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NOTES ON THE SYNTAXONOMY OF THE *ASPLENIETEA TRICHOMANIS* CLASS IN POLAND

KRZYSZTOF ŚWIERKOSZ

Abstract: The paper presents a revised syntaxonomy of rocky and wall plant communities occurring and likely to be found in Poland. Currently, eleven associations and three communities are known from the whole area of the country, and four further associations probably occur. A revised division of the class *Asplenietea trichomanis* (Br.-Bl. *in* Meier & Br.-Bl. 1934) Oberd. 1977 into three orders with six alliances is also given.

Key words: rocky plant communities, wall vegetation, vegetation survey

Krzysztof Świerkosz, Museum of Natural History, Wrocław University, H. Sienkiewicza 21, 50-335 Wrocław, Poland; e–mail: krissw@biol.uni.wroc.pl

INTRODUCTION

The syntaxonomy of rocky and wall plant communities in Poland is generally based on Matuszkiewicz's (1981, 2001) guides, which follow Oberdorfer's (1957) classification of the class '*Asplenietea rupestria*.' The last ten years have brought many new proposals for classification of this class or its lower units in Central Europe, both regionally (Mucina 1993; Pott 1995; Valachovič 1995; Duchoslav 2002) and across European (Brullo & Guarino 1998). In Poland, some new or previously unreported communities and associations have also been recognized, especially in the lowest mountain ranges (Granoszewski 1987; Anioł-Kwiatkowska & Świerkosz 1992; Świerkosz 1992, 1993, 1995). A broad selection of phytosociological material (460 relévés) has also been collected by the author from south-western Poland. This paper summarizes both the extant literature and unpublished data, and puts forward a proposal for classification of rocky and wall plant communities corresponding with new European trends.

METHODS

Plant names follow Mirek *et al.* (2002), except for *Asplenium* species and hybrids (Reichstein 1981). The bryophyte names follow Ochyra and Szmajda (1992). Characteristic (Ch.) and differentiating (D.) species of syntaxonomical units are given for Poland. Species extinct in rocky communities and (with an asterisk) subspecies and hybrids probably occurring in Poland are given in parentheses. A preliminary diagnostic table (Table 1) is also provided.

The nomenclature of plant communities of the order *Tortulo-Cymbalarietalia* follows Brullo and Guarino's (1998) revision, and for the rest of the units follows Mucina (1993) and Valachovič (1995). Names of syntaxonomical units and cited synonyms follow the *Code of Phytosociological Nomenclature* (Barkman *et al*. 1995). The complete list of names of associations and communities used in the last century for the whole of Europe is very long, and requires revision on the pan-European scale; therefore, only the most important synonyms (for Poland, Germany and the Czech Republic) are cited in this paper. For the same reason, a full list of references is not given here; only the most significant papers are included.

SURVEY OF ROCKY AND WALL COMMUNITIES OCCURRING IN POLAND

Class ***Asplenietea trichomanis*** (Br.-Bl. *in* Meier & Br.-Bl. 1934) Oberd. 1977

Order ***Androsacetalia vandellii*** Br.-Bl. *in* Meier & Br.-Bl. 1934 *corr*. Br.-Bl. 1948

Alliance ***Asplenion serpentini*** Br.-Bl. & R. Tx. 1943 *ex* Eggler 1955

1. Association ***Asplenietum serpentini*** Gauckler 1954

Alliance ***Asplenion septentrionalis*** Oberd. 1938

2. Association ***Woodsio-Asplenietum septentrionalis*** R. Tx. 1937

3. Community ***Potentilla neumanniana-Asplenium trichomanes***

Alliance ***Hypno-Polypodion vulgaris*** Mucina 1993

4. Association ***Bartramio-Cystopteridetum*** Stöcker 1962

5. Association ***Hypno-Polypodietum*** Jurko & Peciar 1963

6. Association ***Asplenio-Polypodietum*** Firbas 1924

7. Community ***Pseudotaxiphyllum elegans-Trichomanes speciosum***

Order ***Potentilletalia caulescentis*** Br.-Bl. *in* Br.-Bl. & Jenny 1926

Alliance ***Potentillion caulescentis*** Br.-Bl. *in* Br.-Bl. & Jenny 1926 *emend.* Sutter 1969

8. Association ***Drabo tomentosae-Artemisietum petrosae*** Br.-Bl. *ex* Šmarda 1971

Alliance ***Cystopteridion*** Richard 1972

9. Association ***Cystopteridetum fragilis*** Oberd. 1938

10. Association ***Asplenio-Phyllidetum scolopendrii*** Redžić *et al.* 2002

11. Community ***Saxifraga paniculata-Campanula polymorpha***

Order ***Tortulo-Cymbalarietalia*** Segal 1969

Alliance ***Cymbalario-Asplenion*** Segal 1969 *emend.* Mucina 1993

12. Association ***Tortulo-Cystopteridetum*** (Segal 1969) Świerkosz 1993

13. Association ***Asplenietum rutae-murariae-trichomanis*** Kuhn 1937

14. Association ***Cymbalarietum muralis*** Görs 1966 *ex* Oberd. 1967

Classification and description

Class ***Asplenietea trichomanis*** (Br.-Bl. *in* Meier & Br.-Bl. 1934) Oberd. 1977

Syn: *Asplenietea rupestria* Br.-Bl. *in* Meier & Br.-Bl. 1934 (Art 34)

Ch.: *Asplenium ceterach*, *A. ruta-muraria, A. trichomanes* subsp. *quadrivalens, Cystopteris fragilis, Saxifraga sponhemica, Polypodium vulgare, Rhodiola rosea, Epilobium collinum*

D.: *Sedum maximum, Campanula rotundifolia, Epilobium montanum, Dryopteris filix-mas, Hypnum cupressiforme*

Pioneer, chasmophytic vegetation of rocky and wall habitats growing at mountain and lowland stands. A characteristic feature is the occurrence of many fern species, especially of the genera *Asplenium*, *Cystopteris* and *Polypodium*.

Order ***Androsacetalia vandellii*** Br.-Bl. *in* Meier & Br.-Bl. 1934 *corr*. Br.-Bl. 1948

Syn: *Androsacetalia multiflorae* Br.-Bl. *in* Meier & Br.-Bl. 1934 (Art. 30), *Hypno-Polypodietalia* Jurko & Peciar 1963 (Art. 8)

Ch.: *Asplenium septentrionale, A. trichomanes* subsp. *trichomanes, A.* ×*alternifolium*, *A.* ×*heufleri* (in the past in Poland also *A. adiantum-nigrum*, but now it grows only in the *Asplenietum serpentini* association)

D.: *Calamagrostis arundinacea, Deschampsia flexuosa, Silene nutans*.

Fern-dominated associations of non-calcareous rock habitats in natural stands and old quarries. Synanthropic stands (stone walls or brickwork) are extremely rare, both in Poland (not recorded yet) and Europe (e.g., Segal 1969; Brandes 1992a, b). The order comprises three alliances.

Alliance ***Asplenion serpentini*** Br.-Bl. & R. Tx. 1943 *ex* Eggler 1955

Ch.: *Asplenium adulterinum, A. cuneifolium,* (**A.* ×*centovalense, **A.* ×*praetermissum*)

D.: *Asplenium adiantum-nigrum*, *Centaurea stoebe*, *Dianthus carthusianorum*, *Galium verum*, *Phleum phleoides* and other species from the class *Festuco-Brometea*

Highly specialized communities of serpentine rocks occurring only in southwestern Poland.

All stands recorded in Central Europe (Hilbig & Reichhoff 1977; Oberdorfer 1977a; Müller-Stoll & Toman 1984; Berdowski & Panek 1999; Świerkosz, unpubl.) belong to one association *Asplenietum serpentini* Gauckler 1954.

1. Association ***Asplenietum serpentini*** Gauckler 1954

The characteristic and differentiating species of the alliance are also characteristic of this as-

Table 1. Preliminary diagnostic table of rocky and wall communities occurring and probably occurring in Poland (survey).

No. of association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No. of reléves	27	11	47	9	11	13	32	3	19	16	6	22	33	11	135	52	62
	Androsacetalia vandellii							*Potentilletalia caulescentis*							*Tortulo-Cymbalarietalia*		
Ch. et. D.* Ass. et comm.																	
Asplenium cuneifolium	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asplenium adulterinum	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
*Asplenium adiantum-nigrum**	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium schmidtii	.	III	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asplenium septentrionale (Ch. Or.)	r	III	V	.	III	.	.	.	.	.	.	.	.	.	.	.	.
*Rumex tenuifolius**	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
*Polytrichum piliferum**	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
*Potentilla neumanniana**	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium arvense (loc.)*	r	.	.	II	.	.	.	.	.	.	.	.	.	.	r	r	.
Bartramia ithyphylla	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Rhabdoweisia fugax	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Cynodontium polycarpum	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.
Asplenium scolopendrium	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
Asplenium viride (Ch. All.)	r	.	.	.	.	.	.	.	III	V	I	II	r	.	.	.	.
*Campanula polymorpha**	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.
Bellidiastrum michelii	.	.	.	.	.	.	.	.	.	.	.	IV	r	.	.	.	.
Leontopodium alpinum	.	.	.	.	.	.	.	.	.	.	.	I	III	r	.	.	.
Artemisia eriantha	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.
Draba tomentosa	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.
*Saxifraga caesia**	.	.	.	.	.	.	.	.	.	.	.	r	r	III	.	.	.
*Festuca versicolor**	.	.	.	.	.	.	.	.	.	.	.	r	r	V	.	.	.
Gymnocarpium robertianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Cymbalaria muralis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.
*Sonchus arvensis**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.
*Bromus tectorum**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.
*Ballota nigra**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.
D. All. *Asplenion serpentini* (Cl. *Festuco-Brometea*)																	
Phleum phleoides	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium verum	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus carthusianorum	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Centaure stoebe	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
D. All. *Hypno-Polypodion*																	
Pohlia nutans	.	.	.	.	I	I	II	.	.	.	.	.	.	.	r	.	.
Dryopteris carthusiana	.	.	.	.	I	I	II	.	.	.	.	.	.	.	.	.	.
Dicranum scoparium	r	.	.	.	.	I	II	.	.	.	.	.	.	.	.	.	.
Luzula luzuloides	.	.	.	.	.	.	I	.	.	.	r	.	.	.	.	.	.
Polytrichastrum formosum	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Ch. et D.* Or. *Androsacetalia vandellii*																	
*Calamagrostis arundinacea**	I	IV	II	.	I	I	I	.	r	.	III	.	.	.	r	.	r
*Deschampsia flexuosa**	I	II	II	.	.	I	I	.	.	.	.	.	.	.	.	.	.
*Silene nutans**	II	I	II	I	I	.	.	.	r	.	.	.	.	.	r	.	.
Asplenium ×heufleri	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 1. *Continued.*

No. of association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ch. et D.* All. *Cystopteridion*																	
Ctenidium molluscum	.	.	.	.	r	.	.	.	II	III	.	III	.	.	.	.	.
Neckera crispa	.	.	.	.	.	.	.	.	.	III	I	II	.	.	.	.	.
*Plagiophila asplenioides**	.	.	.	.	.	.	.	3	I	I	.	III	.	.	.	.	.
*Conocephalum conicum**								3	r	r	.	II	.	.	r	.	.
Neckera complanata	.	.	.	.	.	.	.	3	III	.	.	.	.	.	.	.	.
*Mnium stellare**	.	.	.	.	.	.	.	3	III	.	.	.	.	.	r	.	.
Valeriana tripteris	.	.	.	.	.	.	.	.	.	.	IV	I	.	.	.	.	.
*Polystichum aculeatum**	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.
Ch. et D.* All. *Potentillion caulescentis*																	
Campanula cochlearifolia	.	.	.	.	.	.	.	.	.	.	.	V	V	V	.	.	.
*Trisetum alpestre**	.	.	.	.	.	.	.	.	.	.	.	IV	IV	V	.	.	.
*Carex firma**	.	.	.	.	.	.	.	.	.	.	.	III	II	V	.	.	.
Crepis jacquinii	.	.	.	.	.	.	.	.	.	.	.	V	IV	IV	.	.	.
Androsace lactea	.	.	.	.	.	.	.	.	.	.	.	I	r	IV	.	.	.
Kernera saxatilis	.	.	.	.	.	.	.	.	.	.	.	II	II	.	.	.	.
*Gentiana clusii**	.	.	.	.	.	.	.	.	.	.	.	II	II	.	.	.	.
Ch. et D.* Or. *Potentilletalia caulescentis*																	
*Tortella tortuosa**	.	.	.	.	.	.	.	.	I	III	I	V	V	V	.	.	.
Fissidens dubius	.	.	.	.	.	.	.	r	II	III	.	III	I	I	.	.	.
Cardaminopsis arenosa s.l.*	.	.	.	.	.	.	.	.	.	V	.	II	II	r	.	.	.
*Viola biflora**	.	.	.	.	.	.	.	.	r	.	.	II	r	I	.	.	.
Saxifraga paniculata	.	.	.	.	.	.	.	.	.	.	V	II	III	.	.	.	.
Draba aizoides	.	.	.	.	.	.	.	.	.	.	.	r	r	III	.	.	.
Primula auricula	.	.	.	.	.	.	.	.	.	.	.	II	IV	III	.	.	.
Galium anisophyllon	.	.	.	.	.	.	.	.	.	.	.	II	III	II	.	.	.
Ditrichum flexicaule	.	.	.	.	.	.	.	.	.	.	.	II	III	V	.	.	.
Sesleria varia	.	.	.	.	.	.	.	.	.	.	.	V	III	I	.	.	.
D. All. *Cymbalario-Asplenion*																	
Achillea millefolium	r	.	.	r	.	.	.	.	.	.	.	.	.	.	I	II	r
Artemisia vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	III	I
Solidago canadensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	I	I
Chelidonium maius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	r	I
Festuca rubra s.l.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	r
Poa pratensis s.s.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	r
Taxus baccata juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	I
Poa annua	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	r	.
Ch. Or. *Tortulo-Cymbalarietalia*																	
Poa compressa	.	.	r	.	.	.	.	.	r	.	.	.	.	.	I	III	III
Tortula muralis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	III	II
*Encalypta streptocarpa**	.	.	.	.	.	.	.	.	.	III	.	.	.	.	II	r	II
*Sagina procumbens**	r	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	r
*Bryum argenteum**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	r
Bryum caespiticium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	r	.

Table 1. *Continued.*

No. of association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Dom. Ass. (Ch. et D.* Cl. *Asplenietea trichomanis*)																	
Cystopteris fragilis	.	.	.	.	V	.	II	1	IV	IV	r	II	I	.	V	r	.
Asplenium trichomanes	r	I	I	V	II	IV	II	2	III	V	.	I	r	.	II	r	I
Polypodium vulgare	r	I	III	.	I	V	V	1	.	III	r	I	.	.	r	.	r
*Hypnum cupressiforme**	II	.	r	.	IV	.	V	.	I	.	r	II	II	.	II	r	II
Asplenium ruta-muraria	I	III	.	.	.	II	.	.	.	.	.	II	III	.	II	III	V
Ch. et. D.* Cl. *Asplenietea trichomanis*																	
Saxifraga sponhemica	.	.	.	.	.	.	.	.	.	III	.				.	.	.
Epilobium collinum	.	.	.	.	.	.	.	.	I	.	.				.	r	r
*Sedum maximum**	r	IV	II	III	II	II	I	.	.	.	.	.	.	.	I	r	II
*Campanula rotundifolia**	II	IV	II	III	II	.	I	.	.	.	.	.	.	.	I	.	III
*Dryopteris filix-mas**	.	.	r	.	III	I	II	.	.	II	.	.	.	.	II	I	I
*Epilobium montanum**	.	.	.	.	II	.	r	.	I	II	.	r	.	.	II	r	I

Explanation:
1 – Ass. *Asplenietum serpentini* Gauckler 1954 (unpubl.)
2 – Ass. *Woodsio–Asplenietum septentrionalis* R. Tx. 1937 var. *Galium pumilum* (unpubl.)
3 – Ass. *Woodsio–Asplenietum septentrionalis* R. Tx. 1937 var. *typicum* (unpubl.)
4 – Comm. *Potentilla neumanniana–Asplenium trichomanes* (unpubl.)
5 – Ass. *Bartramio–Cystopteridetum* Stöcker 1962 (Anioł-Kwiatkowska & Świerkosz 1992 & unpubl.)
6 – Ass. *Asplenio–Polypodietum* Firbas 1924 (unpubl.)
7 – Ass. *Hypno–Polypodietum* Jurko & Peciar 1963 (Anioł-Kwiatkowska & Świerkosz 1992; Kwiatkowski 1994; Berdowski & Panek 1999, unpubl.)
8 – Ass. *Asplenio–Phyllidetum scolopendrii* Redžić *et al.* 2002 (Fabiszewski *et. al.* 1997)
9 – Ass. *Cystopteridetum fragilis* Oberd. 1938 (unpubl., Śnieżnik Massif)
10 – Ass. *Cystopteridetum fragilis* Oberd. 1938 (Pender & Macicka-Pawlik 1996, Stołowe Mts)
11 – Comm. *Saxifraga paniculata–Campanula polymorpha* (Granoszewski 1987)
12 – Ass. *Bellidiastro michelii–Campanuletum cochlearifoliae* Valachovič & Mucina 1995 (Valachovič 1995)
13 – Ass. *Leontopodio alpini–Campanuletum cochlearifoliae* Unar *in* Unar, Unarova & Šmarda 1985 (Valachovič 1995)
14 – Ass. *Drabo tomentosae–Artemisietum petrosae* Br.–Bl. *ex* Šmarda 1971 (Valachovič 1995)
15 – Ass. *Tortulo–Cystopteridetum* (Segal 1969) Świerkosz 1993 (Świerkosz 1993 & unpubl.)
16 – Ass. *Cymbalarietum muralis* Görs 1966 *ex* Oberd. 1967 (Świerkosz 1993; Szczęśniak & Świerkosz 2003)
17 – Ass. *Asplenietum rutae–murariae–trichomanis* Kuhn 1937 (Weretelnik 1982; Świerkosz 1993 & unpubl.)

sociation (Ch. All. = Ch. Ass.). It grows on both S- and N-facing slopes, at dry or shady localities, with varied abundance of characteristic and accompanying species. A detailed analysis of the distribution and differentiation of this community in Poland and neighboring countries will be prepared for print.

Alliance ***Asplenion septentrionalis*** Oberd. 1938

Syn: *Asplenion septentrionalis* Gams 1927 *p.p.* (Art. 3c)

This is the central unit of the order (Ch All. = Ch. Or.). The association occurs on siliceous rocky slopes on various kinds of volcanic or metamorphic substrates (granite, gneiss, greenstone, basalt, porphyry, melaphyre, andesite and others). Habitats are rather sunny and dry, but shaded habitats are also noted. It may also grow on stony walls (Abromeit 1898; Bróż & Przemyski 1984), sandstone (Świerkosz, unpubl.) and quartzite (Święs 1966; Bróż & Przemyski 1984). Only one good well-formed association has been recognized, and the next one probably does not occur in Poland.

2. Association ***Woodsio-Asplenietum septentrionalis*** R. Tx. 1937

Ch.: *Hieracium schmidtii, Asplenium septentrionale,* (*Woodsia ilvensis* – Ex *in* chasmophytic communities)

D.: *Rumex tenuifolius, Polytrichum piliferum*

In Poland, this association occurs at its northern border of distribution, so the localities recorded are not as rich in species as those in the Czech Republic or southern Germany. It has been described from many sites in the Sudety Mts (Anioł-Kwiatkowska & Świerkosz 1992; Świerkosz 1994; Szczęśniak 1998b), sometimes as '*Asplenietum trichomano-rutae-murariae*' (Kwiatkowski 1995). A detailed analysis of the distribution and differentiation of this community is being prepared for print.

Association *Asplenietum septentrionali-adiantinigri* Oberd. 1938, mentioned by Matuszkiewicz (1981, 2001), probably does not occur in Poland, because all the existing localities of *Asplenium adiantum-nigrum* (Ch. Ass.) are strictly connected with serpentine rocks, where it often grows together with serpentine ferns (Świerkosz 1995; Żołnierz 2001; Świerkosz & Szczęśniak 2003). All the localities on non-serpentine rocks have been extinct for about a century, so it is impossible to draw conclusions about their species composition in the past.

3. Community ***Potentilla neumanniana-Asplenium trichomanes***

D.: *Potentilla neumanniana*, *Cerastium arvense* (loc.)

A community with high abundance of *Potentilla neumanniana* has been observed only at some localities on basalt rocks in the Pogórze Sudeckie foothills (Świerkosz, unpubl.; Szczęśniak, pers. comm.), and it needs further investigation. Its typical feature is a lack of characteristic or differentiating species of *Woodsio-Asplenietum septentrionalis*, but this community has its own unique species composition.

Alliance ***Hypno-Polypodion vulgaris*** Mucina 1993

Ch.: *Bartramia ithyphylla, B. pomimorfis, Hypnum cupressiforme* (dom.), *Polypodium vulgare* (dom.)

D.: *Dryopteris carthusiana, Dicranum scoparium, Luzula luzuloides*, *Polytrichastrum formosum, Pohlia nutans, Vaccinium myrtillus*

The alliance groups associations inhabiting siliceous rocks occurring in shaded parts of slopes, with domination of mosses (especially *Hypnum cupressiforme*) and *Polypodium vulgare*.

4. Association ***Bartramio-Cystopteridetum*** Stöcker 1962

Ch.: *Bartramia ithyphylla, Rhabdoweisia fugax*

D.: *Cystopteris fragilis* (dom.)

A typical feature is low abundance of *Polypodium vulgare* and high frequency of *Cystopteris fragilis*. The association is known from only three localities, all in Central Europe. It occurs in the Thale valley near Altenbrak in Germany (Hilbig & Reichhoff 1977), Pojizěří in the Czech Republic (Kolbek & Petriček 1985), and Ostrzyca Proboszczowicka hill in the Pogórze Kaczawskie foothills (Anioł-Kwiatkowska & Świerkosz 1992).

5. Association ***Hypno-Polypodietum*** Jurko & Peciar 1963

Ch.: *Cynodontium polycarpum, Hypnum cupressiforme* (dom.), *Polypodium vulgare* (opt.)

The central and most common unit of the alliance, known from more than 15 localities in southwestern Poland (Anioł-Kwiatkowska & Świerkosz 1992; Świerkosz 1994, 1995; Kwiatkowski 1994; Szczęśniak 1998a, b; Berdowski & Panek 1999) and from neighboring countries (e.g., Jurko & Peciar 1963; Sýkora 1981; Mucina 1993; Valachovič 1995). It has been reported on various kinds of volcanic and metamorphic rocks, even serpentine and highly crystallized marbles. The most important habitat conditions are shaded sites, forest microclimate, acid soils and the presence of litter in crevices.

6. Association ***Asplenio-Polypodietum*** Firbas 1924

D.: *Asplenium trichomanes* (dom.), *Polypodium vulgare* (dom.)

An association intermediate between the alliances *Asplenion septentrionalis* and *Hypno-*

Polypodion, occurring in places more insolated and drier than the previous one. It is known from five localities in the Sudety foothills (Świerkosz, unpubl.), and from the Czech Republic (Sýkora 1981). It has no characteristic species, but the species composition is very stable. *Hypnum cupressiforme* and *Cystopteris fragilis* are lacking, and often *Asplenium ruta-muraria* is present.

7. Community ***Pseudotaxiphyllum elegans-Trichomanes speciosum***

Ch.: *Trichomanes speciosum*

D.: *Pseudotaxiphyllum elegans*, *Schistostega pennata*

This very rare community occurs in very shaded and deep (sometimes up to 1.5 m) crevices in sandstone rocks in the Pogórze Kaczawskie and Pogórze Izerskie foothills (Krukowski & Świerkosz, in press). In such conditions the inconspicuous gametophytes of *Trichomanes speciosum* are accompanied only by some moss species such as *Pseudotaxiphyllum elegans, Schistostega pennata* or *Distichum inclinatum*, so patches of the community are extremely poor in species. The same species composition has been recorded at other localities of *Trichomanes speciosum* in Central Europe (Vogel *et al.* 1993).

Order ***Potentilletalia caulescentis*** Br.-Bl. in. Br.-Bl. & Jenny 1926

Syn. *Ctenidio-Polypodietalia* Jurko & Peciar 1963 (Art. 8)

Ch.: *Ditrichum flexicaule, D. aizoides, Fissidens dubius, Galium anisophyllon, Primula auricula, Saxifraga paniculata* (opt.), *Sesleria varia*, (**Asplenium trichomanes* subsp. *inexspectans*)

D.: *Cardaminopsis arenosa*, *Hieracium bupleuroides*, *Sesleria tatrae, Tortella tortuosa* (opt.), *Viola biflora*

These are mountain and upland chasmophytic rocky communities inhabiting limestone, only sporadically occurring on other kinds of rocks.

Alliance ***Potentillion caulescentis*** Br.-Bl. *in* Br.-Bl. & Jenny 1926 *emend*. Sutter 1969

Syn. *Asplenion rutae-murariae* Gams 1940 (Art. 8).

Ch.: *Androsace lactea, Campanula cochlearifolia, Crepis jacquini, Kernera saxatilis*

D.: *Carex firma, Gentiana clusii, Trisetum alpestre*

High-mountain limestone communities, in Poland occurring only in the Tatra Mts, with one described association (Braun-Blanquet 1930; Valachovič 1995).

8. Association ***Drabo tomentosae-Artemisietum petrosae*** Br.-Bl. *ex* Šmarda *et al*. 1971

Syn.: *Artemisia petrosa-Draba tomentosa* Br.-Bl. 1930 (Art. 3b)

Ch.: *Draba tomentosa, Artemisia eriantha*

D.: *Saxifraga caesia, Festuca versicolor*

Its occurrence has been observed at alt. 1800 m and higher, on S-facing slopes (Valachovič 1995).

Two other associations have been described from the Slovakian Tatra Mts, and their occurrence is also probable on the Polish side.

Association *Leontopodio alpini-Campanuletum cochlearifoliae* Unar *in* Unar, Unarova & Šmarda 1985

Ch.: *Leontopodium alpinum*

D.: *Anthyllis alpestris, Jovibarba hirta* subsp. *glabrescens, Scabiosa lucida, Thesium alpinum*

This association occurs at alt. 1500–1900 m, on S- and SW-facing slopes of dolomite and limestone rocks. It has been reported from the Nízke Tatra, Vysoké Tatra and Západné Tatra Mts, Veľká Fatra Mts and the Slovakian part of the Pieniny Mts (Valachovič 1995).

Association *Leontopodio alpini-Asteretum alpini* Šmarda *ex* Šmarda *et al*. 1971

Ch.: *Aster alpinus*, *Leontopodium alpinum* (dom.)

D.: *Carex sempervirens* subsp. *tatrorum*

This syntaxon is critical. It is known only from one locality in the Belianske Tatry Mts and needs further investigation. It may be merely a variant of the previous association (Valachovič 1995).

Alliance ***Cystopteridion*** Richard 1972

Ch.: *Asplenium viride, Ctenidium molluscum*, *Cystopteris alpina, C. fragilis* (opt.), *Moehringia muscosa, Neckera complanata, N. crispa, Valeriana tripteris*

D.: *Conocephalum conicum, Mnium stellare, Plagiophila asplenioides, Polystichum aculeatum*

This alliance groups chasmophytic vegetation of shaded sites, mainly on basic but sometimes also on greenstone and calcareous sandstones of uplands and the lowest part of mountains. It is most common in deep ravines and near streams.

9. Association ***Cystopteridetum fragilis*** Oberd. 1938

Syn.: *Asplenio viridis-Cystopteridetum* Oberd. (1936) 1949 (Art. 3c), *Ctenidio-Polypodietum* Jurko & Peciar 1963 (Art. 23)

Ch.: *Asplenium viride, Cystopteris fragilis* (opt.), *Moehringia muscosa*.

D.: *Cardaminopsis arenosa* subsp. *borbasii* (loc. in the Sudete Mts)

The most common associations of this alliance occur in the Carpathian and Sudete Mts, on their foothills, in the Wyżyna Kielecko-Sandomierska upland, and probably also in the Wyżyna Krakowsko-Częstochowska upland.

10. Association ***Asplenio-Phyllidetum scolopendrii*** Redžić *et al.* 2002

Syn.: *Cystopteris-Phyllitis*–Ass. Faber 1936 (Art. 7)

Ch.: *Asplenium scolopendrium*

This syntaxon has an unclear character, because in Poland it has been recorded (but as '*Asplenietum trichomano rutae-murariae*') only from Wąwóz Myśliborski canyon near Jawor in the Pogórze Kaczawskie foothills (Fabiszewski *et al.* 1997, tab. 2, rel. 1–3). The occurrence of characteristic and differentiating species of the alliance *Cystopteridion* justifies its classification here, although the substratum (metamorphic greenstone) indicates its affiliation with the alliance *Hypno-Polypodion*. However, this taxon should also occur on limestone rocks in the Pieniny and Beskidy Mts, and thus it requires collection of more phytosociological material in Poland for a detailed description to be made.

11. Community ***Saxifraga paniculata-Campanula polymorpha***

D.: *Campanula polymorpha, Saxifraga paniculata* (dom.)

The community has been described as 'fragments of communities of the *Asplenietea rupestria* class' from calcareous sandstone on Kudłoń Mt. in the Gorce Mts (Granoszewski 1987), at alt. 1105–1117 m. Its distribution, diagnostic features and affiliation with this alliance require further research, as both the type of substratum and abundance of *Hypno-Polypodion* differentiating species indicates its affiliation with the order *Androsacetalia vandellii*.

It is very probable that the next association of this alliance, very common in ravines of Slovakia (Valachovič 1995), can be found in the Polish Tatra Mts.

Association *Bellidiastro michelii-Campanuletum cochlearifoliae* Valachovič & Mucina 1995

Ch.: *Bellidiastrum michelii* (subdom.)

D.: *Ranunculus alpestris, Swertia perennis, Viola biflora*

Order ***Tortulo-Cymbalarietalia*** Segal 1969

Ch.: *Asplenium ruta-muraria* (opt.), *Bryum caespiticium, Cymbalaria muralis, Poa compressa, Sedum album, Tortula muralis*

D.: *Bryum argenteum, Encalypta streptocarpa* (?), *Sagina procumbens*

Synanthropic wall communities of secondary habitats, but sometimes occurring also in natural habitats (limestone rocks in southern Poland). In Central Europe this order is represented by a single alliance; a further two occur in the Mediterranean area (Brullo & Guarino 1998).

Alliance ***Cymbalario-Asplenion*** Segal 1969 *emend*. Mucina 1993

Ch. All. = Ch. O.

D.: *Achillea millefolium, Artemisia vulgaris, Solidago canadensis, Chelidonium majus, Festuca rubra* s.l., *Poa annua, P. pratensis, Taxus baccata* and others, transited from *Artemisietea vulgaris* and *Stellarietea mediae* classes.

12. Association ***Tortulo-Cystopteridetum*** (Segal 1969) Świerkosz 1993

NOMENCLATURAL TYPE: *Tortulo-Cystopteridetum*, Table 3 rel. 4 (in Świerkosz 1993), lectotypus ass. hoc loco

Syn. *Asplenietum rutae-murariae-trichomanis* var. with *Cystopteris fragilis* Segal 1969 (Art. 35); *Asplenio-Cystopteridetum fragilis* verarmte Tieflageform Oberd. 1977 (Art. 7a); *Cystopteris fragilis*–Gesellschaft Mucina 1993 (Art. 3c); *Asplenio rutae-murariae-Gymnocarpietum robertiani* Kolbek & Sádlo 1994 (Art. 23); *Asplenio trichomanis-Cystopteridetum fragilis* Brullo & Guarino 1998 (Art. 23); *Cystopteris fragilis*-[*Cymbalario-Asplenion*] comm. Duchoslav 2002 (Art. 3c)

Ch.: *Cystopteris fragilis* (dom.), *Gymnocarpium robertianum*

A very common association of shaded walls, occurring near streams, on ruins and old churches. At the driest localities it prefers N-facing walls. In Poland it has frequently been noted as a form or variant of '*Asplenietum trichomano-rutae-murariae*' (e.g., Weretelnik 1982). In Central Europe the association has been noted under different names, as a variant or subassociation (e.g., Segal 1969; Oberdorfer 1977; Mucina 1993) and as a separate association (e.g., Brullo & Guarino 1998; Boublík 2002).

13. Association ***Asplenietum rutae-murariae-trichomanis*** Kuhn 1937

Syn.: *Asplenietum trichomano-rutae-murariae* (Kuhn 1937) R. Tx. 1937 (Art. 33); *Asplenietum rutae-murariae* Schwickerath 1944 (Art. 22, 23); *Tortulo-Asplenietum* Oberd 1957 (Art. 3a)

Ch.: *Asplenium ruta-muraria* subsp. *ruta-muraria* (dom.), *Tortula muralis* (subdom.)

D.: *Asplenium trichomanes* subsp. *quadrivalens* (subdom.), *Syntrichia ruralis*

The core association of the alliance, occurring on various kinds of walls, but generally in more insolated and drier places, with regular humus accumulation. It is also found on natural limestone rocks of uplands in southern Poland (Kornaś 1950); since in the original diagnosis the association is clearly of ruderal character, the connection between these forms needs further investigation.

The association is very frequently recorded from Poland and neighboring territories, so the literature sources are not listed in this paper.

14. Association ***Cymbalarietum muralis*** Görs 1966 *ex*. Oberd 1967

Syn.: *Cymbalarietum muralis* Görs 1966 (Art. 3a); *Asplenietum trichomano rutae-murariae cymbalarietosum* Oberd. 1977 (Art. 2b); *Cymbalaria muralis*-[*Cymbalario-Asplenion*] comm. Duchoslav 2002 (Art. 3c).

Ch.: *Cymbalaria muralis*

D.: *Ballota nigra, Bromus sterilis, B. tectorum, Sonchus arvensis, S. oleraceus*

The characteristic species is *Cymbalaria muralis*, which has come from the Mediterranean. The association is almost always found on castles and on walls around palaces and churches, indicating that in Poland its origin is anthropogenic (Szczęśniak 1998b; Szczęśniak & Świerkosz 2003). Some localities of the association could be created by natural factors: sites are noted on basalt and greenstone in the vicinity of old buildings (Świerkosz 1993, unpubl.). The association is very common in the warmer areas of Central Europe (Oberdorfer 1977b; Brandes 1992a, b; Mucina 1993; Poldini & Vidali 1994; Valachovič 1995). Four subassociations has been described in Poland (Szczęśniak & Świerkosz 2003).

Also probable is the occurrence of the following association.

Association *Corydalidetum luteae* Kaiser 1926

Syn.: *Asplenio-Corydalidetum luteae* Segal 1969 (Art. 23); *Corydalis lutea*–Ges. Brandes 1992 (Art. 3c); *Corydalis lutea*-[*Cymbalario-Asplenion*] comm. Duchoslav 2002 (Art. 3c)

Ch.: *Corydalis lutea*

The characteristic species of the association is sometimes recorded from Poland, but no phytosociological relévés have been made.

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