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Plant communities on walls in North Korea: a preliminary report

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ABSTRACT: During several botanic expeditions to North Korea (Democratic People's Republic of Korea), new plant communities of wall habitats were distinguished and described. Four types of vegetation, such as the *Commelino communis – Sedetum sarmentosi,* and the communities of *Camptosorus sibiricus – Pilea peploides, Oxalis stricta – Microlepia pilosella,* and *Saxifraga fortunaei – Boehmeria spicata* were described.

KEYWORDS: *Commelino communis – Sedetum sarmentosi*, North Korea, phytosociology, walls

Introduction

Walls are a habitat widespread on all continents (perhaps except for Antarctica). The oldest walls are several thousand years old. They represent a specific type of habitat of anthropogenic origin, to a great extend resembling natural rock faces and cliffs. They appear as vertical surfaces covered by only a shallow layer of fine-grained soil. The walls are open to colonization mainly by R-strategy plants, belonging especially to the group of anemochore plants. These taxa are characterized by low fidelity, and form plant assemblages of low organizational status. Walls house species of different ecological demands, ranging from pronouncedly oligotrophic to nutrient-demanding, from xerophilous to mesophilous, and from heliophilous to sciophilous species. The influence of aspect (insolation) as well as chemical composition of the substrate (incl. the quality of the stone material and of the binding substances) are of ecological relevance. Only some cosmopolitic lichens and bryophytes may show a higher habitat fidelity. Where the

walls are found adjacent to rock cliffs, petrophytic species typical of rock crevices (ferns in particular) are often encroaching upon wall habitats.

The vegetation of walls has been studied in greater detail only in Europe and northern Africa, especially in the Mediterranean, where walls represent a very frequent landscape element and their vegetation is very rich. We are not aware of any published data from East Asia up to the present. Even in Japan, where a detailed analysis of vegetation is available (MIYAWAKI 1980-1989), this vegetation type hardly been mentioned.

The paper presents an unique material from the northern part of the Korean Peninsula. It can only with difficulty be compared with other types of the Korean and/or East Asiatic vegetation, including types as the ruderal communities or the communities of rock habitats.

Material and methods

Phytosociological relevés were made in 1986, 1989 and 1990 in different regions of the northern part of the Korean Peninsula (in the surroundings of Kaesong and Haeju, as well as in the Suyangsan Mts., Chonmasan Mts., and Kumgangsan Mts.) at altitudes from 10 to 500 m (Fig. 1). Relevés were collected from June to October in optimally developed stands using the Zürich-Montpellier approach (BRAUN-BLANQUET 1964).

The nomenclature of plants mainly follows RI & HWANG (1984) except for *Gymnocarpium jessoense* (KOIDZ.) KOIDZ., *Isodon excisus* KUDO, *Saxifraga fortunaei* HOOK., *Spiraea japonica* L. f., *Plagiomnium tezukae* (SAK.) T. KOP., *Climacium japonicum* LINDL., *Gollania ruginosa* (MITT.) BROTH., *Entodon rubicundus* (MITT.) JAEG. & SAUERB., *Grimmia apocarpa* HEDW., and *Lejeunea japonica* MITT. The nomenclature of the bryophytes and lichens is according to NEUHÄUSLOVA & KOLBEK (1982).

Results

Plant communities

Commelino communis – Sedetum sarmentosi ass. nova hoc loco

Nomenclatural type: Tab. 1, relevé 7 (holotypus)
Characteristic species combination: *Artemisia asiatica* (const.), *Commelina communis* (diff.), *Humulus japonica* (const.), *Parthenocissus tricuspidata* (diff., dom.), *Sedum sarmentosum* (char., dom.), *Taraxacum officinalis* (const.)

The *Commelino communis–Sedetum sarmentosi* is an open community on low walls in settlements and on walls bordering river banks in the Kumgangsan Mts. The dominant *Sedum sarmentosum* and *Parthenocissus tricuspidata* controll primarily the conspicuous physiognomy. During the flowering period *Commelina communis* also becomes significant. All three species are creeping herbs able to colonize free stone faces outside the crevices. The walls are usually shaded, either permanently or at least for part of a day. The average number of species in the herb layer is less than 11. This community was sampled at altitudes 100-180 m and at various aspects.

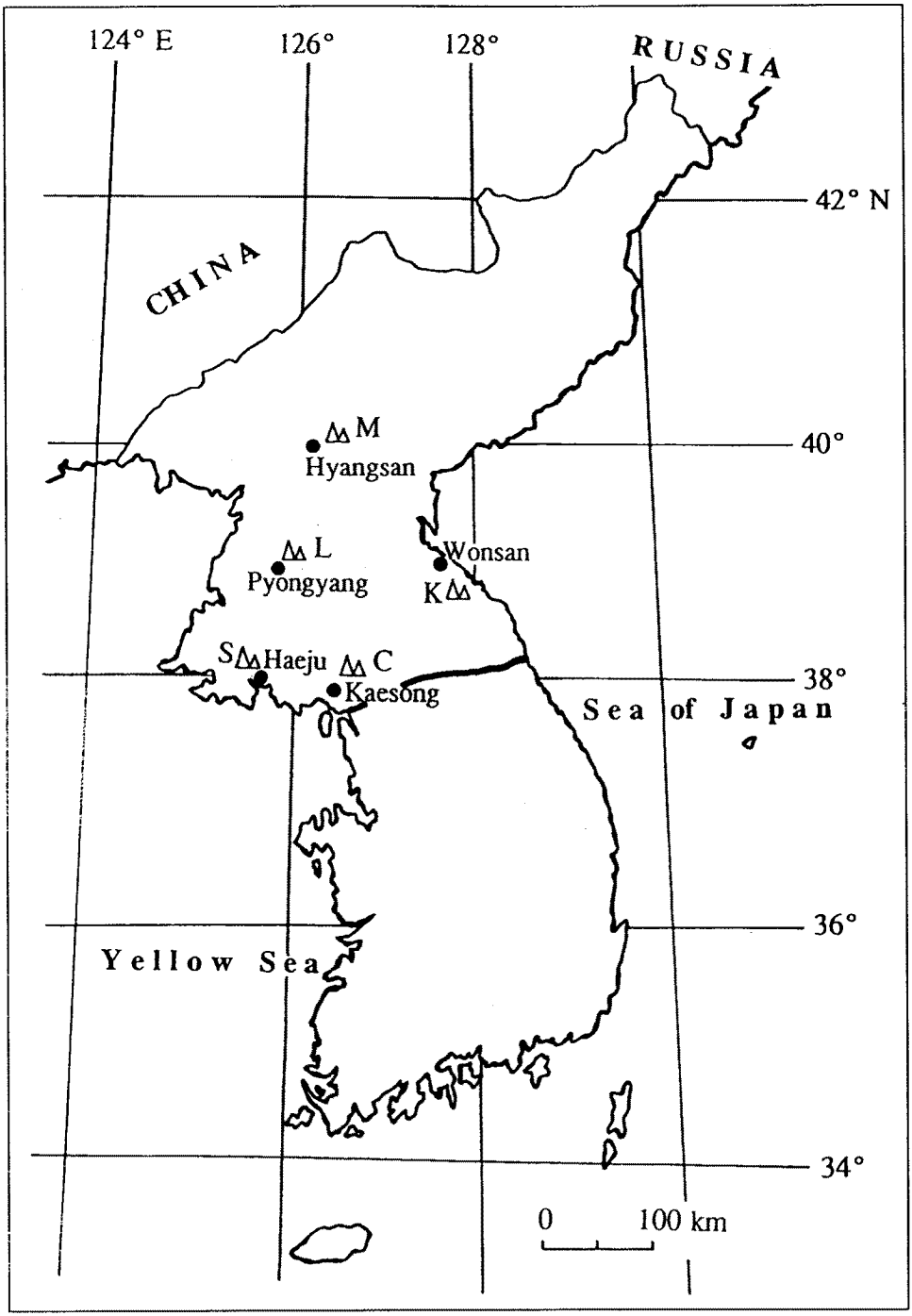


Fig. 1 - Map of area. C - Chonmasan Mts., S - Suyangsan Mts., K - Kumgangsan Mts.

Camptosorus sibiricus–Pilea peploides community

Diagnostic species: *Camptosorus sibiricus, Chrysanthemum indicum, Parthenocissus tricuspicata, Pilea peploides, Weigela florida*

This community was found on the Suyangsan song Ruin in the Suyangsan Mts. and at one locality in the Kumgangsan Mts. Both habitats are formed by old granite walls which are dry to mesic, insolated for part of a day. The typical taxon is the grass *Tripogon chinensis* var. *coreensis*. The cover of both herb and moss layers is very low.

Oxalis stricta–Microlepia pilosella community

Diagnostic species: *Asplenium incisum, Microlepia pilosella, Oxalis stricta*

A community of dry and usually insolated walls, very poor in species, found in the environs of Kaesong. The dominants are the ferns *Microlepia pilosella* and *Asplenium incisum*, significant species of rock crevices. The moss layer is only poorly developed. Relevé no. 6 (Tab. 2) from Haeju possess a special character, and can be only preliminary included in this community.

Saxifraga fortunaei–Boehmeria spicata community

Diagnostic species: *Boehmeria spicata, Lepisorus ussuriensis, Mukdenia rossii, Saxifraga fortunaei, Selaginella rossii, Woodsia polystichoides*

A community of shaded and very moist, granodiorite walls from the Chonmasan Mts. Among the communities described, it is the species richest one. The dominant species are *Saxifraga fortunaei, Boehmeria spicata* and *Selaginella rossii*. This community was found on north-facing walls of deep canyons, mostly in vicinity of waterfalls or streams. The high air humidity and almost permanent influence of water spray correlate the presence of a high number of species typical of wet rock habitats.

Classification of the Korean plant communities of walls

The studied vegetation comprises open-canopy plant communities of herbs, bryophytes (and lichens) distributed on walls and ruins in the northern part of the Korean Peninsula, in habitats analogous to European communities of the *Parietarietea judaicae* and *Asplenietea trichomanis*. The vegetation of walls in North Korea colonizes both sunny habitats as well as those situated in moist and heavily shaded sites.

Plant communities of siliceous walls in colline and montane belts of North Korea (a preliminary survey):

1. dry and sunny walls (*Oxalis stricta–Microlepia pilosella* community)
2. mild dry and intermittently shaded walls (*Commelino communis–Sedetum sarmentosi, Camptosorus sibiricus–Pilea peploides* community)
3. moist and shaded walls (*Saxifraga fortunaei–Boehmeria spicata* community).

Discussion

Though the vegetation of walls represents a relatively poor and widely distributed phenomenon, its classification has not yet been unified. In the mediterranean Europe this vegetation has been classified within the *Parietarietea judaicae* (cf. OBERDORFER 1969), and the *Asplenietea trichomanis*.

The classification of the North Korean rock fissyres appears to be more complicated than in Europe. In comparison with the separate class of rock communities of North Korea (KOLBEK, JAROLÍMEK & VALACHOVIČ submitted), it becomes evident that the vegetation of walls, above all in the towns (Kaesong, Haeju), is very different, as to species composition. The group of species common both to rocks and walls in the North Korea (*Asplenium incisum, Cystopteris fragilis, Mukdenia rossii*) is at least within the material used, smaller than in Europe. Many of species occurring on rocks in North Korea were not recognized on walls during our study. In the mountains, in particular in the vicinity of Buddhist monasteries and along touristic paths, the proportion of species belonging to the group of crevice-dwelling plants was higher on walls. The classification of the wall plant communities is controversial because of absence of a majority of crevice-dwelling plants, as well as due to the occurrence of ruderal and nitrophilous taxa. The classification in the widely-conceived European class of the *Asplenietea trichomanis* is not possible. The floristic composition of the communities is very different, and the common taxa are represented only by several widely distributed taxa, such as *Taraxacum* sect. *Ruderalia*, *Chelidonium majus, Festuca ovina* s.l., *Poa pratensis, Setaria* sp. div., etc. It would also be premature to establish new high-rank units only on basis of data used in our study considering that no analogous units are known from Japan (MIYAWAKI 1980-1989).

The wall communities of Europe and North Korea are similar as to the structure of stands. The vascular plants grow in cushions of bryophytes or from crevices filled with fine soil. Analogous soil and moisture conditions manifest themselves in approximately similar proportions. Ferns and succulents (genus *Sedum*), are predominant, accompanied mainly by nitrophilous species (genera *Lactuca, Mycelis, Chelidonium, Corydalis, Urtica, Boehmeria, Glechoma* and others) on shaded walls. In general, mosses (such as *Tortula* and *Bryum*) are represented, as well. Frequent are also anemochore plants of the genera *Artemisia, Conyza, Taraxacum, Hieracium* (*Asteraceae*) and graminoids of the genera *Bromus, Poa* and *Festuca*.

Summary

The vegetation of walls represents a specific habitat suitable for colonization by R-strategy plants weak in competition, especially from the group of anemochore taxa. These are characterized by a low degree of fidelity and the formation of accidental groups, with a high beta-diversity. East Asian wall communities have not yet been comprehensively treated. No relevés from studies of the vegetation of Japanese towns are known to us. Nor from the Korean Peninsula any material on this type of vegetation was published. From this point of view, this paper presents an unique study from the northern part of the Korean Peninsula, which it is very difficult to compare with other types of the Korean and/or East Asian vegetation, e.g. with ruderal communities or with the

communities of rock habitats. The aim of the present contribution therefore is not to classify the communities, but only to draw the attention of botanists to this neglected vegetation type in East Asia. Four well differentiated types typical for various ecological conditions were found: *Commelino communis–Sedetum sarmentosi* ass. nova, the communities *Camptosorus sibiricus–Pilea peploides, Oxalis stricta–Microlepia pilosella* and *Saxifraga fortunaei–Boehmeria spicata.*

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References

BRAUN-BLANQUET J. (1964): Pflanzensoziologie. 3. Aufl. – Springer Verlag, Wien, p. 1-865.

KOLBEK J., JAROLÍMEK I. & VALACHOVIČ M. [submitted]: Rock plant communities of the northern part of the Korean Peninsula. – Biologia, Bratislava,

MIYAWAKI A. [ed.] (1980-1989): Vegetation of Japan. Vol. 1-10. – Shibundo Publishers, Tokyo.

NEUHÄUSLOVÁ Z. & KOLBEK J. (1982): A list of higher plants, bryophytes and lichens of Central Europe used in the bank of geobotanical data in the Botanical Institute of Czechoslovak Academy of Sciences. – Průhonice. [in Czech]

OBERDORFER E. (1969): Zur Soziologie der Cymbalario-Parietarietea, am Beispiel der Mauerteppich-Gesellschaften Italiens. – Vegetatio 17: 206-213.

RI J.-D. & HWANG H.-D. (1984): Sigmulmjongsadzon [List of plant names]. – Goahakbaekgoasa-dzon-Tschulpansa, Pyongyang.

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Tables 1 & 2 and Appendix on p. 73-75

Table 1. - *Commelino communis–Sedetum sarmentosi* KOLBEK et VALACHOVIČ ass. nova, North Korea.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	Const.
Exposition	NW	NNE	E	SE	S	S	E	N	S	S	N	(%)
Inclination (°)	90	75	80	80	70	75	80	35	20	40	20	
Area (m^2)	9	9	6	9	6	8	6	6	8	8	8	
Cover of herb layer (E_1, %)	10	10	<10	20	40	30	30	50	50	40	50	
Cover of moss layer (E_0, %)	30	20	35	0	0	0	0	0	0	0	0	
Altitude (a. s. l.)	100	100	100	100	110	120	140	110	140	160	180	
Number of species (E_1)	9	7	7	14	9	14	10	13	11	10	14	
Herb layer - E_1												
Characteristic and differentiation species												
Sedum sarmentosum	1	2	2	1	2	2	2	3	2	1	2	100
Commelina communis	.	.	+	r	.	+	1	r	1	2	2	73
Parthenocissus tricuspidata	.	.	.	1	2	2	2	.	2	3	3	64
Other species												
Artemisia asiatica	r	.	.	2	+	r	+	1	1	r	+	82
Humulus japonica	.	.	.	.	r	r	r	r	1	+	1	64
Taraxacum officinalis agg.	r	+	r	+	.	.	r	+	.	.	.	55
Carex lanceolata	1	r	.	+	r	+	.	.	.	.	.	45
Agropyron * *transiens*	.	.	.	+	.	.	.	+	1	+	1	45
Chylocalyx senticosus	.	.	.	.	.	r	.	1	+	+	+	45
Glechoma hederacea	+	+	.	.	.	.	.	.	.	r	+	36
Erigeron canadensis	.	.	.	.	.	.	.	+	1	.	+	36
Viola mandshurica	+	+	+	.	.	.	.	.	.	.	.	27
Rumex acetosella	1	.	.	.	1	+	.	.	.	.	.	27
Arthraxon hispidus	.	.	.	.	+	r	.	.	.	.	r	27
Chelidonium majus	2	.	.	.	.	.	.	.	+	.	.	18
Geranium sieboldii	.	r	.	.	.	.	.	+	.	.	.	18
Bidens frondosa	.	.	+	.	.	.	.	+	.	.	.	18
Cerastium caespitosum	.	.	.	1	.	+	.	.	.	.	.	18
Artemisia capillaris	.	.	.	1	.	.	.	.	r	.	.	18
Lactuca bungeana	.	.	.	+	.	.	.	.	r	.	.	18
Festuca ovina	.	.	.	.	+	+	.	.	.	.	.	18
Chrysanthemum indicum	.	.	.	.	.	+	.	2	.	.	.	18
Siegesbeckia pubescens	.	.	.	.	.	.	r	1	.	.	.	18
Setaria glauca	.	.	.	.	.	.	.	.	.	r	1	18
Artemisia feddei	.	.	.	.	.	.	.	.	.	r	r	18
Moss layer - E_0												
Plagiothecium cavifolium	2	2	2	.	.	.	.	.	.	.	.	27
Rhacomitrium canescens	2	.	2	.	.	.	.	.	.	.	.	18
Brachythecium plumosum	1	.	+	.	.	.	.	.	.	.	.	18
Grimmia apocarpa	.	+	1	.	.	.	.	.	.	.	.	18

Species in one relevé only: *Oxalis stricta* r/1, *Thuidium glaucum* +/1, *Trifolium repens* +/2, *Bryum argenteum* 1/3, *Hypnum hamulosum* +/3, *Oplismenus undulatifolius* r/3, *Phragmites japonica* r/3, *Ligustrum ovalifolium* 1/4, *Paraixeris denticulata* 1/4, *Erigeron annuus* 1/4, *Isodon excisus* +/4, *Spodiopogon sibiricus* +/5, *Persicaria nepalensis* +/6, *Rosa multiflora* +/6, *Stellaria media* +/7, *Poa annua* r/7, *Prunus leveilleana* juv. r/7, *Oenothera biennis* r/8, *Bromus japonicus* +/11, *Corydalis* sp. juv. +/11.

Table 2. - Communities of *Camptosorus sibiricus–Pilea peploides* (rel. 1-5), *Oxalis stricta–Microlepia pilosella* (rel. 6-8) and *Saxifraga fortunaei–Boehmeria spicata* (rel. 9-12).

Relevé number	1	2	3	4	5	Const.	6	7	8	Const.	9	10	11	12	Const.
Exposition	N	NE	E	SW	NW	(%)	N	E	S	(%)	NW	NW	NW	NW	(%)
Inclination (°)	85	80	90	90	85		90	90	90		85	77	85	72	
Area (m^2)	6	6	12	12	7		30	1	1		5	16	9	9	
Cover of herb layer (E_1, %)	20	10	15	20	30		20	70	60		75	55	25	25	
Cover of moss layer (E_0, %)	20	15	10	20	0		<1	1	10		85	70	80	70	
Altitude (a. s. l.)	300	300	300	300	500		10	80	120		200	140	140	140	
Number of species (E_1)	7	9	9	7	12		8	7	7		10	12	13	11	
Diagnostic species															
Herb layer - E_1															
Pilea peploides	1	1	1	1	1	100	.	.	.	0	.	.	.	.	0
Camptosorus sibiricus	2	1-2	1	.	.	60	.	.	.	0	.	.	r	.	25
Oxalis stricta	.	.	.	.	.	0	+	+	+	100		.	.	.	0
Microlepia pilosella	.	.	+	1	.	40	.	4	2	67	+	.	.	.	25
Boehmeria spicata	.	.	.	.	.	0	2	1	.	67	2	3	1	1	100
Lepisorus ussuriensis	.	.	.	+	.	20	.	.	.	0	1	1	+	+	100
Saxifraga fortunaei	.	.	.	.	(+)	(20)	.	.	.	0	4	2	2	2	100
Higher syntaxa															
Parthenocissus tricuspidata	2	1	1	2	.	80	.	r	.	33	.	.	.	.	0
Asplenium incisum	.	r	.	.	2	40	.	1	2	67	.	.	.	.	0
Tripogon chinensis var. *coreensis*	.	.	2	2	.	40	.	.	.	0	.	.	.	.	0
Sedum spectabile	.	.	+	r	.	40	.	.	.	0	.	.	.	.	0
Sedum polytrichoides	.	.	.	+	+	40	.	.	.	0	+	+	+	.	75
Mukdenia rossii	.	.	.	.	2	20	.	.	.	0	+	+	+	+	100
Sedum verticullatum	.	.	.	.	+	20	.	.	.	0	.	.	.	.	0
Cystopteris fragilis	.	.	.	.	.	0	.	.	1	33	.	.	.	.	0
Woodsia polystichoides	.	.	.	.	.	0	.	.	.	0	1	+	+	+	100
Selaginella rossii	.	.	.	.	.	0	.	.	.	0	2	2	2	.	75
Gymnocarpium jessoense	.	.	.	.	.	0	.	.	.	0	.	1	+	+	75
Dryopteris saxifraga	.	.	.	.	.	0	.	.	.	0	.	+	.	r	50
Davallia mariesii	.	.	.	.	.	0	.	.	.	0	+	.	.	.	25
Selaginella involvens	.	.	.	.	.	0	.	.	.	0	.	.	r	.	25
Other species															
Weigela florida juv.	1-2	2	r	.	.	60	.	.	.	0	.	.	.	.	0
Chrysanthemum indicum	+	r	+	.	.	60	.	.	.	0	.	.	.	.	0
Rhododendron mucronulatum	+	r	.	.	.	40	.	.	.	0	.	.	.	+	25

Table 2 - continued

Relevé number	1	2	3	4	5	Const.	6	7	8	Const.	9	10	11	12	Const.
Lactuca bungeana	.	.	.	.	.	0	.	.	.	0	.	1	+	+	75
Polystichum tripteron	.	.	.	.	.	0	.	.	.	0	.	1	+	+	75
Deutzia glabrata juv.	.	.	.	.	.	0	.	.	.	0	.	1	+	r	75
E_0 - Moss layer															
Polytrichum juniperinum	2	2	2	2	.	80	+	.	.	33	.	.	.	.	0
Pleurozium schreberi	2	2	.	2	.	60	.	.	.	0	.	.	.	.	0
Bryum sp.	.	.	.	.	.	0	.	+	2	67	.	.	.	.	0
Fissidens cristatus	.	.	.	.	.	0	.	.	.	0	3	2	2	4	100
Schistidium apocarpum	.	.	.	.	.	0	.	.	.	0	2	1	2	.	75
Plagiomnium tezukae	.	.	.	.	.	0	.	.	.	0	.	2	2	2	75
Climacium japonicum	.	.	.	.	.	0	.	.	.	0	.	2	1	+	75

Other species in one relevé only: *Lactuca raddeana* r/1, *Artemisia keiskeana* r/2, *Benzoin obtusilobum* juv. r/2, *Impatiens textorii* r/3, *Astilbe chinensis* 1/5, *Athyrium coreanum* 1/5, *Calamagrostis arundinacea* +/5, *Equisetum arvense* +/5, *Orthodon punctatum* +/5, *Spiraea japonica* juv. +/5, *Agropyron *transiens* +/6, *Artemisia capillaris* +/6, *Erigeron canadensis* +/6, *Miscanthus sinensis* +/6, *Poa pratensis* +/6, *Setaria viridis* r/6, *Chelidonium majus* +/7, *Centipeda minima* r/7, *Viola mandshurica* 2/8, *Spiraea* sp. juv. +/8, *Festuca ovina* r/8, *Paraixeris chelidoniifolia* +/9, *Radula* sp. 4/9, *Gollania ruginosa* 2/12, *Entodon rubicundus* 1/12, *Lejeunea japonica* 1/12.

Appendix

Location of relevés

Table 1 (*Commelino–Sedetum*): Rel. 1-4 Kumgangsan, granite walls in the village of Ondzongri, June 21, 1990; Rel. 5-11 granite walls banking the Ondzongtschon River, near to Ondzongri, June 27, 1990.

Table 2 (communities of the *Camptosorus–Pilea, Oxalis–Microlepia, Saxifraga–Boehmeria*): Rel. 1-4 East Suyangsan, walls of the Suyangsan sony Ruin, July 5, 1990; Rel. 5 Kumgangsan, walls in the forest near Kuryongpopo Waterfall, June 28, 1990; Rel. 6 Haeju, rock wall of the embankment, July 4, 1990; Rel. 7 Manvolde near the Kaesong, October 20, 1989; Rel. 8 Royal tomb of Kongmin (the last of the Koryo Dynasty) near to Kaesong, October 22, 1989; Rel. 9-12 Chonmasan, artificial granite walls near the Pagion Waterfall, October 23, 1986 and October 21, 1989.