Diantho gratianopolitani-Aurinietum saxatilis, a relict community of rock fissures in the Czech Republic

***Diantho gratianopolitani-Aurinietum saxatilis*, reliktní společenstvo skalních štěrbin v České republice**

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A new association *Diantho gratianopolitani-Aurinietum saxatilis* from the alliance *Asplenion septentrionalis* is described from nutrient-poor siliceous rocks of river valleys and solitary hills in the Czech Republic. The community is assayed as a relict fragment of vegetation surviving in extreme habitats from the early Holocene.

K e y w o r d s : Phytosociology, rock vegetation, relict, *Asplenietea trichomanis*, Czech Republic

Introduction

The *Asplenietea trichomanis* is a primitive vegetation of rock and wall fissures. The communities are dominated by chasmophytic petrophytes which mainly consist of small hemicryptophytic ferns and chamaephytic or hemicryptophytic dicotyledones.

In the Czech Republic, this vegetation differs strongly from that of neighbouring large mountain systems of the Alps and Carpathians. These mountain areas can be accounted as a distribution centre of this vegetation in Central Europe, as regards number of species, vegetation units, and localities. The *Asplenietea* belong to common vegetation units in these areas, being differentiated into a large number of communities. Many of them are natural, large-scale and rich in stenovalent petrophilous species (Oberdorfer 1992, Grabherr & Mucina 1993, Valachovič 1995).

In the Czech Republic, this vegetation is rather rare and poorly developed, though 12 associations have been reported so far (Moravec et al. 1995), and an occurrence of further 7 communities is presumed (Kolbek & Sádlo, in prep.). However, 16 of these communities are species-poor and have small number of diagnostic species (mostly one or two) which are often euryvalent (e.g. some species of *Asplenium*), or synantropic (neophytes such as *Cymbalaria muralis*). Many of these communities occur only in man-made habitats (walls, stone pits). Most communities of the *Asplenietea* occurring in the Czech Republic can be thus evaluated as only poor derivatives of this vegetation. However, the community under study which is natural and rich in species of *Asplenietea*, represents a considerable exclusion.

Methods

In the field research, the methods of the Braun-Blanquet approach were used (Braun-Blanquet 1964, Dierschke 1994). The vegetation was sampled using 7-grade Braun-Blanquet scale. Mosses and lichens were determined only in a part (about 50 %) of relevés and they were not included into the relevé table. The relevé data from SW Moravia were adopted from the paper Tichý & Chytrý (1996).

Plant names follow Neuhäuslová & Kolbek (1982). Subspecies names are indicated by an asterisk. Names of plant communities follow Moravec et al. (1995).

Diantho gratianopolitani-Aurinietum saxatilis ass. nova (Table 1)

Nomenclatural type: Table 1, relevé 8, holotypus. Species of moss layer of the type relevé: *Bartramia pomiformis* 1, *Cladonia* sp. r, *Dicranum scoparium* 2, *Grimmia* sp. +, *Hypnum cupressiforme* +, *Pleurozium schreberi* 2. Name-giving species: *Aurinia saxatilis* (L.) Desv., *Dianthus gratianopolitanus* Vill.

Diagnostic species combination: *Aurinia saxatilis, Dianthus gratianopolitanus, Hieracium pallidum, Aster alpinus, Biscutella laevigata, Allium *sibiricum, Asplenium septentrionale, Rumex acetosella* s. l., *Campanula rotundifolia* s. l., *Sedum maximum, Deschampsia flexuosa, Festuca ovina, F. pallens.*

Higher syntaxa: *Asplenion septentrionalis* Oberd. 1938, *Androsacetalia vandelii* Br.-Bl. in Meier et Br.-Bl. 1934 corr. Br.-Bl. 1948, *Asplenietea trichomanis* (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977.

Composition, structure and habitats

The association represents a primitive petrophytic community of fissures of nutrient-poor silicate rocks. Small ferns (*Asplenium septentrionale, Polypodium vulgare*) and xerophilous chamaephytes (*Aurinia saxatilis, Dianthus gratianopolitanus, Aster alpinus, Biscutella laevigata*) play a major role in the stands.

The herb layer has a low cover, mostly less than 25 %, but many stands are extended to more than 30 m^2 in some localities. The dominating petrophytes are accompanied by acidophytes, mesophilous species of woodlands and scrub, and, partly, by some species of the *Festuco-Brometea* and the *Sedo-Scleranthetea*. The species of synanthropic habitats such as walls are largely absent from the community.

Cover of the moss layer reaches up to 80 % though in many cases it does not exceed 10 %. Xerophilous mosses *Ceratodon purpureus* and *Polytrichum piliferum* occur regularly, and dominate at sunny sites. Some epilithic lichens such as *Umbilicaria hirsuta* are also common, and mosses *Bartramia pomiformis, Dicranum scoparium* and *Pleurozium schreberi* often occur in shady habitats.

The community was found in five territories of the Czech Republic which are characterized in Table 2, and it probably occurs also in valleys of some other rivers such as Mže, Sázava, Ohře and Oslava.

The habitats are open, dry, sunny or moderately shaded, of all aspects. Vertical or step-like cliffs and rock outcrops are the most typical habitats. Sloping rock plates, rock tops, shallow rockshalters or rock niches, and stabilized stony debris are less frequent. The soil type is acidic lithosol (proto-ranker). In some localities, the nutrient-poor bedrock is enriched by an admixture of carbonates, indicated by *Asplenium ruta-muraria*.

In thermophilous localities, the *Diantho-Aurinietum* contacts on the communities of open rocky grassland ("rock-steppes") such as the *Alysso saxatilis-Festucetum pallentis*

Table 1. – *Diantho gratianopolitani-Aurinietum saxatilis*. Subass. *polypodietosum vulgaris*: relevé 1-37, constancy C1. Subass. *festucetosum pallentis*: relevé 38-62, constancy C2). Total constancy of the community: C3.

Relevé number	1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 C1	8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 C2	C3
Diantho-Aurinietum:			
Aurinia saxatilis	1 + - - 1 . + 2 + 1 . . 2 . 2 . . + 2 + 2 2 . . 2 . 2 . . - - 2 2 2 2 2 2 70	- 2 2 + 2 2 + + 2 + 2 . 2 2 . . 2 . . 2 1 3 1 2 -	76	73
Dianthus gratianopolitanus	2 2 2 . 2 . 2 1 2 . . 2 . . + . . . 2 1 . . . . . 2 . . . . 2 35	+ - 1 - 1 + 1 2 2 2 1 + 2 + + 2 1 + . 1	76	52
Hieracium pallidum	- + + 1 . . + . + - - . . 1 + . + . 1 . . . 1 + - 1 . + ... 46	+ - + + . . + + + - + . . . 2	40	44
Aster alpinus	 0	+ 2 + 1 1 1 . . . . . + ...	28	11
Biscutella laevigata	. . . . . + ... 3	. . . . . + + . . . 1	12	6
*Allium *sibiricum*	. . . . . 1 3	. . . . .	0	2
D.-A. polypodietosum:				
Polypodium vulgare	2 2 1 2 2 + 2 2 . 2 1 2 2 + 2 2 - 2 . 2 + - + 2 . 2 1 . - 1 . . . . 2 . 73	. . . . .	0	44
Poa nemoralis	. . . . . + . 1 + 1 2 . + 1 . - 1 . + . + . 2 + + . . . - . + + + - - . + 57	. . . . .	0	34
Asplenium trichomanes	. 2 - - + 1 . + . 2 + - - - . 1 . 1 . . . 1 38	. . . . .	0	23
Cardaminopsis arenosa	- + 1 - 1 2 . . - . . . . . + . . . + . - . . . + . + ... 32	. . . . .	0	19
Dryopteris filix-mas	- . . + 1 - - . . . . + . 1 + . . 1 . . . . + + . + ... 32	. . . . .	0	19
*Viola *saxatilis*	. . . . . + ... - . 1 . . . . . 1 + ... 1 16	. . . . .	0	10
*Saxifraga *sponhemica*	. . . . . 1 . . . 2 . . . . . 1 8	. . . . .	0	5
Asplenion septentrionalis, Asplenietea trichomanis:				
Asplenium septentrionale	. . + - + 1 - - 1 + 2 1 + + . . . + . + + 2 1 . - + + + . 2 + - . . 2 . . 68	. - + + - . . . 2 2 1 1 + + . . + 1 . 2 2	52	61
Acetosella vulgaris	1 . . . + . + ... 1 . . . . . + 1 + . . + . 1 . + 1 + 1 . . - 1 2 43	. 1 1 1 1 1 1 + 2 1 . + + 1 + . 1 . + 1 . . + + 1	76	56
Campanula rotundifolia s. l.	- - - . . . - 1 . . + - + - 1 . . . . . 1 + . + . + + . + + + + + + + + 59	+ . . - . . 1 + 1 + . + + - . . . . + + . . . 1	48	55
Sedum maximum	+ 1 + . 1 . + . - . + - + + + . + . - + + - . . . + . . . - . . - . + 54	. + . - . - . . . + ... -	20	40
Vincetoxicum hirundinaria	. . . . . - . + 2 . . . . . + ... + . 2 . + 19	. 1 1 1 . 1 . . . . - . . . . . -	24	21
Asplenium ruta-muraria	. . . . . - . . + 1 . - 11	. . . . . - . . . . -	12	11
Cystopteris fragilis	. . . . . + . . - 1 . . . . . - 11	. . . . .	0	6
Hieracium murorum	. . + ... + ... + ... 8	. . . . . + . .	4	6
Chelidonium majus	. . . . . - . . . . - . . . . . + . . 8	. . . . .	0	5
Epilobium collinum	. . . . . - . . 1 . . . . . + ... + ... 11	. . . . .	0	6

Acidophilous species:					
Deschampsia flexuosa	1 . . - . . . . . . - . + . . + . + - . + . . . 1 + + + + 1 + . + . . 1 .	46	. . + . 2 + 1 . . - . . 1 - . . . . + ...	32	40
Festuca ovina	1 1 2 + - - - + + . . 2 . . 2 . + - . - - . . . + 1 . + . . . 2 . . . 2 .	54	. . . . 2 2	8	35
Hieracium umbellatum	. . . . . . + ... + ... + ... + . . 1 -	16	. . . . - . 1 . . + + + . + + ...	28	21
Calluna vulgaris	. . - + ... - . . . . + ... - .	14	. + . + . + + ...	16	15
Solidago virgaurea	+ . . + ... + . . + ... + ...	14	. . . .	0	8
Lembotropis nigricans	. . . . + ... + ... +	8	. . . . -	4	6
Thermophilous species:					
Festuca pallens	. . 1 . 1 . 2 . . . . 2 . . . . 1 . . . . . + . .	16	+ 1 1 2 1 + 2 2 . . 2 2 2 1 . 1 2 2 . + + 2 1 .	80	42
*Allium *montanum*	. . . . + ... + ... + ... + . . + ...	14	. 2 . + . + - . - - . + ... + ...	32	21
Sedum album	. - . . . . . - . . + . 1 . . . . 2 . . - - . . . . - . . . + ...	24	. . . . - . . . . -	8	18
Centaurea rhenana	. . . . + ... + ... + ...	8	. - . . . . . . + . + . -	16	11
Scleranthus perennis	. . . . -	3	. + 1 + ... - . . . . + ...	20	10
Euphorbia cyparissias	. . . . - . .	3	. + . + - - . . . . -	20	10
Sedum reflexum	. . - . . . - . . . + - . . . . + ...	14	. -	4	10
Potentilla arenaria	. . . . 1 . . . - . . . . -	8	. . . . . + ... + ...	8	8
Woodland and scrub species:					
Cotoneaster integerrimus	. . + + . . 1 . . . . + . . . 1 1 . . . . 1	19	. + . . + . + + ... + . . . + ...	24	21
Betula alba	- . . . . + ... - . . . . + . - . . . . - . .	16	+ . . . . - . . . . . + ...	12	15
Arrhenatherum elatius	. 1 . . . . . 1 . . - 1 . . . 1	14	. . . . + + ...	8	11
Calamagrostis arundinacea	. . . . + . - - 1	11	1 . . . + ... 2 2	16	13
Achillea stricta	. + ... + . + - . . . + ... -	16	. . . .	0	10
Rubus idaeus	. - . . . . - . . . . + + . + . . + ...	16	. . . . + ...	4	11
Frangula alnus	. . . . . . + ... + ... + ...	8	. . . . -	4	6
Geranium robertianum	. . . . + ... - . . - + ...	11	. . . .	0	6

Other species (with total constancy not reaching 5%):

Acinos arvensis 22: -; *Agrostis vinealis* 40: +, 42: +; *Alliaria petiolata* 8: +; *Anthericum liliago* 39: -, 43: +, 56: 1; *Anthoxanthum odoratum* 51: -, 56: +; *Artemisia campestris* 21: -; *Aruncus dioicus* 14: 1; *Asperula cynanchica* 31: +, 45: +, 46: +; *Campanula rapunculoides* 25: -, 29: -; *Carex humilis* 40: +; *C. supina* 40: -; *Centaurea triumphetii* 10: -; *Dryopteris dilatata* 27: 1, 33: 1; *Galeobdolon montanum* 16: +; *Galeopsis bifida* 15: -, 16: +; *G. ladanum* 46: -; *G. speciosa* 29: -; *Galium album* 18: +; *G. aparine* 15: - *G. glaucum* 10: -, 50: +, 54: +; *Genista germanica* 9: -; *G. pilosa* 61: +; *Geranium columbinum* 6: +; *G. sanguineum* 8: +, 12: +; *Fallopia convolvulus* 16: -; *F. dumetorum* 15: +; *Fragaria vesca* 23: +; *Hieracium pilosella* 62: 1; *H. sabaudum* 40: +; *Juniperus communis* 55: +; *Knautia arvensis* 28: +; *Lilium martagon* 26: -; *Melampyrum nemorosum* 16: 1; *M. pratense* 4: -; *Melica transsilvanica* 8: +, 15: +, 18: +; *Mycelis muralis* 10: -; *Myosotis stricta* 39: -; *Oxalis acetosella* 16: +; *Phegopteris connectilis* 24: +; *Poa bulbosa* 39: -; *P. compressa* 30: -; *Polygonatum odoratum* 7: -, 10: +, 39: +; *Potentilla neumanniana* 28: +; *Rosa canina* 40: 2; *R. pendulina* 23: +; *Rubus fruticosus* s.l. 12: +; *Sambucus racemosa* 52: -; *Sanguisorba minor* 39: -; *Senecio nemorensis* 15: -; *Seseli osseum* 50: +; *Silene nutans* 3: +; *Sorbus aucuparia* 42: -; *Stachys recta* 43: -; *Stellaria holostea* 37: +; *Steris viscaria* 42: +; *Thalictrum aquilegiifolium* 14: -; *Thymus pulegioides* 10: -, 11: +, 13: -; *Valeriana collina* 18: +; *Verbascum* cf. *densiflorum* 17: 1, 19: -, 22: -; *Veronica chamaedrys* 16: -; *V. dillenii* 22: -, 39: -;

(*Festuco-Brometea*) and *Polytricho piliferi-Scleranthetum perennis* (*Sedo-Scleranthetea*). In the other localities, the community is associated with acidophilous vegetation such as the *Antherico-Callunetum* and *Vaccinio-Calamagrostietum arundinaceae* (*Nardo-Callunetea)*, or woodland communities.

Historical interpretation of the community

The steep cliffs represent a remarkable relict habitat (Ložek 1973) that differs from the major part of Central-European landscape. Their environment is extreme and recall in many aspects that of the Glacial and early Holocene (e.g. stony grounds, scarcity of snow cover, harsh "continental" microclimate with large temperature range, summer dry periods and numerous regelation cycles). These conditions lasted without marked changes during all the Holocene and thus the localities were less accessible to plant invasions and many of them have been newer colonized by woodland (Ložek 1973). Therefore, these isolated rocky localities may be responsible for survival of many relict species during the Holocene.

A characteristic feature of the *Diantho-Aurinietum* is a common presence of taxa which are rare in the Czech Republic (Holub et al. 1979) because their distribution is strongly refugial and relict (Table 2). All of these plants have a narrow ecological range, a low competitive ability, and they are more or less heliophilous and quite unable to survive in the woodland. Some of them are of arcto-alpine (e. g. *Saxifraga rosacea* s.l.) or boreo-continental distribution (e. g. *Aster alpinus*) or they are Central-European endemics (e. g. *Campanula gentilis*).

Table 2. – Relict taxa of the *Diantho-Aurinietum* in different areas.
O – recent occurrences, * – extinct taxa which were reported in the last century and which probably grew in the community, ? – questionable data. Data on the extinct plants were taken from Grohmann & Prinz (1938), Procházka in prep., Sýkora (1972), Šimr (1954). Regions: 1. České středohoří Mts: solitary volcanic hills, altitudes 440-520 m, phonolite, 2. Lužické hory Mts and their foothills: solitary volcanic hills, 650-690 m, phonolite, 3. Central Bohemia, river and brook valleys, 190-290 m, slates, porphyrite, metabasites, lydite, 4. SW Bohemia, river valleys, 490–650 m, granite, paragneiss, 5. SW Moravia, river and brook valleys, 280–420 m, amphibolite, gneiss, granulite.

Region	1	2	3	4	5
Achillea stricta	O	.	.	.	.
*Allium * sibiricum*	.	O	.	.	.
Allium strictum	.	O	.	.	.
Aster alpinus	O	*	.	.	.
Aurinia saxatilis	O	.	O	O	O
Biscutella laevigata	*	.	O	.	.
Campanula gentilis	.	.	O	.	.
Campanula moravica	.	.	.	.	O
Cotoneaster integerrimus	O	.	O	.	O
Dianthus gratianopolitanus	O	.	O	.	.
Festuca pallens	O	.	O	.	O
Hackelia deflexa	*	*	.	*	.
Hieracium pallidum	O	O	O	O	O
Iris aphylla	*	.	.	.	.
Rosa alpina	.	.	.	O	.
Rumex acetosella (diploid type)	O	.	?	.	.
*Saxifraga *sponhemica*	*	.	O	.	?
Silene inflata (broad-leaved type)	.	.	O	O	.
*Viola *saxatilis*	*	.	O	.	O
Woodsia ilvensis	*	*	.	*	.

Taxonomical and phytogeographical remarks on some of the taxa given in Table 2: *Achillea stricta* is the name used for tall and broad-leaved plants from Vltava-valley, representing a local taxon from *A. millefolium* group. *Allium *sibiricum*, *A. strictum* and *Aster alpinus* are represented by a geographically isolated populations (Klíč, Bořeň and Ralsko Mts.). *Campanula gentilis* is an endemic taxon from *C. rotundifolia* group. *Rumex acetosella* s. l. comprises in most localities an abundant taxon *R. tenuifolius*, but a relict status is assumed in a rare diploid taxon of uncertain name, which occurs in some rocky localities (Kubát 1990). *Silene inflata* s. l. is represented in the community by a broad-leaved type which resembles subsp. *antelopum* and occurs in relict localities in some deep valleys and at isolated hills (e. g. Vltava and Jizera rivers, Moravian Karst, Ralská pahorkatina Hills). *Viola *saxatilis* which belongs to *V. tricolor* group, is probably a relict and endemic taxon of Central Europe (Kirschner & Skalický 1990).

An outstanding role of these localities can be also illustrated by occurrence of many other relict species and communities associated with the *Diantho-Aurinietum*. Species such as *Arctostaphyllos uva-ursi, Ribes alpinum, Pleurospermum austriacum, Rosa majalis*, and communities *Antherico-Callunetum* Stöcker apud Schubert 1960, *Vincetoxicetum officinalis* Kaiser 1926, *Festuco-Saxifragetum* Stöcker 1962, *Calamagrostio arundinaceae-Vaccinietum* Sýkora 1972, *Cynancho-Calamagrostietum arundinaceae* Sýkora 1972, *Impatienti-Dryopteridetum* Sýkora 1972, community of *Ribes alpinum, Hieracio pallidi-Pinetum* Stöcker 1965, and *Antherico-Coryletum* Kaiser 1926 can be given as examples (Sádlo & Kolbek 1994, Sádlo 1996).

For these reasons, it can be suggested, that the refugial taxa of the *Diantho-Aurinietum* (Table 2) are a part of the palaeochoric element (Roberts 1989) in the Central-European landscape, and also the community as a whole is of a relict nature. Species of an ancestral periglacial vegetation, from which the *Diantho-Aurinietum* arised, had the last chance to spread in the open landscape in the early Holocene. Subsequently the community became relict because the expansion of woodland caused the isolation of the habitats.

The community can be characterized as a relict fragment of vegetation surviving from the early Holocene but its recent composition is not completely palaeochoric. During later phases of the Holocene, the community still changed by extinction of some palaeochoric species and by invasion of apochoric species (such as pastural weeds and woodland species), often coming from less extreme surrounding habitats.

A historical and ecological analogy in basic substrata (limestones) in the Czech Republic is an open grassland community *Saxifrago aizoi-Seslerietum calcariae* (*Seslerio-Festucion pallentis, Festuco-Brometea*), which also inhabits extreme cliff habitats. This community differs from the *Diantho-Aurinietum* in its physiognomy but it is likewise relict, contains only small number of "modern" pastural weeds and its origin is dated into the last Glacial and early Holocene (Ložek 1973).

Comparison with other units

The *Diantho-Aurinietum* can be confused with some other communities of rocky habitats, e. g. some of its stands were former classified as *Diantho gratianopolitani-Festucetum* (Sádlo 1996) and *Alysso-Festucetum* (Tichý & Chytrý 1996). Böswartová (1984) gives one relevé similar to this community (but with some species of shrub layer) as the

community *Deschampsia flexuosa-Dianthus gratianopolitanus*. The vegetation closely related to the community studied, which occurs in similar habitats and shares some indicative species, can be divided into three groups:

(1) Communities dominated by petrophilous ferns *Asplenium septentrionale, A. trichomanes, Polypodium vulgare* and some others. These communities (such as the *Asplenietum septentrionalis, Woodsio-Asplenietum, Asplenio-Polypodietum* Firbas 1926) belong to the alliances *Asplenion septentrionalis* and *Hypno-Polypodion*. They resemble the *Diantho-Aurinietum* by an ample occurrence of ferns and by their habitat affinities, but differ from it markedly by the absence of the relict chasmophytic dicotyledones.

(2) Communities dominated by *Festuca pallens* and *Aurinia saxatilis*. This group of communities is rich in thermophilous species of the *Festuco-Brometea* and *Sedo-Scleranthetea*. It is classified as the *Alysso-Festucion pallentis* that comprises xerophilous and thermophilous vegetation on siliceous rocky slopes, mostly of southern aspect (Kolbek 1975, Oberdorfer 1992, Pott 1995).

The *Alysso saxatilis-Festucetum pallentis* is the vegetation unit of this alliance most resembling the community under study. This community is often species-rich and its extensive stands are widespread in the Czech Republic in areas of thermophilous vegetation (Moravec et al. 1995, Tichý & Chytrý 1996). It occurs in similar, nutrient-poor rocky habitats as the *Diantho-Aurinietum*. Both communities share species such as *Aurinia saxatilis, Festuca pallens* and *Allium *montanum*. In warm areas, the *Alysso-Festucetum* replaces the *Diantho-Aurinietum* that is restricted to more extreme habitats in higher altitudes without an evidence of a historical invasion of thermophilous flora, in localities with substrata very poor in nutrients and in the extensive vertical, hardly colonizable cliffs open to sunshine and exposed to weather extremes.

A comparison of both communities (Table 3) shows, that they differ in many species and cannot thus be identified. The lack of thermophilous species in the *Diantho-Aurinietum* makes it also hardly possible to include this community into the *Alysso-Festucion*.

(3) Communities dominated by *Festuca pallens* and *Dianthus gratianopolitanus* or *Aster alpinus*. These communities were recorded from Germany (Gauckler 1938, Oberdorfer 1992, Pott 1995, Stöcker 1962) and are also included into the *Alysso-Festucion* due to high constancy of thermophilous species such as *Erysimum crepidifolium* and *Galium glaucum*. They inhabit not only rock cliffs but mostly less extreme stony slopes. These correspond with their physiognomy of short open grasslands with higher herb cover (mostly 40–60%). In most stands, *Aurinia saxatilis* and species of the *Asplenietea* are absent. Three units of this vegetation were described:

The *Diantho-Festucetum* and *Astero-Festucetum* are communities of warm slopes, rich in species of the *Festuco-Brometea* and *Sedo-Scleranthetea*. The *Hieracio pallidi-Dianthetum gratianopolitani* is a smal-scale developed (4–6 m^2) and species-poor, open grassland community. Although only name-giving species, *Festuca pallens* and few acidophytes prevail in this community, it may be probably unified with the *Diantho-Festucetum*.

Table 3. – Comparison of the *Diantho-Aurinietum* and the *Alysso-Festucetum*. Frequency (%) and range of values in Braun-Blanquet scale (in parentheses) are shown.
Diantho-Aurinietum – column 1: subass. *polypodietosum*, relevés from thermophilous localities; 2: subass. *polypodietosum*, relevés from non-thermophilous localities; 3: subass. *festucetosum*, relevés from thermophilous localities; 4: subass. *festucetosum*, relevés from non-thermophilous localities.
Alysso-Festucetum – column 5: Kolbek (1975) – 15 relevés; 6: Tichý & Chytrý (1996) – 12 relevés; 7: Böswartová (1984) – 11 relevés; 8: Kubíková (1976) – 8 relevés; 9: Kubíková (1982) – 12 relevés; 10: Kolbek & Petříček (1985) – 4 relevés, and Jaroš (1980) – 3 relevés.

Column	1	2	3	4	5	6	7	8	9	10
Number of relevés	10	27	13	12	15	12	11	8	12	7
D-*Diantho-Aurinietum*:										
Dianthus gratianopolitanus	60(12)	26(+2)	85(–2)	67(+2)	.	.	.	.	.	.
Deschampsia flexuosa	50(–+)	44(–1)	38(–2)	25(–1)	.	.	.	.	33(+1)	.
Calamagrostis arundinacea	.	15(–1)	8(++)	25(12)	.	.	.	.	.	.
Biscutella laevigata	.	4(++)	8(++)	17(+1)	.	.	.	13(++)	.	.
Calluna vulgaris	10(––)	15(–+)	31(++)	.	.	.	9(––)	.	.	.
Arrhenatherum elatius	10(––)	15(11)	15(++)	.	.	.	.	.	.	.
Rubus idaeus	10(––)	19(–+)	8(++)	.	.	.	9(++)	.	.	.
Lembotropis nigricans	10(++)	7(++)	8(––)	.	.	.	.	.	.	14(++)
Festuca ovina	40(–2)	59(–2)	.	17(22)	.	25(+2)	.	.	.	.
Betula pendula	20(––)	15(–+)	.	25(–+)	.	.	.	.	.	.
Aster alpinus	.	.	46(+2)	8(++)	.	.	.	.	.	.
Polypodium vulgare	70(12)	74(–2)	.	.	.	25(+1)	.	.	.	14(++)
Poa nemoralis	50(–2)	59(–2)	.	.	.	.	.	.	.	.
Cardaminopsis arenosa	30(+1)	33(–2)	.	.	.	8(++)	.	.	.	14(11)
Dryopteris filix-mas	30(–1)	33(–1)	.	.	.	.	.	.	.	.
Achillea stricta	10(––)	19(–+)	.	.	.	.	.	.	.	.
D-*Alysso-Festucetum*:										
Artemisia campestris	.	.	.	.	60(–1)	50(++)	91(+2)	38(+1)	58(+1)	86(–1)
Euphorbia cyparissias	10(––)	.	38(–+)	.	93(–1)	42(+1)	73(–1)	75(–1)	42(+1)	57(–1)
Stachys recta	.	.	.	.	67(–1)	8(++)	36(+2)	38(+1)	50(+1)	14(++)
Centaurea rhenana	30(++)	.	31(–+)	.	60(–1)	58(++)	73(–1)	63(+1)	75(+2)	.
Dianthus carthusianorum	.	.	.	.	53(–+)	8(++)	64(–1)	25(–+)	25(+1)	.
Hieracium pilosella	.	.	.	.	7(++)	17(++)	55(+1)	25(–2)	33(+1)	.
Hypericum perforatum	.	.	.	.	33(––)	8(++)	27(–+)	13(––)	17(++)	.
Potentilla argentea	.	.	.	.	47(–1)	25(–+)	27(–+)	.	33(+1)	14(++)
Galium glaucum	.	4(––)	8(++)	8(++)	60(–1)	.	64(–1)	25(11)	17(+1)	57(+2)
Asperula cynanchica	10(++)	.	15(++)	.	7(++)	.	55(–+)	13(––)	25(+1)	29(–1)
Pseudolysimachion spicatum	.	.	.	.	20(++)	.	18(–+)	13(11)	25(11)	14(––)
Seseli osseum	.	.	.	.	.	50(–+)	82(+2)	38(++)	33(–2)	29(–+)
Echium vulgare	.	.	.	.	27(–+)	17(++)	45(–+)	.	8(++)	.
Sedum sexangulare	.	.	.	.	13(––)	8(++)	55(++)	.	8(11)	.
Centaurea scabiosa	.	.	.	.	7(––)	8(++)	.	25(–1)	33(++)	.
Anthericum liliago	.	.	23(–1)	.	13(++)	.	45(+1)	38(+2)	17(+1)	.
Hieracium echioides	.	.	.	.	20(–+)	.	9(++)	25(+1)	17(++)	.
Verbascum lychnitis	.	.	.	.	7(++)	.	18(++)	13(++)	8(++)	.
Hieracium cymosum	.	.	.	.	13(––)	.	.	13(––)	17(++)	14(––)
Carex humilis	.	.	.	.	7(11)	.	36(+2)	25(11)	.	.
Trifolium arvense	.	.	.	.	20(–+)	.	18(–+)	.	8(++)	.
Thymus pulegioides	10(++)	7(––)	.	.	13(++)	.	91(+1)	.	.	14(––)
Achillea collina	.	.	.	.	67(++)	.	.	13(++)	58(+1)	.
Koeleria macrantha	.	.	.	.	33(–2)	.	.	13(++)	17(+1)	.
Jovibarba sobolifera	.	.	.	.	.	.	9(++)	25(11)	8(++)	.

Pulsatilla pratensis	.	.	.	.	.	.	27(−+)	13(++)	.	14(−−)
Scabiosa ochroleuca	.	.	.	.	27(++)	.	45(−2)	.	.	.
	.									
Asplenietea (opt.):	.									
Asplenium septentrionale	90(−2)	59(−2)	69(−2)	33(+2)	33(++)	50(−+)	91(+1)	25(++)	58(+1)	29(+1)
Aurinia saxatilis	90(−2)	63(−2)	85(+2)	67(−3)	100(+2)	100(13)	100(++)	63(13)	83(+2)	100(+3)
Acetosella vulgaris	70(−1)	33(+2)	85(+2)	67(+1)	7(++)	58(−+)	45(−1)	50(++)	50(+1)	.
Hieracium pallidum	40(−1)	48(−1)	62(−+)	17(+2)	13(−+)	.	18(++)	63(++)	58(+1)	29(−+)
Sedum maximum	50(−1)	56(−1)	31(−+)	8(−−)	73(+1)	.	9(++)	38(++)	42(+2)	29(−+)
Campanula rotundifolia s. l.	40(−+)	67(−1)	54(−1)	42(−1)	.	25(++)	18(++)	50(−1)	17(++)	29(−+)
Vincetoxicum hirundinaria	20(−2)	19(+2)	46(−1)	.	.	8(++)	36(−+)	13(11)	25(+1)	.
Asplenium trichomanes	40(−+)	37(−2)	.	.	.	17(++)	9(++)	.	25(−+)	29(−1)
Asplenium ruta-muraria	20(−1)	7(−+)	23(−−)	.	.	8(++)	.	.	17(++)	14(++)
Viola * *saxatilis*	20(−1)	15(+1)	.	.	.	17(++)	.	.	33(−1)	.
Cystopteris fragilis	10(++)	11(−1)	.	.	.	8(−−)	.	.	.	.
	.									
Festuco-Brometea (opt.):	.									
Festuca pallens	50(+2)	4(11)	85(+2)	75(+2)	73(−2)	67(+3)	91(13)	100(13)	58(+3)	100(−2)
Allium * *montanum*	40(++)	4(++)	62(−2)	.	87(−2)	17(+1)	9(11)	50(+2)	83(+3)	71(+2)
Potentilla arenaria	20(−1)	4(−−)	8(++)	8(++)	33(−1)	.	55(−1)	75(+2)	42(+2)	43(++)
Sedum album	40(−1)	19(−2)	15(−−)	.	20(−+)	58(−1)	18(+2)	13(++)	33(+2)	86(+2)
Sedum reflexum	40(−+)	4(−−)	8(−−)	.	27(−1)	17(+1)	64(−1)	13(++)	17(++)	14(−−)
Hieracium umbellatum	50(−+)	4(11)	23(−1)	33(++)	13(+1)	25(+2)	82(−1)	.	17(++)	.
Cotonester integerrimus	50(+1)	7(++)	31(++)	17(++)	20(−1)	8(−−)	.	25(+1)	42(+3)	.
Polygonatum odoratum	10(−−)	4(++)	8(++)	.	7(−−)	.	9(−−)	.	8(++)	14(−−)

Variability of the community

The occurrence of diagnostic species of the association shows apparent differences between both individual localities and regions (Table 2) which are caused by the relict status of these species. At present, no locality includes all of these species, although in the past most of them occurred e.g. at Mt. Bořeň (cf. Grohmann & Prinz 1938, Sádlo 1996). The stands differ also in the abundance of the thermophilous species. But the difference between stands of shady and sunny habitats seems to be the most relevant for a syntaxonomical decision. Thus, two subunits are proposed:

***Diantho-Aurinietum polypodietosum vulgaris* subass. nova hoc loco** (Table 1, relevés 1–37)

Nomenclatural type is identical with the type of the association.
Name-giving species: *Polypodium vulgare* L.
Differential species: *Polypodium vulgare, Poa nemoralis, Viola saxatilis, Asplenium trichomanes, Dryopteris filix-mas, Cystopteris fragilis.*

The stands are often rich in ferns, have higher cover of both herb and moss layer and occur on half-shaded sites both in lower and higher altitudes.

***Diantho-Aurinietum festucetosum pallentis* subass. nova hoc loco** (Table 1, relevés 38–62)

Nomenclatural type: Table 1, relevé 38, holotypus. Species of moss layer in the relevé: *Ceratodon purpureus* +.
Name-giving species: *Festuca pallens* Host.

The subassociation has no differential species except the higher constancy of *Festuca pallens*. The stands are often rich in thermophilous species and occur at sunny and dry sites in lower altitudes, so that the subassociation represents a transitional type influenced by the *Alysso-Festucetum*.

Souhrn

Nově popisovaná asociace *Diantho gratianopolitani-Aurinietum saxatilis* představuje primitivní společenstvo s převahou obligátních petrofytů, osídlující štěrbiny minerálně chudých skal (břidlice, rula, znělec, granulit) v hlubokých údolích (střední Čechy, Předšumaví, Prebohemikum) a na izolovaných vulkanických kopcích (severní Čechy). Společenstvo je vázáno na extrémní biotopy primárního holocénního bezlesí a významnou roli v něm mají druhy reliktní (paleochorní a zároveň refugiální) jako *Aster alpinus*. To svědčí o reliktnosti celého společenstva. Jeho původ lze datovat nejpozději do starého holocénu, kdy měly diagnostické druhy společenstva poslední šanci k šíření v otevřené krajině. Dnešní skladba společenstva ovšem není reliktní kompletně – jde o fragment staroholocénní vegetace, pozdějším vývojem ochuzený o některé paleochorní druhy a naopak obohacený o četné druhy apochorní (tj. „moderní"). Společenstvo patří do svazu *Asplenion septentrionalis* (*Asplenietea trichomanis*) a zřetelně se liší od ekologicky i skladebně dosti podobných společenstev sv. *Alysso-Festucion pallentis*, které velká účast xerotermních druhů již řadí do třídy Festuco-Brometea.

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Appendix 1. – Localities of relevés presented in Table 1.

1, 2, 8, 12, 15, 53: Valley of the Vltava River, Štěchovice, rocks at northern end of the village, proterozoic slates, alt. 225 m, 10.9.1996; **4, 16, 22, 25, 29:** Valley of the Vltava River, Štěchovice, rocks between river dam and the camp Ztracenka, porphyrites and proterozoic slates, alt. 230–260 m, 20.9.1996; **10:** Valley of the Vltava River, Ždáň 1,2 km S of Slapy, rocks in river bow, metabasites, alt. 290 m, 20.3.1997.; **49, 50, 54:** Valley of the Vltava river: Vraný n.V., Zvolská homole rocks 1.5 km N of the village, proterozoic slates, alt. 230 m, 20.9.1985; **11:** Valley of the Vltava River: Měchenice, rocks in river bow about 1 km SW of Vraný, proterozoic slates, alt. 200 m, 15.4.1997; **28:** Valley of the Vltava River: Zbraslav, rocks at the southern end of the village, proterozoic slates, alt. 190 m, 10.9.1985; **32, 33, 34, 37:** Valley of the Vltava river: Český Krumlov, rocks at the southern end of the town, biotitic paragneiss, alt. 490–510 m, 5.7.1997; **36:** Valley of the Berounka River, Mokropsy, rocks at the right riverside against the village, ordovician shales, alt. 230 m, 15.4.1997; **3, 5, 7, 9, 19, 20, 26, 31, 35, 45, 46, 47, 48, 55, 57, 58:** Valley of the Kocába River, Štěchovice, rocks near the camp Luisiana, about 2 km SW of the village, proterozoic slates, alt. 240–350 m, 20.3.1997; **6:** Valley of the Kocába River, Malé Lečice, cca 2,3 km N of the village, proterozoic slates, alt. 260 m, 20.3.1997; **13, 18, 21, 27, 30:** Valley of the Šárecký potok brook, Praha, rocks in the Džbán Defile, lydite, alt. 270–290 m, 1.4.1997; **14, 23, 24:** Valley of the Vydra river, Čeňkova Pila, Dračí skály rocks approximately 1.5 km N of the village, leucocratic granite, alt. 650 m, 3.7.1997; **38, 39, 40, 41, 42, 43, 44, 51, 52, 56:** České Středohoří Mts: Mt. Bořeň near Bílina, phonolite, alt. 440–520 m, 10.6.1994; **17:** Lužické hory Mts.: Mt. Klíč near Svor, phonolite, 650m, 14.4.1997; **59:** Valley of the Dyje river: Podhradí n. D., rocks 0.5 km N of the village, amphibolite, alt. 380 m, 12.6.1993 (Tichý & Chytrý 1996, rel. 2.); **61:** Valley of the Dyje river: Čížov, rocks 1.5 km W of the village, gneiss, alt. 420 m, 7.8.1992 (Tichý & Chytrý 1996, rel. 6); **60, 62:** Valley of the Jihlava river: Lhánice, rocks 1–1.6 km S-SE of the village, granulite, alt. 280m, 2.6.1993 and 29.4.1992 (Tichý & Chytrý 1996, rel. 10,15).

Appendix 2. – Header data of the relevés in Table 1.

Relevé No.	Area (m^2)	Aspect	Slope (°)	Cover (%)	
				E_1	E_2
1	15	NE	75	20	5
2	12	NE	60	20	5
3	20	NE	65	35	50
4	10	NW	85	15	5
5	8	NE	75	40	30
6	7	E	75	20	80
7	17	NE	60	45	20
8	30	N	65	40	15
9	9	S	75	25	5
10	20	SE	75	40	20
11	8	E	65	30	15

Relevé No.	Area (m^2)	Aspect	Slope (°)	Cover (%)	
				E_1	E_2
12	15	NE	65	25	75
13	10	S	75	20	5
14	15	W	80	15	25
15	15	N	75	25	10
16	8	N	80	25	25
17	5	S	75	10	5
18	12	SW	90	20	20
19	10	S	70	30	30
20	10	NE	75	40	45
21	10	W	80	15	5
22	9	E	45	20	25
23	10	S	90	20	5
24	5	NW	90	15	25
25	20	N	80	15	10
26	20	N	75	25	40
27	8	S	80	20	10
28	5	N	85	10	5
29	5	W	85	10	15
30	10	W	60	20	35
31	8	SW	45	25	20
32	10	S	70	20	10
33	30	S	80	10	0
34	20	SW	90	15	< 1
35	10	SW	90	15	1
36	10	N	75	25	20
37	10	S	70	20	5
38	9	S	80	12	< 1
39	40	S	30	30	5
40	40	SE	35	26	5
41	60	SE	30	20	< 1
42	15	W	30	20	1
43	15	SE	35	20	5
44	25	W	30	15	0
45	8	S	45	20	30
46	10	S	45	25	25
47	10	S	70	20	30
48	10	S	85	20	5
49	9	W	85	7	0
50	7	SW	70	20	5
51	30	N	45	20	3
52	30	N	80	15	1
53	6	NW	75	20	1
54	5	SW	75	15	0
55	12	SW	80	20	1
56	30	S	20	15	10
57	10	S	45	15	30
58	15	E	80	15	1
59	25	S	90	3	2
60	16	S	80	50	0
61	25	SES	80	10	0
62	6	SES	50	50	50