				*Valeriano-Caricetum flavae*			*C-A*	
Moss									
Aneura maxima D	**1**	**1**	**+**	**+**	**+**	**+**	**1**	**+**	**8**
Plagiomnium elatum D	1	2	1	1	1	+	1	+	8
Brachythecium rivulare D	2	2	3	3	–	2	–	3	6
Lophocolea bidentata D	–	+	–	–	–	–	+	–	2
Calliergonella cuspidata D	–	–	–	–	3	–	–	–	1
Conocephalum conicum D	–	–	–	–	–	–	–	+	1
Conocephalum salebrosum D	–	–	–	–	–	–	+	–	1
Fissidens adianthoides D	–	–	–	–	–	–	+	–	1
Lophozia obtusa D	–	–	–	–	–	–	+	–	1
Plagiochila asplenioides D	+	–	–	–	–	–	–	–	1
Rhytidiadelphus squarrosus D	–	–	–	–	–	+	–	–	1

NEW LOCALITIES OF *ANEURA MAXIMA* IN POLAND

1. **Pieniny**, Krościenko near Dunajec, Doliny Wyżne, 600 m a.s.l., (N 49º25'44,4"; E 20º24'51,5"), *Valeriano-Caricetum flavae*, 3.11.2008, *leg. G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 32 done 02.08.2009).
2. **Pieniny**, Cyrla near Wysoki Dział, 610 m a.s.l. (N 49º25'37"; E 20º24'03,7"), *Caltho-Alnetum,* 10.04.2008. *leg. G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 26 done 29.07.2009).
3. **Pieniny**, Łonny Potok, 500 m a.s.l., (N 49º25'57,8"; E 20º24'46,1"), *Caltha laeta-Cherophyllum hirsutum* com., *leg. G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 25 done 29.07.2009).
4. **Pieniny**, Nowa Góra, Czerniawa, 790 m a.s.l., (N 49º25'58,7; E 20º23'43,4"), *Caltha laeta-Cherophyllum hirsutum* com., 1.05. 2009, *leg. M. Mierzeńska, G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 27 done 01.08.2009).
5. **Pieniny**, Nowa Góra, Czerniawa, 750 m a.s.l., (N 49º24'58,7"; E 20º23'49,3"), *Caltha laeta-Cherophyllum hirsutum* com., 1.05. 2009, *leg. M. Mierzeńska, G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 31 done 02.08.2009).
6. **Pieniny**, Nowa Góra, 760 m a.s.l., (N 49º25'08"; E 20º23'47"), *Valeriano-Caricetum flavae*, 1.05.2009, *leg. M. Mierzeska, G. Vončina*, det. M. Mierzeńska.
7. **Pieniny**, Przełęcz Szopka, 760 m a.s.l., (N 49º25'03,9"; E 20º24'26,5"), *Valeriano-Caricetum flavae*, 1.05.2009, *leg. M. Mierzeńska, G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 28 done 02.08.2009).
8. **Pieniny**, Nowa Góra, Wymiarki, 780 m a.s.l., (N 49º25'05,3"; E 20º23'49,3"), *Caltha laeta-Cherophyllum hirsutum* com., 1.05.2009, *leg. M. Mierzeńska, G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 29 done 02.06.2009).
9. **Pieniny**, Nowa Góra, Forendówka, 780 m a.s.l., (N 49º25'07,3"; E 20º23'28,4"), *Valeriano-Caricetum flavae* 1.05. 2009, *leg. M. Mierzeńska, G. Vončina*, det. M. Mierzeńska (phytosociological relevé no. 30 done 02.08.2009).

Specimens are deposited in the herbarium KRA-B.

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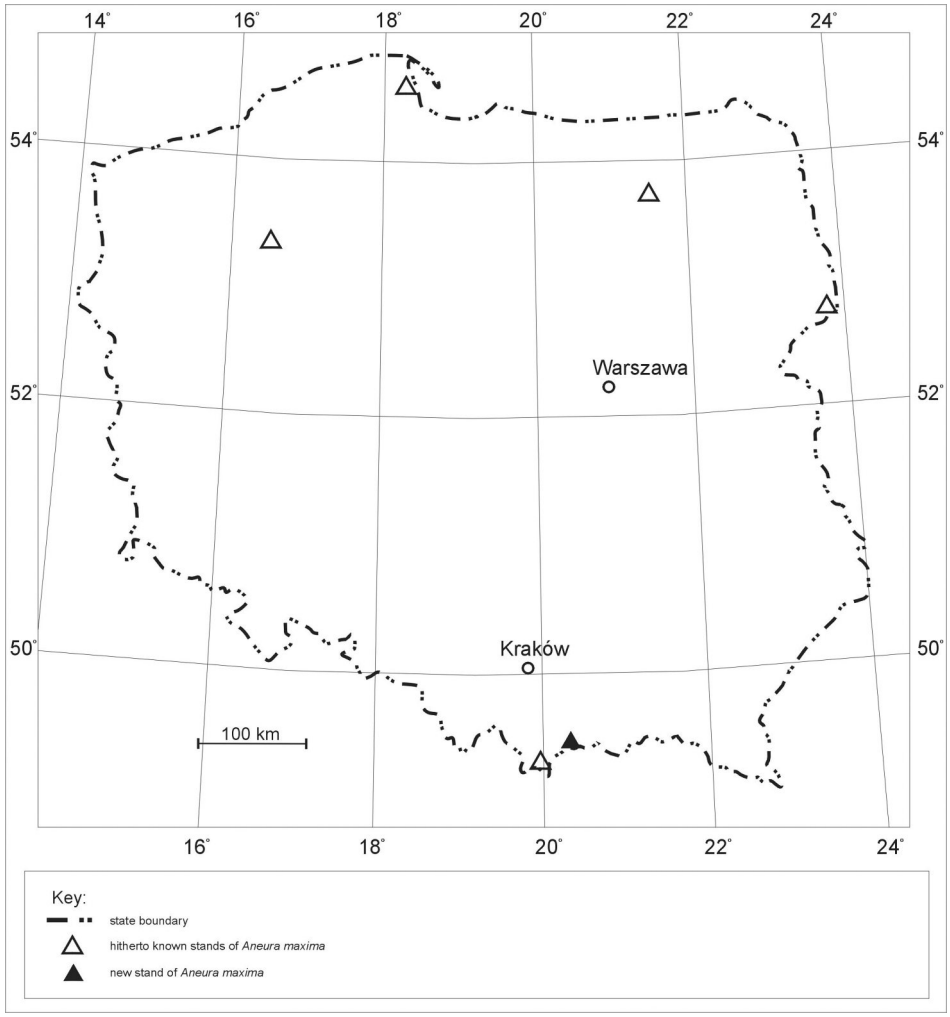

Fig. 2. Localities of *Aneura maxima* (Schiffn.) Steph. in Poland.

REFERENCES

ANDRIESSEN L., SOTIAUX A., NAGELS C. & SOTIAUX O., 1995 — *Aneura maxima* (Schiffn.) Steph. in Belgium, new for the European liverwort flora. *Journal of bryology* 18: 803–806.

BUCZKOWSKA K. & BĄCZKIEWICZ A., 2006 — *Aneura maxima* - a liverwort new to Poland. *Cryptogamie, Bryologie* 27: 453-458.

HILL M. O., BELL N., BRUGGEMAN-NANNENGA M. A., BRUGUES M., CANO M. J., ENROTH J., FLATBERG K. I., FRAHM J. P., GALLEGO M. T., GARILLETI R., GUERRA J., HEDENÄS L., HOLYOAK D. T., IGNATOV M. S., LARA F., MAZIMPAKA V., MUNOZ J., SODERSTROM L., 2006 — An annotated checklist of the mosses of Europe and Macaronesia. *Journal of bryology* 28: 198-267.

KLAMA H., 2006 — Systematic Catalogue of polish Liverwort and Hornwort Taxa. In: J. Szweykowski. *An annotated Checklist of Polish Liverworts and Hornworts*. Kraków, W. Szafer institute of botany, Polish academy of science, pp. 83-100.

LOSKOTOVÁ E., 2006 — Interesting records of *Aneura maxima* (Schiffn.) Steph. (Metzgeriales) in Czech Republic and Slovakia. *Silva Gabreta* 12: 15-18.

MATUSZKIEWICZ W., 2001 — *Przewodnik do oznaczania zbiorowisk rolinnych Polski*. Warszawa, PWN, seria *Vademecum Geobotanicum*, 538 p.

SCHUMACKER R. & VÁŇA J., 2000 — Identification keys to the liverworts and hornworts of Europe and Macaronesia (Distribution & Status). *Documents de la station scientifique des Hautes-Fagnes* 31: 1-160.

VANDERPOORTEN A., SOTIAUX A. & ENGELS P., 2006 — A GIS-based model of the distribution of the rare liverworts *Aneura maxima* at the landscape scale for an improved assessment of its conservation status. *Biodiversity and conservation* 15: 829-838.