

# FLORA AND VEGETATION OF THE NATURAL RESERVE “ZUGRENI GORGES” (SUCEAVA COUNTY)

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The vascular flora, along with all the vegetal communities growing in the Natural Reserve “Zugreni Gorges” (Suceava county), is presented in this paper. Also, there is the only place in the world where it grows a very strictly endemic plant species, namely *Pietrosia levitomentosa* (syn. *Andryala levitomentosa*). This species, accompanied by others, makes an endemic vegetal association, namely: ass. *Sempervivo soboliferae-Andryaletum levitomentosae* Seghedin 1985.

*Key words:* vascular flora, endemic species, plant communities.

## INTRODUCTION

This paper is intended to draw up a floristical and coenological survey over an extremely interesting area in the Eastern Carpathians, namely the Natural Reserve “Zugreni Gorges” (Suceava county), the only place in the world where an endemic plant – *Pietrosia levitomentosa* (*Andryala levitomentosa*) – grows. This paper is written down basically to the foreseeing adhesion of Romania to the European Union and the Habitat Directive 92/43/EEC, this site being already proposed as a site of the European Network Natura 2000, as part of our contribution towards this process.

**Location.** It is situated in the central part of the Eastern Carpathians, on Crucea commune territory, at ca. 20 km north-east of Vatra Dornei town. This natural reserve is distributed in the forestry wards of Vatra Dornei and Crucea (Latitude 47°24', Longitude 25°31'). **Surface.** 151.10 ha, both on Mountain Pietrosul Bistriței and on the Massif of Rarău-Giumalău. The river of Bistrița is crossing down this reserve on a length of ca. 2 km, making there those gorges relief type. **Altitude.** It is situated between 740 m (at the level of Bistrița river) and 1791 m on the summit of Pietrosul Bistriței. **Status.** It has been legiferated as a natural reserve through Dec. No. 492/1973 of the Suceava county council. It is a mixt reserve: geological, botanical and, also, it is interesting from the landscape point of view. **Slope.** It is situated on the northern slope of Pietrosul Bistriței summit and on the southern slope of Rarău-Giumalău massif. **Geology.** The Bistriței Mountains are made of gneiss. The Rarău Mountains are made of limestone and crystalline schists, belonging to the jurassic age. **Climate.** According to Koppen, that region has a boreal climate (type D<sub>f</sub>), with cold, wet winters, and unstable and chilly summers. The nearest meteo station is on Rarău Summit, where 921 mm precipitations/year are registered. The average temperature is +4.2°C per year.

**Aeolian regime.** The most frequent winds are those from the west (31.7%), while those from the east have a frequency of 9.4%. Those western winds raise the degree of soil humidity by their raining contributions. One can remark the fact that along the Bistrița river, the winds have a smaller intensity, being channelized by the passage of that valley.

**Historical surveys.** The first mentions over the flora of that region have been made by *D. Brândză* (1889); later on, *D. Grecescu* (1898), *A. Procopianu-Procopovici* (1906) made other mentions; *V. Leandru* (1969) published a paper over the spruce forests in Bucovina; *P. Raclaru* (1970) published his doctor's degree thesis over the flora and vegetation of Rarău Massif; *T. Seghedin* (1985) elaborated his doctor's degree thesis on the Bistriței Mountains; *C. Dobrescu* (1986) made, also, some contributions over the flora from Giumalău Massif; *D. Mititelu et al.* (1989) elaborated a synthesis paper over the flora and vegetation of the Suceava county.

## MATERIAL AND METHODS

All the studies have been made on the basis of field surveys, between 1994 and 2004, on the literature over that area, and on the herbarium sheets. The methodology of vegetation survey followed that of the Central European School, the Braun-Blanquet method.

## RESULTS AND DISCUSSIONS

### A. Vascular flora of the Natural Reserve "Zugreni Gorges" (Suceava county)

The nomenclature of the vascular plant species follows [16].

*PTERIDOPHYTA*: *Asplenium ruta-muraria*, *A. septentrionale*, *A. trichomanes*, *Asplenium trichomanes-ramosum*, *Athyrium filix-femina*, *Botrychium lunaria*, *Cystopteris fragilis*, *C. montana*, *Dryopteris carthusiana*, *D. dilatata*, *D. filix-mas*, *Diphasiastrum tristachyum*, *Equisetum arvense*, *E. fluviatile*, *E. hyemale*, *E. palustre*, *E. sylvaticum*, *E. telmateia*, *Gymnocarpium dryopteris*, *G. robertianum*, *Huperzia selago*, *Lycopodium annotinum*, *L. clavatum*, *Matteuccia struthiopteris*, *Phegopteris connectilis*, *Polypodium vulgare*, *Polystichum aculeatum*, *P. setiferum*, *Pteridium aquilinum*, *Selaginella helvetica*, *S. selaginoides*.

PINOPHYTA: *Abies alba*, *Juniperus communis* ssp. *communis*, *J. communis* ssp. *alpina*, *Larix decidua* ssp. *carpatica*, *Picea abies*, *Pinus mugo*, *P. sylvestris*.

MAGNOLIOPHYTA: *Acer campestre*, *A. platanoides*, *A. pseudoplatanus*, *Achillea distans* ssp. *distans*, *A. distans* ssp. *alpina*, *A. distans* ssp. *stricta*, *A. millefolium* ssp. *millefolium*, *A. millefolium* ssp. *sudetica*, *Acinos arvensis*, *Aconitum anthora*, *A. degenii* ssp. *paniculatum*, *A. napellus* ssp. *hians*, *A. lycoctonum* ssp. *vulparia*, *A. moldavicum* ssp. *moldavicum*, *A. toxicum* ssp. *toxicum*, *Actaea spicata*, *Adenostyles alliariae* var. *kernerii*, *Adoxa moschatellina*, *Aegopodium podagraria*, *Agrimonia eupatoria*, *Agrostis capillaris*, *A. stolonifera*, *Ajuga genevensis*, *A. reptans*, *Alchemilla mollis*, *A. vulgaris* s. l., *Alisma plantago-aquatica*, *Alliaria petiolata*, *Allium victorialis*, *Alnus glutinosa*, *A. incana*, *Alopecurus pratensis* ssp. *pratensis*, *Alyssum repens* ssp. *repens*, *Anemone nemorosa*, *Angelica sylvestris*, *Antennaria dioica*, *Anthemis tinctoria* ssp. *tinctoria*, *Anthericum ramosum*, *Anthoxanthum odoratum*, *Anthriscus sylvestris*, *Anthyllis vulneraria* ssp. *polyphylla*, *Aquilegia nigricans* ssp. *nigricans*, *Arabis alpina*, *A. hirsuta*, *Arctium lappa*, *A. minus*, *A. tomentosum*, *Arnica montana*, *Arrhenatherum elatius* s.l., *Artemisia absinthium*, *A. vulgaris*, *Aruncus dioicus*, *Asarum europaeum*, *Asperula cynanchica*, *Aster alpinus*, *Astragalus glycyphyllos*, *A. onobrychis* ssp. *onobrychis*, *Astrantia major*, *Atriplex tatarica*, *Atropa belladonna*, *Aurinaria saxatilis* ssp. *saxatilis*, *Avenula compressa*, *A. pubescens*, *Barbarea vulgaris*, *Bellis perennis*, *Berteroa incana*, *Betula pendula*, *B. pubescens* ssp. *carpatica*, *Biscutella laevigata*, *Blysmus compressus*, *Brachypodium pinnatum*, *B. sylvaticum*, *Briza media*, *Bunias orientalis*, *Bupleurum falcatum*, *Calamagrostis arundinacea*, *C. pseudophragmites*, *C. varia*, *C. villosa*, *Calamintha sylvatica* ssp. *sylvatica*, *Caltha palustris*, *Campanula alpina*, *C. bononiensis*, *C. carpatica*, *C. cervicaria*, *C. glomerata*, *C. kladniana*, *C. latifolia*, *Campanula patula* ssp. *abietina*, *C. persicifolia*, *C. rapunculoides*, *C. rotundifolia* ssp. *polymorpha*, *C. rotundifolia* ssp. *rotundifolia*, *C. serrata*, *C. sibirica* ssp. *sibirica*, *C. sibirica* ssp. *divergentiformis*, *C. trachelium*, *Capsella bursa-pastoris*, *Cardamine amara*, *C. bulbifera*, *C. flexuosa*, *C. glanduligera*, *C. hirsuta*, *C. impatiens*, *Cardaminopsis arenosa* ssp. *borbasii*, *Carduus acanthoides*, *C. personata* ssp. *personata*, *Carex atrata*, *C. digitata*, *C. montana*, *C. nigra* ssp. *nigra*, *C. ovalis*, *C. pallescens*, *C. pendula*, *C. remota*, *C. sempervirens*, *C. spicata*, *C. sylvatica*, *C. vesicaria*, *C. vulpina*, *Carlina acaulis* ssp. *acaulis*, *C. vulgaris*, *Carum carvi*, *Centaurea jacea*, *C. phrygia*, *C. scabiosa*, *C. stoebe* ssp. *australis* (*C. micranthos*), *Cephalanthera rubra*, *Cerastium fontanum* ssp. *fontanum*, *C. sylvaticum*, *Chaenorrhinum minus*, *Chaerophyllum aromaticum*, *C. aureum*, *C. hirsutum*,

*Chamaecytisus hirsutus*, *C. ratisbonensis*, *Chelidonium majus*, *Chenopodium bonus-henricus*, *Chrysosplenium alternifolium*, *Cicerbita alpina*, *Cichorium intybus*, *Cicuta virosa*, *Cimicifuga europaea*, *Circaea alpina*, *C. lutetiana*, *C. intermedia*, *Cirsium arvense*, *C. erisithales*, *C. furiens*, *C. heterophyllum*, *C. oleraceum*, *C. palustre*, *C. rivulare*, *C. vulgare*, *C. waldsteinii*, *Clematis alpina*, *Clinopodium vulgare*, *Colchicum autumnale*, *Convolvulus arvensis*, *Corallorhiza trifida*, *Coronilla varia*, *Corthusa matthioli*, *Corylus avellana*, *Cotoneaster integerrimus*, *Crepis biennis*, *C. jacquinii*, *C. paludosa*, *Cruciata glabra*, *C. glabra* ssp. ? *alpina*, *C. pedemontana*, *Cynosurus cristatus*, *Dactylis glomerata* ssp. *glomerata*, *D. glomerata* ssp. *aschersoniana* (*Dactylis polygama*), *Dactylorhiza maculata*, *Daphne mezereum*, *Daucus carota*, *Deschampsia cespitosa* ssp. *cespitosa*, *D. flexuosa*, *Descurainia sophia*, *Dianthus carthusianorum*, *D. deltoides*, *D. tenuifolius*, *Digitalis grandiflora*, *Doronicum austriacum*, *D. columnae*, *Dorycnium pentaphyllum* ssp. *herbaceum*, *Draba nemorosa*, *Echinops sphaerocephalus*, *Eleocharis palustris*, *Elsholtzia ciliata*, *Elymus caninus* ssp. *biflorus*, *E. hispidus* ssp. *hispidus*, *Epilobium angustifolium*, *E. collinum*, *E. dodonaei*, *E. montanum*, *Epipactis helleborine*, *Epipogium aphyllum*, *Erigeron annuus* ssp. *annuus*, *Eritrichium nanum* ssp. *jankae*, *Erophila verna* s.l., *Eryngium campestre*, *Erysimum odoratum*, *Euonymus nanus*, *Eupatorium cannabinum*, *Euphorbia amygdaloides*, *E. carniolica*, *E. cyparissias*, *E. villosa* ssp. *villosa*, *Euphrasia minima*, *E. rostkoviana*, *E. stricta* ssp. *stricta*, *Fagus sylvatica*, *Fallopia dumetorum*, *Festuca airoides*, *F. altissima*, *F. amethystina* ssp. *amethystina*, *F. carpatica*, *F. drymeia*, *F. nigrescens*, *F. nitida* ssp. *flaccida*, *F. porcii*, *F. pratensis*, *F. rubra* ssp. *rubra*, *F. rupicola*, *F. versicolor*, *Filipendula ulmaria*, *F. vulgaris*, *Fragaria moschata*, *F. vesca*, *F. viridis*, *Frangula alnus*, *Galeopsis pubescens*, *G. speciosa*, *G. tetrahit*, *Galium album*, *G. anisophyllum*, *G. aparine*, *G. boreale*, *G. mollugo*, *G. odoratum*, *G. palustre*, *G. schultesii*, *G. verum*, *Genista tinctoria* ssp. *tinctoria*, *Gentiana acaulis*, *G. asclepiadea*, *G. cruciata* ssp. *cruciata*, *G. cruciata* ssp. *phlogifolia*, *Gentiana praecox*, *Geranium palustre*, *G. phaeum*, *G. pratense*, *G. robertianum*, *G. sanguineum*, *G. sylvaticum*, *Geum montanum*, *G. rivale*, *G. urbanum*, *Glechoma hederacea*, *G. hirsuta*, *Glyceria plicata*, *Gnaphalium sylvaticum*, *Gymnadenia conopsea*, *G. odoratissima*, *Helleborus purpurascens*, *Helianthemum nummularium* ssp. *nummularium*, *H. oelandicum* ssp. *alpestre*, *Hepatica nobilis*, *H. transsilvanica*, *Heracleum sphondylium* ssp. *sphondylium*, *Hieracium alpinum*, *H. argillaceum*, *H. aurantiacum*, *H. caesium*, *H. murorum* ssp. *murorum*, *H. pilosella* ssp. *pilosella*, *H. racemosum*, *H. rotundatum*, *H. sabaudum*, *H. umbellatum* f. *commune*, *H. villosum*,

*H. rohacsense* ssp. *rohacsense* (*H. alpinum bifidum*), *Hippophaë rhamnoides* ssp. *carpatica*, *Holcus lanatus*, *Homogyne alpina*, *Hordelymus europaeus*, *Hypericum maculatum*, *H. montanum*, *H. perforatum*, *Hypochoeris radicata*, *H. uniflora*, *Impatiens noli-tangere*, *Inula salicina*, *Isopyrum thalictroides*, *Jovibarba globifera* ssp. *globifera*, *Juncus articulatus*, *J. bufonius*, *J. compressus*, *J. effusus*, *J. inflexus*, *J. tenuis*, *J. trifidus*, *Kernera saxatilis*, *Knautia arvensis* ssp. *arvensis*, *K. arvensis* ssp. *pannonica*, *K. arvensis* ssp. *rosea*, *K. longifolia*, *Lamiastrum galeobdolon*, *Lamium album*, *L. maculatum*, *Lappula squarrosa*, *Lapsana communis*, *Laserpitium krapfii*, *L. latifolium*, *Lathyrus hallersteinii*, *L. pratensis*, *L. sylvestris*, *L. vernus*, *Leontodon autumnalis* ssp. *autumnalis*, *L. hispidus* ssp. *hispidus*, *Leontopodium alpinum*, *Lepidium ruderale*, *Leucanthemum vulgare*, *L. waldsteinii*, *Ligusticum mutellina*, *Lilium martagon*, *Linaria genistifolia*, *L. vulgaris*, *Linum catharticum*, *Listera ovata*, *Lolium perenne*, *Lonicera nigra*, *L. xylosteum*, *Lotus corniculatus*, *Luzula alpinopilosa* ssp. *alpinopilosa*, *L. campestris*, *L. luzuloides*, *L. pilosa*, *L. sylvatica*, *Lychnis flos-cuculi*, *Lycopus europaeus*, *Lysimachia nummularia*, *L. punctata*, *L. vulgaris*, *Lythrum salicaria*, *Maianthemum bifolium*, *Matricaria discoidea*, *Medicago lupulina*, *Melampyrum bihariense*, *M. pratense*, *M. saxosum*, *M. sylvaticum*, *Melica uniflora*, *Mentha arvensis* ssp. *arvensis*, *M. longifolia*, *Mercurialis perennis*, *Milium effusum*, *Minuartia verna* ssp. *verna*, *Moehringia trinervia*, *Moneses uniflora*, *Monotropa hypopitys*, *Mycelis muralis*, *Myosotis scorpioides*, *M. sylvatica*, *Myosoton aquaticum*, *Myricaria germanica*, *Nardus stricta*, *Neottia nidus-avis*, *Nepeta pannonica*, *Odontites verna*, *Oenothera biennis*, *Onobrychis viciifolia*, *Ononis arvensis* ssp. *arvensis*, *Origanum vulgare* ssp. *vulgare*, *Orobanche purpurea*, *Orthilia secunda*, *Oxalis acetosella*, *Paris quadrifolia*, *Parnasia palustris*, *Petasites albus*, *P. hybridus*, *P. kablikianus*, *Phalaris arundinacea*, *Phleum alpinum* ssp. *alpinum*, *P. pratense*, *Phyteuma orbiculare*, *P. vagneri*, *Pietrosia levitomentosa* (*Andryala levitomentosa*), *Pimpinella major*, *P. saxifraga*, *Plantago lanceolata*, *P. major*, *P. media*, *Platanthera bifolia*, *Poa annua*, *P. chaixii*, *P. compressa*, *P. nemoralis*, *P. pratensis*, *P. rehmannii*, *P. trivialis*, *Polygala amara*, *Polygonatum latifolium*, *P. verticillatum*, *Polygonum amphibium* f. *terrestre*, *P. aviculare*, *P. hydroppiper*, *Populus tremula*, *Potentilla anserina*, *P. aurea* ssp. *aurea*, *P. aurea* ssp. *chrysocraspeda*, *P. erecta*, *P. reptans*, *Prenanthes purpurea*, *Primula elatior* ssp. *leucophylla*, *P. veris*, *Prunella vulgaris*, *Prunus avium*, *Pseudorchis albida* (*Gymnadenia albida*), *Pulmonaria mollis* ssp. *mollissima*, *P. officinalis*, *P. rubra*, *Pulsatilla alpina* ssp. *alba*, *Pyrola minor*, *P. rotundifolia*, *Ranunculus acris*, *R. carpaticus*, *R. ficaria* ssp. *calthifolius*, *R. pseudomontanus*, *R. repens*, *R. serpens*

ssp. *nemorosus*, *R. strigulosus*, *Rhinanthus alpinus*, *R. minor*, *Rhodiola rosea*, *Ribes uva-crispa*, *Rorippa sylvestris* ssp. *sylvestris*, *R. sylvestris* ssp. *kernerii*, *Rosa pendulina*, *R. spinosissima*, *Rubus hirtus*, *R. idaeus*, *Rumex acetosa*, *R. acetosella*, *R. alpinus*, *R. aquaticus*, *R. arifolius*, *R. crispus*, *R. obtusifolius* ssp. *obtusifolius*, *R. sanguineus*, *Sagina procumbens*, *Salix alba*, *S. aurita*, *S. caprea*, *S. cinerea*, *S. pentandra*, *S. purpurea*, *S. silesiaca*, *Salvia glutinosa*, *S. pratensis*, *S. verticillata*, *Sambucus racemosa*, *Sanguisorba minor*, *S. officinalis*, *Sanicula europaea*, *Saponaria officinalis*, *Saxifraga cuneifolia*, *S. luteo-viridis*, *S. paniculata*, *S. pedemontana* ssp. *cymosa*, *Scabiosa columbaria* ssp. *columbaria*, *S. lucida* ssp. *barbata*, *S. ochroleuca*, *Scirpus sylvaticus*, *Scorzonera purpurea* ssp. *rosea*, *Scrophularia nodosa*, *Sedum acre*, *S. annuum*, *S. hispanicum*, *S. maximum*, *S. sexangulare*, *S. telephium* ssp. *fabaria*, *Sempervivum montanum* ssp. *montanum*, *S. zeheborii*, *Senecio carniolicus*, *S. doria* ssp. *doria*, *S. jacobaea*, *S. nemorensis* ssp. *fuchsii*, *S. nemorensis* ssp. *nemorensis*, *S. subalpinus*, *Seseli annuum*, *S. libanotis*, *Sesleria bielzii*, *Silene dioica*, *S. latifolia* ssp. *alba*, *S. nutans* ssp. *nutans*, *S. nutans* ssp. *dubia*, *S. vulgaris*, *Sinapis arvensis*, *Soldanella hungarica* ssp. *major*, *Solidago virgaurea* ssp. *virgaurea*, *Sorbus aucuparia*, *Spiraea chamaedryfolia*, *Stachys germanica*, *S. officinalis*, *S. sylvatica*, *Stellaria graminea*, *S. holostea*, *S. media*, *S. nemorum*, *Streptopus amplexifolius*, *Symphytum cordatum*, *S. officinale*, *Tanacetum corymbosum*, *T. vulgare*, *Taraxacum officinale*, *Telekia speciosa*, *Teucrium chamaedrys*, *T. montanum*, *Thalictrum aquilegifolium*, *T. flavum*, *T. lucidum*, *T. minus* ssp. *saxatile*, *Thesium linophyllum*, *Thlaspi arvense*, *T. perfoliatum*, *Thymus alpestris*, *T. bihoriensis*, *T. comosus*, *T. glabrescens*, *T. praecox* ssp. *polytrichus* (*T. balcanus*), *T. pulegioides*, *Tilia cordata*, *Torilis arvensis*, *Tragopogon pratensis* ssp. *pratensis*, *Traunsteinera globosa*, *Trifolium alpestre*, *T. aureum*, *T. campestre*, *T. hybridum* ssp. *hybridum*, *T. medium* ssp. *medium*, *T. montanum*, *T. pannonicum*, *T. pratense* ssp. *pratense*, *T. repens* ssp. *repens*, *Trisetum flavescens*, *Tussilago farfara*, *Ulmus glabra*, *Urtica dioica*, *U. urens*, *Vaccinium myrtillus*, *V. uliginosum* ssp. *microphyllum*, *V. uliginosum* ssp. *uliginosum*, *V. vitis-idaea*, *Valeriana montana*, *V. officinalis* ssp. *officinalis*, *V. officinalis* ssp. *sambucifolia*, *V. tripteris*, *Veratrum album* ssp. *album*, *Verbascum lanatum*, *V. lychnitis* ssp. *lychnitis*, *V. nigrum* ssp. *nigrum*, *V. thapsus* ssp. *thapsus*, *Verbena officinalis*, *Veronica anagallis-aquatica* ssp. *anagallis-aquatica*, *V. chamaedrys* ssp. *chamaedrys*, *V. fruticans*, *V. montana*, *V. officinalis*, *V. serpyllifolia* ssp. *serpyllifolia*, *V. urticifolia*, *Viburnum opulus*, *Vicia cracca*, *V. sepium*, *V. sylvatica*, *Vincetoxicum hirundinaria* ssp. *hirundinaria*, *Viola declinata*, *V. hirta*, *V. montana*, *V. reichenbachiana*, *V. tricolor* ssp. *tricolor*.

There have been registered 597 vascular plant species, with 35 sub-species, and 2 hybrids (in the previous papers there have been registered 190 vascular plant species, only).

Life's forms analysis:

Category	H	G	G(H)	Hd	Ch	Ph	T	Ch-H/ T-H
No.	370	40	8	4	43	44	39	49
%	61.97	6.70	1.34	0.67	7.20	7.37	6.53	8.20

Floristic analysis:

Category	Euras	Circ	Cosm	Eur	Alp. Carp. Balc.	End (Carp., Carp. Rm., Carp. E & S)	Others
No.	160	64	28	139	31	18	157
%	27.80	10.72	4.69	23.28	5.19	3.01	25.29

The endemic plant species registered into this natural reserve are the next ones:

a) local endemites: *Pietrosia levitomentosa* – on Pietrosul Bogolin summit, at ca. 1750 m.s.l.;

b) Carpathian endemites (in general): *Aconitum moldavicum* ssp. *hosteanum*, *Campanula rotundifolia* ssp. *polymorpha*, *Cardamine glanduligera*, *Festuca carpatica*, *Symphytum cordatum*, *Leucanthemum waldsteinii*, *Melampyrum saxosum*, *Poa rehmannii*, *Campanula carpatica*, *Phyteuma vagneri*;

c) Romanian Carpathian endemites: *Aconitum moldavicum* ssp. *moldavicum*, *Scabiosa lucida* ssp. *barbata*, *Silene nutans* ssp. *dubia*, *Dianthus tenuifolius*, *Eritrichium nanum* ssp. *jankae*, *Thymus bihoriensis*;

d) Eastern & Southern Carpathian endemites: *Gentiana cruciata* ssp. *phlogifolia*, *Primula elatior* ssp. *leucophylla*, *Ranunculus carpaticus*, *Hepatica transsylvanica*.

Some plant species into the natural reserve of "Zugreni Gorges" are pretty rare, such as: *Matteuccia struthiopteris*, *Pinus mugo*, *Arnica montana*, *Avenula compressa*, *Corrallorhiza trifida*, *Doronicum columnae*, *Elsholtzia ciliata*, *Epipogium aphyllum*, *Ligusticum mutellina*, *Lilium martagon*, *Rhodiola rosea*, *Telekia speciosa*, *Euonymus nana*, *Leontopodium alpinum* (this last one is situated at only 740 m.s.l. there).

From the floristical division point of view, this natural reserve belongs to the Euro-Siberian region, East-Carpathians province, the Mountains of Bistriței, Bârgăului & Călimani circumscription (following Al. Borza, 1965).

The next plant species are registered under some international documents, requiring preservation measures in Romania: *Campanula serrata* (Habitat Directive, Annex IIb), *Huperzia selago* (syn. *Lycopodium selago*) (Habitat Directive, Annex IVb), *Lycopodium annotinum* (Habitat Directive, Annex IVb), *Lycopodium clavatum* (Habitat Directive, Annex IVb), *Arnica montana* (Habitat Directive, Annex Vb), *Campanula patula* ssp. *abietina* (Bern Convention), *Pietrosia levitomentosa* (Global Red List, Bern Convention).

### **B. The Vegetation of the Natural Reserve “Zugreni Gorges” (Suceava county)**

There have been investigated the vegetation from Pietrosul Bistriței slopes as well as the vegetation from Rarău Massif, inside the natural reserve. Thus, we have registered 16 vegetal associations from 14 vegetal alliances, 11 orders & 10 vegetation classes.

The methodology in this paper followed that of the central European school (namely, Braun-Blanquet and Tuxen).

The vegetation of Pietrosul Bistriței slopes is represented by the spruce forests (belonging to the ass. *Hieracio rotundati-Piceetum*), with a canopy up to 0.95, on steep slopes inside the natural reserve.

On subalpine belt of vegetation of Pietrosul Broștenilor summit, there are phytocoenoses of the next vegetal associations: ass. *Campanulo abietinae-Juniperetum*, ass. *Oreochloo-Juncetum trifidi*, and ass. *Vaccinietum uliginosi*. The grasslands from the same vegetation belt belong to the ass. *Potentillo chrysocraspedae-Festucetum airoidis*.

Along the Bistrița river banks there are phytocoenoses of the next vegetal associations: ass. *Calamagrostium pseudophragmitis*, ass. *Poo compressae-Tusilaginetum*, ass. *Telekio-Filipenduletum*, ass. *Telekio speciosae-Alnetum incanae* subass. *matteuccietosum*, and ass. *Petasitetum hybridi*.

The rocks inside that natural reserve are covered, more or less, by phytocoenoses of the next vegetal associations: ass. *Sempervivo soboliferae-Andryaletum levitomentosae* and ass. *Campanulo carpaticae-Poëtum rehmannii* (these vegetal associations are endemic for Eastern Carpathians).

In Rarău massif (inside the natural reserve “Cheile Zugreni”), on the southern slopes, there have been settled down the next vegetal associations: ass. *Calamagrostio arundinaceae-Digitalietum grandiflorae*, ass. *Betulo-Pinetum*, and ass. *Spiraeo-Coryletum*.

Syntaxonomical framings of the vegetal associations from the natural reserve “Cheile Zugreni” (Suceava county) are like the next one (this syntaxonomical framing has been made following [Coldea Gh., 1991]).



- Cl. *Phragmito-Magnocaricetea* Klika in Klika et Novák 1941  
 Ord. *Nasturtio-Glycerietalia* Pign. 1953  
 Al. *Phalaridion arundinaceae* Kopecky 1968  
 1. Ass. *Calamagrostetum pseudophragmitis* Kopecky 1968  
 Cl. *Asplenieta trichomanis* (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977  
 Ord. *Potentilletalia caulescentis* Br.-Bl. 1926  
 Al. *Gypsophilion petraeae* Borhidi et Pócs 1957  
 2. Ass. *Sempervivo soboliferae-Andryaletum levitomentosae* Seghedin 1985  
 Cl. *Loiseleurio-Vaccinieta* Eggler ex Schubert 1960  
 Ord. *Junipero-Pinetalia mugii* Boşcaiu 1971  
 Al. *Pinion mugii* Pawl. 1928  
 3. Ass. *Campanulo abietinae-Juniperetum* Simon 1966  
 Cl. *Juncetea trifidi* Hadač 1946  
 Ord. *Caricetalia curvulae* Br.-Bl. 1926  
 Al. *Caricion curvulae* Br.-Bl. 1925  
 4. Ass. *Oreochloa-Juncetum trifidi* Szafer et al. 1927  
 5. Ass. *Potentillo chrysocraspedae-Festucetum airoidis* Boşcaiu 1971  
 Al. *Loiseleurio-Vaccinion* Br.-Bl. 1926  
 6. Ass. *Vaccinietum uliginosi* Hadač 1956  
 Cl. *Elyno-Seslerietea* Br.-Bl. 1948  
 Ord. *Seslerietalia albicantis* Br.-Bl. 1926  
 Al. *Festuco saxatilis-Seslerion bielzii* (Pawl. et Walas 1949) Coldea 1984  
 7. Ass. *Campanulo carpaticae-Poëtum rehmannii* Seghedin 1985  
 Cl. *Artemisietea vulgaris* Lohmeyer et al. ex von Rochow 1951  
 Ord. *Onopordetalia acanthii* Br.-Bl. et R. Tx. ex Klika et Hadač 1944  
 Al. *Dauco-Melilotion* Görs 1966  
 8. Ass. *Poa compressae-Tussilaginetum* R. Tx. 1931  
 Cl. *Epilobietea angustifolii* R. Tx. et Preising ex von Rochow 1951  
 Ord. *Atropetalia* Vlieg. 1937  
 Al. *Epilobion angustifolii* (Rübel 1933) Soó 1933  
 9. Ass. *Calamagrostio arundinaceae-Digitalietum grandiflorae* (Silling. 1933) Oberd. 1957  
 Cl. *Molinio-Arrhenatheretea* R. Tx. 1937  
 Ord. *Molinietalia caeruleae* W. Koch 1926  
 Al. *Filipendulion* Segal 1966  
 10. Ass. *Telekio-Filipenduletum* Coldea 1996  
 11. Ass. *Petasitetum hybridum* (Dost. 1933) Soó 1940  
 Ord. *Arrhenatheretalia* Pawl. 1928  
 Al. *Cynosurion* R. Tx. 1947  
 12. Ass. *Festuco rubrae-Agrostetum capillaris* Horv. 1951  
 Cl. *Quercu-Fagetea* Br.-Bl. et Vlieger in Vlieger 1937  
 Ord. *Fagetalia sylvaticae* Pawl. in Pawl. et al. 1928  
 Al. *Alno-Ulmion* Br.-Bl. et R. Tx 1943 em. Müller et Görs 1958  
 Subal. *Alnenion glutinosae-incanae* Oberd. 1953  
 13. Ass. *Telekio speciosae-Alnetum incanae* Coldea (1986) 1990  
 -subass. *matteuccietosum* Soó 1962; Lungu 1971  
 Al. *Symphyto-Fagion* Vida 1959  
 Subal. *Calamagrostio-Fagenion* Boşcaiu et al. 1982  
 14. Ass. *Spiraeo-Coryletum* Ujv. 1944  
 Cl. *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939  
 Ord. *Vaccinio-Piceetalia* Br.-Bl. 1939  
 Al. *Dicrano-Pinion* (Lib. 1933) Matuszk. 1962  
 15. Ass. *Betulo-Pinetum* Burduja et Ştefan 1982  
 Al. *Piceion abietis* Pawl. in Pawl. et al. 1928  
 Subal. *Soldanello majori-Picenion* Coldea 1991  
 16. Ass. *Hieracio rotundati-Piceetum* Pawl. et Br.-Bl. 1939

### Description of the vegetal associations

1. Ass. *Calamagrostetum pseudophragmitis* Kopecky 1968

**Area:** Clusters of this vegetal association have been identified on some islands or even on the riversides of the Bistrița river, on gravels, having a pioneer function.

**Synecology, structure and floristic composition.** The floristic composition is poor, there being some meso-hygrophilous plant species, such as: *Galium palustre*, *Petasites hybridus*, *Cirsium oleraceum*, etc. This association is developing towards the association of *Salici-Myricarietum*, by swarding (Table 1, rel. No. 1–2).

Table 1

Ass. *Calamagrostetum pseudophragmitis* Kopecky 1968

Altitude, m.s.l.	740	740
Surface of the relevé, sq. m.	25	25
Coverage, %	95	95
No. of the relevé	1	2
<b>Characteristic species for association</b>		
<i>Calamagrostis pseudophragmitis</i>	5	5
<b>Nasturtio-Glycerietalia et Phragmito-Magnocaricetea</b>		
<i>Mentha longifolia</i>	+	+
<i>Galium palustre</i>	–	+
<i>Ranunculus repens</i>	+	+
<b>Molinio-Arrhenatheretea</b>		
<i>Petasites hybridus</i>	+	–
<i>Festuca pratensis</i>	1	–
<i>Poa trivialis</i>	–	+
<i>Cirsium oleraceum</i>	+	–
<i>Agrostis stolonifera</i>	+	–
<i>Lotus corniculatus</i>	1	–
<i>Festuca rubra</i>	–	+
<i>Dactylis glomerata</i> ssp. <i>glomerata</i>	+	–
<i>Angelica sylvestris</i>	–	+
<i>Potentilla anserina</i>	–	+
<b>Aliae</b>		
<i>Trifolium repens</i>	–	+
<i>Alnus incana</i>	1	–
<i>Salix purpurea</i>	–	+
<i>Rumex alpinus</i>	–	+
<i>Myosoton aquaticum</i>	–	+
<i>Geranium robertianum</i>	+	–

Place and date of relevés: the Bistrița river (Zugreni **Gorges** area), 27<sup>th</sup> of July, 2000.

2. Ass. *Sempervivo soboliferae-Andryaletum levitomentosae* Seghedin 1985

**Area:** The endemic plant species *Pietrosia levitomentosa* (*Andryala levitomentosa*) is installed only on Pietrosul Bogolin peak, at ca. 1 750 m.s.l. The

substratum is made by porphyroid gneisses, typical for Pietrosul Bistriței Massif; the pH is acid and the winds are quite strong.

**Synecology, structure and floristic composition.** This local endemic plant is making, together with other plant species, two vegetal populations, having a coverage between 25% and 60%. *Pietrosia levitomentosa* has been discovered there by N. Tomescu, Ioan Bosică & Fr. Nagy-Toth, on 7th July, 1961, followed by Em. Țopa on 12th July, 1962, and by Tr. Ștefureac & Em. Țopa on 28th August, 1962 (Table 2, rel. No. 1–10).

Table 2

Altitude, m.s.l.	1730–1750									
Exposure	S	S - V	N	V	S	V	V	V	S	V
Slope, in degrees	75	45	50	50	45	45	45	60	25	25
Coverage, %	50	55	25	20	20	25	25	70	30	30
Surface of the relevé, sq. m.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
No. of the relevé	1	2	3	4	5	6	7	8	9	10
<b>Characteristic species for association</b>										
<i>Pietrosia levitomentosa</i>	2	1	1	1	1	1	1	4	2	2
<b>Potentilletalia et Asplenietea trichomanis</b>										
<i>Cystopteris fragilis</i>	+	–	+	–	–	–	–	–	–	–
<i>Campanula carpatica</i>	+	–	–	–	–	–	–	–	–	–
<i>Campanula kladniana</i>	+	1	1	+	+	–	–	+	–	–
<i>Polypodium vulgare</i>	–	+	–	–	–	–	–	–	–	–
<b>Seslerietalia et Elyno-Seslerietea</b>										
<i>Dianthus tenuifolius</i>	+	+	–	–	–	–	–	–	–	–
<b>Caricetalia et Juncetea trifidi</b>										
<i>Juncus trifidus</i>	+	–	+	–	–	–	–	–	–	–
<i>Festuca airoides</i>	2	3	2	2	2	2	2	1	1	1
<i>Campanula patula</i> ssp. <i>abietina</i>	+	–	–	–	–	–	–	–	–	–
<i>Hieracium alpinum</i>	–	–	+	–	–	–	–	–	–	–
<i>Hypochoeris uniflora</i>	+	–	–	–	–	–	–	–	–	–
<i>Hieracium aurantiacum</i>	–	–	–	–	–	–	–	+	+	–
<b>Vaccinio-Piceetea</b>										
<i>Vaccinium myrtillus</i>	+	–	+	–	–	+	+	+	–	+

Table 2  
(continued)

No. of the relevé	1	2	3	4	5	6	7	8	9	10
<i>Vaccinium vitis-idaea</i>	+	1	+	+	-	-	+	+	1	+
<i>Juniperus communis</i> ssp. <i>nana</i>	+	+	+	1	-	-	+	-	-	-
<i>Luzula luzuloides</i>	+	+	+	-	+	-	-	+	+	-
<b>Aliae</b>										
<i>Arnica montana</i>	+	-	-	-	-	-	-	-	-	-
<i>Cetraria islandica</i>	+	-	+	+	+	-	-	+	+	-
<i>Xanthoria parietina</i>	+	+	+	+	+	-	+	+	-	-
<i>Thamnia vermicularis</i>	+	+	-	-	+	-	-	-	-	+

Place and date of relevés: Bistrița Mountains (Pietrosul Bogolin Peak), 29<sup>th</sup> July, 2000.

### 3. Ass. *Campanulo abietinae-Juniperetum* Simon 1966

**Area.** This vegetal association is installed on the ridge between Pietrosul Bogolin Peak and Pietrosul Bistriței Peak. That habitat is very windy, with a strong sunstroke, shallow andosols, and rocks outside the soil, here and there.

**Synecology, structure and floristic composition.** The dominant plant species in this association is *Juniperus communis* ssp. *nana*, having coverages up 60%–70%; this plant is accompanied by other plant species from the subalpine belt of vegetation, like the next ones: *Vaccinium uliginosum* ssp. *uliginosum*, *Campanula patula* ssp. *abietina*, *Potentilla aurea* ssp. *aurea*, *Festuca airoides* etc. (Table 3, rel. No. 1–2).

Table 3  
Ass. *Campanulo abietinae-Juniperetum* Simon 1966

Altitude, m.s.l.	1000	1050
Exposure	E-N-E	E
Slope, in degrees	15	25
Coverage, %	90	90
Surface of the relevé, sq. m.	100	100
No. of the relevé	1	2
<b>Characteristic species for association</b>		
<i>Juniperus communis</i> ssp. <i>nana</i>	5	5
<i>Campanula patula</i> ssp. <i>abietina</i>	+	+
<b>Junipero-Pinetalia et Loiseleurio-Vaccinieta</b>		
<i>Luzula luzuloides</i>	+	+
<i>Laserpitium krapfii</i>	-	+
<i>Homogyne alpina</i>	1	1

Table 3  
(continued)

<i>Soldanella hungarica</i> ssp. <i>major</i>	+	+
<i>Deschampsia flexuosa</i>	+	+
<i>Cruciata glabra</i>	+	+
<b>Juncetea trifidi et Caricetalia curvulae</b>		
<i>Achillea distans</i>	–	+
<i>Vaccinium uliginosum</i> ssp. <i>uliginosum</i>	+	–
<i>Festuca nigrescens</i>	1	+
<i>Potentilla aurea</i> ssp. <i>aurea</i>	+	+
<i>Hieracium aurantiacum</i>	+	+
<b>Nardetalia et Nardo-Callunetea</b>		
<i>Hypericum maculatum</i>	–	+
<i>Nardus stricta</i>	+	+
<b>Vaccinio-Piceetea</b>		
<i>Picea abies</i> <i>juv.</i>	2	1
<i>Vaccinium myrtillus</i>	2	1
<i>Vaccinium vitis-idaea</i>	+	+
<i>Melampyrum sylvaticum</i>	1	+
<i>Luzula sylvatica</i>	–	+
<b>Aliae</b>		
<i>Rubus idaeus</i>	–	+
<i>Veratrum album</i> ssp. <i>album</i>	+	–
<i>Polygonatum verticillatum</i>	–	+

Place and date of relevés: Bistrița Mountains (between Pietrosul Bogolin Peak and Pietrosul Bistriței Peak), 29<sup>th</sup> July, 2000.

#### 4. Ass. *Oreochloo-Juncetum trifidi* Szafer et al. 1927

**Area.** It is met on the ridge between Pietrosul Bogolin and Pietrosul Bistriței, at over 1 600 m.s.l. *Juncus trifidus* is an oligothermic, silicicolous plant species, having a distribution area in all higher mountains in Europe (including here Caucasus & Urals), as well as the mountains from Asia and Northern America, where it makes, as a rule, well dominated vegetal covers. In Romania, this vegetal association has a limited area: in the Eastern Carpathians (the mountains of Rodnei, Călimani, Țibleș and Maramureș), the Southern Carpathians (Bucegi, Retezat, Făgăraș, Parâng, etc.), lacking in the Apuseni Mountains. On Pietrosul Bistriței it occupies only small areas.

**Synecology.** This association has obvious xero-thermophilous features, growing in quite windy habitats, on sunny slopes, with declivities between 5 to 45 degrees, on acid soils, poor in minerals; sometimes it grows on steep slopes. In the summer time it is submitted to a strong sunstroke, when it is registered a shortcoming in humidity of soil, which is equalized by the humidity in air. In the spring time, this association has mesophilous features, being well provided with the

humidity of the soil. It grows on very tiny soils, even on the base rocks, sometimes very thinly split.

**Structure and floristic composition.** The dominant species is *Juncus trifidus*, but *Oreochloa disticha* is missing here. Some of the plant species are characteristic for this association, like: *Hieracium alpinum*, *Cetraria islandica*, *Carex sempervirens*, *Festuca airoides*, *Homogyne alpina* and others (Table 4, rel. No. 1–2).

Table 4

Ass. *Oreochloo-Juncetum trifidi* Szafer *et al.* 1927 (rel. No. 1–2); Ass. *Potentillo chrysocraspedae-Festucetum airoidis* Boşcaiu 1971 (rel. No. 3–4);  
Ass. *Vaccinietum uliginosi* Hadač 1956 (rel. No. 5–7)

Altitude, m.s.l.	1780	1780	1680	1700	1680	1700	1650
Surface of the relevé, sq. m.	0.5	0.5	25	25	0.5	2	2
Coverage, %	90	70	75	95	70	65	100
Exposure	–	S	N-E	N-V	S	E	E
Slope, in degrees	–	2	25	10	7–8	8	5
No. of the relevé	1	2	3	4	5	6	7
<b>Characteristic species for association</b>							
<i>Juncus trifidus</i>	5	3	+	+	–	–	–
<i>Festuca airoides</i>	–	–	4	4	–	–	2
<i>Vaccinium uliginosum</i> ssp. <i>uliginosum</i>	+	–	1	1	4	4	1
<b>Caricion et Caricetalia curvulae</b>							
<i>Potentilla aurea</i> ssp. <i>aurea</i>	–	–	+	+	–	–	–
<i>Deschampsia flexuosa</i>	–	–	1	+	–	–	+
<i>Campanula alpina</i>	–	–	+	–	–	–	–
<i>Euphrasia minima</i>	–	–	–	+	–	–	–
<i>Cruciata glabra</i>	–	–	1	1	–	–	–
<i>Hieracium aurantiacum</i>	–	–	–	–	+	–	–
<i>Hypochoeris uniflora</i>	–	–	–	–	+	–	–
<i>Huperzia selago</i>	–	–	+	–	–	+	+
<i>Campanula kladniana</i>	–	–	–	–	–	–	+
<b>Juncetea trifidi</b>							
<i>Homogyne alpina</i>	–	+	+	+	–	–	+
<i>Hieracium alpinum</i>	–	+	–	–	–	–	–
<i>Gentiana praecox</i>	–	–	+	–	–	–	–
<i>Phyteuma vagneri</i>	–	–	+	–	–	–	–
<i>Cetraria islandica</i>	+	–	+	+	+	–	–
<i>Thamnotia vermicularis</i>	+	–	–	–	+	–	–
<b>Vaccinio-Piceetalia</b>							
<i>Vaccinium myrtillus</i>	+	1	+	+	–	–	–
<i>Vaccinium vitis-idaea</i>	+	1	+	+	–	–	–
<i>Juniperus communis</i> ssp. <i>nana</i>	–	–	+	–	1	+	2
<i>Picea abies</i> juv.	–	–	–	–	+	–	–

Table 4  
(continued)

Aliae							
<i>Festuca nigrescens</i>	–	–	1	1	–	–	–
<i>Nardus stricta</i>	–	–	+	+	–	–	–
<i>Viola declinata</i>	–	–	–	+	–	–	–
<i>Thymus pulegioides</i>	–	–	1	1	–	–	–
<i>Alchemilla vulgaris</i> s.l.	–	–	–	+	–	–	–
<i>Antennaria dioica</i>	–	–	+	+	–	–	–
<i>Lotus corniculatus</i>	–	–	–	+	–	–	–
<i>Campanula patula</i> ssp. <i>abietina</i>	–	–	+	–	–	–	–
<i>Luzula luzuloides</i>	–	–	+	+	–	–	–
<i>Trifolium repens</i> ssp. <i>repens</i>	–	–	+	–	–	–	–
<i>Seseli libanotis</i>	–	–	+	+	–	–	–
<i>Anthoxanthum odoratum</i>	–	–	–	+	–	–	–
<i>Potentilla erecta</i>	–	–	1	1	–	–	–
<i>Dianthus tenuifolius</i>	–	–	–	+	–	–	–
<i>Veratrum album</i> ssp. <i>album</i>	–	–	+	–	–	–	–
<i>Carex ovalis</i>	–	–	1	–	–	–	–

Place and data of relevés: rel. No. 1–2 Bistrița Mountains (between Pietrosul Bogolin Peak and Pietrosul Bistriței Peak), 29<sup>th</sup> July, 2000; rel. No. 3–4 Bistrița Mountains (between Pietrosul Bogolin Peak and Pietrosul Bistriței Peak), 29<sup>th</sup> July, 2000; rel. No. 5–7 Bistrița Mountains (between Pietrosul Bogolin Peak and Pietrosul Bistriței Peak), 29<sup>th</sup> July, 2000.

5. Ass. *Potentillo chrysocraspedae-Festucetum airoidis* Boșcaiu 1971 (= Ass. *Festucetum supinae* Domin 1933)

**Area.** The grasslands edified by this vegetal association are widespread in the Romanian Carpathians, on habitats between 1540 m.s.l., in Giumalău Massif, to 2 500 m.s.l. in the Mountain Mândra – Parâng (I. Resmeriță, 1974). Inside the natural reserve of Zugreni Gorges, phytocoenoses of this association are spread only on the ridge between Pietrosul Bogolin and Pietrosul Bistriței Summits, even on the steep slopes along the main ridge.

**Synecology.** The phytocoenoses are settled down in those nano-relief forms, on the rocks, on soils having a variable thickness, more or less skeleton-like, on various slopes, frequently windy.

**Structure and floristic composition.** The phytocoenoses are homogeneous from the floristic point of view, having a small number of species, all of them being convergently from ecologic-syngenetic point of view. Those kinds of phytocoenoses make primary climatogenic grasslands, of sub-alpine type. This association has a meso-xerophilous and oligotrophic towards meso-oligotrophic nature. It is settled down, on plane or on more or less inclined slopes (Table 4, rel. No. 3–4).

6. Ass. *Vaccinietum uliginosi* Hadač 1956 (= Ass. *Vaccinium uliginosum*-*Cetraria islandica* Gancev 1963; Ass. *Vaccinietum uliginosi* Beldie 1967; Ass. *Cetrario-Vaccinietum uliginosi* Hadač 1956)

**Area.** The phytocoenoses dominated by *Vaccinium uliginosum* ssp. *uliginosum* are sporadically spread in that area, from ca. 1 550 m.s.l. to ca. 1 650 m.s.l.

**Synecology.** Those phytocoenoses have cryo-xerophilous features, being a long time covered with a slight carpet of snow, irrespectively the soil can be frozen in the wintertime, or also can be dried in the summertime. They are settled down on skeletal, superficial, humico-siliceous, obviously podzolic soils.

**Structure and floristic composition.** This association is characterized by the presence of some arcto-alpine plant species: *Festuca airoides*, *Antennaria dioica*, and others. Generally, in those phytocoenoses there are few plants, owing to the fact that *Vaccinium uliginosum* ssp. *uliginosum* has a great coverage capacity of the soil, making dense carpets; from it are getting through sporadically samples of *Juncus trifidus*, *Festuca airoides*, and others. Those phytocoenoses occupy small areas (few square metres), on the ridge between the peaks of Pietrosul Bogolin and Pietrosul Bistriței. This association is an indicator of utmost conditions like strong winds, growing in dryness conditions during the spring and summer seasons (Table 4, rel. No. 5-7).

7. Ass. *Campanulo carpaticeae-Poëtum rehmannii* Seghedin 1985

**Area:** This vegetal association is settled down on rocky slopes in that natural reserve.

**Synecology.** The characteristic plant species are *Campanula carpaticea* and *Poa rehmannii*, being at the same time the dominant ones in association.

**Structure and floristic composition.** From the floristic point of view, one can remark the presence of the next species: *Saxifraga paniculata*, *Polypodium vulgare*, *Silene nutans* ssp. *dubia*, *Dianthus tenuifolius*, *Seseli libanotis*, *Aurinia saxatilis* ssp. *saxatilis* and so on, whose settlement is favored by the alkaline substratum of those rocks (Table 5, rel. No. 1-5).

Table 5

Ass. *Campanulo carpaticeae-Poëtum rehmannii* Seghedin 1985

Altitude, m.s.l.	760	760	750	740	750
Exposure	N	N	N	N	N-E
Slope, in degrees	80	80	85	80	85
Surface of the relevé, sq. m.	4	4	4	4	10
Coverage, %	60	10	40	30	55
No. of the relevé	1	2	3	4	5



Table 5  
(continued)

<b>Characteristic species for association</b>					
<i>Poa rehmannii</i>	3	+	3	3	3
<i>Campanula carpatica</i>	1	-	1	1	1
<b>Seslerietalia et Elyno-Seslerietea</b>					
<i>Saxifraga paniculata</i>	1	1	-	-	+
<i>Dianthus tenuifolius</i>	-	1	+	+	+
<i>Scabiosa lucida</i> ssp. <i>barbata</i>	-	-	-	-	+
<i>Selaginella helvetica</i>	1	-	-	-	-
<i>Bupleurum falcatum</i>	+	-	-	-	-
<i>Aquilegia nigricans</i>	-	-	-	-	+
<b>Asplenietalia et Asplenietea</b>					
<i>Cardaminopsis arenosa</i> ssp. <i>borbasii</i>	+	+	-	-	+
<i>Asplenium ruta-muraria</i>	+	+	-	-	-
<i>Polypodium vulgare</i>	-	-	+	+	+
<i>Sempervivum montanum</i> ssp. <i>montanum</i>	-	+	+	-	-
<i>Silene nutans</i> ssp. <i>dubia</i>	-	+	-	-	+
<i>Cystopteris fragilis</i>	+	-	+	-	+
<i>Asplenium trichomanes</i> ssp. <i>trichomanes</i>	+	-	-	-	-
<i>Asplenium trichomanes-ramosum</i>	1	-	-	-	-
<b>Thlaspietea</b>					
<i>Thymus comosus</i>	-	-	-	-	+
<i>Aurinia saxatilis</i> ssp. <i>saxatilis</i>	+	-	-	-	+
<i>Spiraea chamaedryfolia</i>	-	-	-	-	+

Table 5  
(continued)

<b>Trifolio-Geranietea</b>					
<i>Seseli libanotis</i>	-	+	-	-	+
<i>Campanula rapunculoides</i>	-	-	+	+	+
<i>Chrysanthemum corymbosum</i>	-	-	+	-	+
<b>Molinio-Arrhenatheretea</b>					
<i>Valeriana officinalis</i> ssp. <i>officinalis</i>	-	+	-	-	+
<i>Campanula sibirica</i> ssp. <i>sibirica</i>	-	+	-	-	+
<i>Sedum maximum</i>	-	1	-	-	-
<i>Euphrasia rostkoviana</i>	-	-	+	+	-
<i>Lotus corniculatus</i>	-	-	-	-	+
<b>Aliae</b>					
<i>Campanula persicifolia</i>	-	-	+	+	+
<i>Digitalis grandiflora</i>	-	-	+	-	-
<i>Pimpinella saxifraga</i>	-	-	-	-	1
<i>Asarum europaeum</i>	+	-	-	-	-
<i>Geranium robertianum</i>	+	-	-	-	-
<i>Galium album</i>	-	+	-	-	-
<i>Jovibarba globifera</i> ssp. <i>globifera</i>	+	-	-	+	-

Place and date of relevés: the Rarău Mountains (Zugreni Gorges area), 28<sup>th</sup> July, 2000.

#### 8. Ass. *Poa compressae-Tussilaginetum* R. Tx. 1931

**Area.** The phytocoenoses of this vegetal association are settled down on some sections of the banks of the river Bistrița; the river sides are permanently wet, thanks to the closeness of the water and the shadow of the steep slopes, covered by lignaceous vegetation.

**Synecology:** It is a pioneer vegetation, where *Tussilago farfara* has a dominant role and *Poa compressa* is a characteristic plant species into the association.

**Structure and floristic composition.** The coverage of the vegetation varies between 35% and 85%. Among the characteristic plant species for this class (*Artemisietea vulgaris*), frequently there are the next ones: *Urtica dioica*, *Cirsium arvense*, *C. vulgare*, *Arctium tomentosum*. Among the transgressive plant species, more frequently are: *Prunella vulgaris*, *Trifolium repens* ssp. *repens*, *Mentha longifolia* (Table 6, rel. No. 1).

Table 6

Ass. *Poa compressae-Tussilaginetum* R. Tx. 1931, Surface of the relevé, sq.m. = 70;  
Coverage, % = 70

<b>Characteristic species for association:</b>	
<i>Tussilago farfara</i>	(AD = 4)
<i>Poa compressa</i>	(AD = +)
<b>Arction lappae</b>	
<i>Arctium tomentosum</i>	(AD = +)
<i>Melilotus officinalis</i>	(AD = +)
<b>Artemisietea</b>	
<i>Cirsium arvense</i>	(AD = +)
<i>Urtica dioica</i>	(AD = +)
<i>Cichorium intybus</i>	(AD = +)
<i>Cirsium vulgare</i>	(AD = +)
<b>Molinio-Arrhenatheretea</b>	
<i>Prunella vulgaris</i>	(AD = +)
<i>Trifolium repens</i> ssp. <i>repens</i>	(AD = +)
<i>Veronica serpyllifolia</i> ssp. <i>Serpyllifolia</i>	(AD = +)
<i>Mentha longifolia</i>	(AD = +)
<i>Trifolium pratense</i> ssp. <i>pratense</i>	(AD = +)
<i>Dactylis glomerata</i> ssp. <i>glomerata</i>	(AD = +)
<i>Galium mollugo</i>	(AD = +)
<b>Aliae</b>	
<i>Echium vulgare</i>	(AD = +)
<i>Origanum vulgare</i>	(AD = +)
<i>Calamagrostis arundinacea</i>	(AD = +)
<i>Epilobium montanum</i>	(AD = 1)
<i>Lysimachia nummularium</i>	(AD = +)
<i>Galeopsis terahit</i>	(AD = +)
<i>Petasites hybridus</i>	(AD = +)
<i>Potentilla argentea</i>	(AD = 1)
<i>Glechoma hederacea</i>	(AD = +)
<i>Cirsium oleraceum</i>	(AD = +)

Table 6  
(continued)

Characteristic species for association:	
<i>Equisetum telmateia</i>	(AD = +)
<i>Stellaria nemorum</i>	(AD = +)
<i>Daucus carota</i>	(AD = +)
<i>Rumex crispus</i>	(AD = 1)

Place and date of relevé: Bistrița river (Zugreni Gorges area), 28<sup>th</sup> July 2000.

9. Ass. *Calamagrostio arundinaceae-Digitalietum grandiflorae* (Silling, 1933) Oberd. 1957 (= Ass. *Calamagrostio-Spireetum ulmifoliae* Resm. et. Csűrös 1966)

**Area.** These vegetal associations are settled down on the rocky walls of Zugreni Gorges, on rocks and mountain passes and detritus, in the course of fastening.

**Synecology.** The characteristic plant species are also dominant into the association, making coverages 70%–80% on the soil surface.

**Structure and floristic composition.** Those phytocoenoses are settled down in the semidark places, having a relatively rich structure, with meso-hygrophilous plant species; but, here and there, there are saxicolous, and heliophilous plant species. With a higher frequency, there are the next species: *Spiraea chamaedryfolia*, *Rubus idaeus*, *Senecio nemorensis* ssp. *fuchsii* and so on (Table 7, rel. No. 1–2).

Table 7

Ass. *Calamagrostio arundinaceae-Digitalietum grandiflorae* (Silling, 1933) Oberd. 1957

Altitude, m.s.l.	780	800
Surface of the relevé, sq. m.	100	100
Exposure	N–E	–
Slope, in degrees	5	–
Coverage, %	45	55
No. of the relevé	1	2
<b>Characteristic species for association</b>		
<i>Digitalis grandiflora</i>	+	+
<i>Calamagrostis arundinacea</i>	1	2
<i>Spiraea chamaedryfolia</i>	2	2
<b>Atropetalia et Epilobietea angustifolii</b>		
<i>Senecio nemorensis</i> ssp. <i>fuchsii</i>	+	+
<i>Rubus idaeus</i>	1	1
<i>Fragaria vesca</i>	1	–
<i>Sambucus racemosa</i>	+	+

Table 7  
(continued)

<b>Betulo-Adenostyletea</b>		
<i>Rosa pendulina</i>	–	+
<i>Aconitum toxicum</i>	–	+
<b>Trifolio-Geranietea</b>		
<i>Origanum vulgare</i> ssp. <i>vulgare</i>	+	–
<i>Glechoma hederacea</i>	1	–
<b>Molinio-Arrhenatheretea</b>		
<i>Seseli libanotis</i>	+	–
<i>Sedum maximum</i>	–	+
<i>Veronica chamaedrys</i> ssp. <i>chamaedrys</i>	+	–
<b>Aliae</b>		
<i>Campanula persicifolia</i>	–	+
<i>Poa nemoralis</i>	–	+
<i>Valeriana tripteris</i>	–	+
<i>Silene nutans</i> ssp. <i>nutans</i>	+	–
<i>Asplenium trichomanes</i> - <i>ramosum</i>	–	+
<i>Salvia glutinosa</i>	+	+
<i>Dryopteris filix-mas</i>	+	–
<i>Galium schultesii</i>	–	1
<i>Veronica urticifolia</i>	+	–
<i>Mercurialis perennis</i>	–	+
<i>Sorbus aucuparia</i>	+	+
<i>Picea abies</i>	–	+

Place and date of relevés: Rarău Mountains (Zugreni Gorges area), 28<sup>th</sup> of July, 2000.

#### 10. Ass. *Telekio-Filipenduletum* Coldea 1996

**Area.** This vegetal association is a hygrophilous one, whose phytocoenoses have been identified on the banks along the Bistrița river, at the confluence with the Colbu river.

**Synecology.** The vegetation is discontinuous, on small patches (20–100 square metres). The edifier plant species are *Telekia speciosa* and *Filipendula ulmaria*, which cover the soil up to 70%–80%.

**Structure and floristic composition.** Besides the edifier plant species there are other hygrophilous species, characteristic for order and class, like the next ones: *Valeriana officinalis*, *Mentha longifolia*, *Cirsium oleraceum*, *Stachys sylvatica*, *Aegopodium podagraria* and so on (Table 8, rel. No. 1).

Table 8

Ass. *Telekio-Filipenduletum* Coldea 1996 (rel. No. 1); Ass. *Petasitetum hybridi* (Dostal 1933) Soo 1940 (rel. No. 2–3); Ass. *Festuco rubrae-Agrostetum capillaris* Horv. 1951 (rel. No. 4–5)

Altitude, m.s.l.	740	740	740	720	720
Surface of the relevé, sq.m.	20	50	50	100	100
Coverage, %	80	100	100	80	85
No. of the relevé	1	2	3	4	5
<b>Characteristic species for association</b>					
<i>Telekia speciosa</i>	2	–	+	–	–
<i>Filipendula ulmaria</i>	3	–	–	–	–
<i>Petasites hybridus</i>	–	5	5	–	–
<i>Agrostis capillaris</i>	–	–	–	3	2
<i>Festuca rubra</i>	–	–	–	1	2
<b>Filipendulion</b>					
<i>Carduus personata</i>	–	+	–	–	–
<i>Eupatorium cannabinum</i>	–	–	+	–	–
<b>Agrostideto-Festucion rubrae</b>					
<i>Centaurea phrygia</i>	–	–	–	1	+
<i>Hieracium aurantiacum</i>	–	–	–	+	–
<i>Hypochoeris radicata</i>	–	–	–	+	+
<i>Carlina acaulis</i>	–	–	–	+	+
<b>Cynosurion</b>					
<i>Cynosurus cristatus</i>	–	–	–	+	1
<i>Potentilla erecta</i>	–	–	–	+	+
<i>Hieracium pilosella</i> ssp. <i>pilosella</i>	–	–	–	+	+
<i>Alchemilla vulgaris</i> s.l.	–	–	–	1	+
<b>Agrostideto-Festucetalia rubrae</b>					
<i>Anthoxanthum odoratum</i>	–	–	–	+	+
<i>Leucanthemum vulgare</i>	–	–	–	+	+
<i>Stellaria graminea</i>	–	–	–	1	1
<i>Trifolium montanum</i>	–	–	–	+	+
<i>Thymus pulegioides</i>	–	–	–	+	–
<i>Hypericum maculatum</i>	–	–	–	+	–
<i>Crepis biennis</i>	–	–	–	–	+
<i>Rumex acetosa</i>	–	–	–	–	+
<i>Gymnadenia conopsea</i>	–	–	–	–	+
<i>Veratrum album</i> ssp. <i>album</i>	–	–	–	–	+
<i>Euphrasia stricta</i>	–	–	–	1	–
<b>Molinietalia et Molinio-Arrhenatheretea</b>					
<i>Stachys sylvatica</i>	1	–	–	–	–
<i>Thalictrum aquilegifolium</i>	+	–	–	–	–
<i>Lathyrus pratensis</i>	+	–	–	+	–
<i>Mentha longifolia</i>	+	+	+	–	–
<i>Equisetum arvense</i>	+	–	–	–	–
<i>Trifolium repens</i> ssp. <i>repens</i>	+	–	–	+	1
<i>Cirsium erysithales</i>	+	–	–	–	–

Table 8  
(continued)

<i>Cirsium oleraceum</i>	1	+	-	-	-
<i>Ranunculus repens</i>	+	-	-	-	-
<i>Achillea millefolium</i>	+	-	-	+	-
<i>Veronica chamaedrys</i> ssp. <i>chamaedrys</i>	+	-	-	-	+
<i>Veronica officinalis</i>	+	-	-	-	.
<i>Valeriana officinalis</i> ssp. <i>officinalis</i>	+	-		1	-
<i>Angelica sylvestris</i>	+	-	+		
<i>Agrostis stolonifera</i>	+	-	-	-	-
<i>Myosotis scorpioides</i>	-	+	+	-	-
<i>Symphytum officinale</i>	-	+	-	-	
<i>Taraxacum officinale</i>	-	-	+	-	+
<i>Equisetum palustre</i>	-	+	-	-	-
<i>Poa trivialis</i>	-	-	+	-	-
<i>Dactylis glomerata</i> ssp. <i>glomerata</i>	-	-	+	-	-
<i>Silene dioica</i>	-	+	-	-	-
<i>Deschampsia cespitosa</i> ssp. <i>cespitosa</i>	-	-	-	+	+
<i>Poa pratensis</i>	-	-	-	-	+
<i>Holcus lanatus</i>	-	-	-	1	-
<i>Phleum pratense</i>	-	-	-	-	+
<i>Geum rivale</i>	-	-	-	+	-
<i>Carum carvi</i>	-	-	-	+	+
<i>Geranium pratense</i>	-	-	-	-	+
<i>Lysimachia nummularia</i>	-	-	-	+	+
<i>Trifolium pratense</i> ssp. <i>pratense</i>	-	-	-	+	+
<i>Bellis perennis</i>	-	-	-	+	+
<i>Lotus corniculatus</i>	-	-	-	-	+
<i>Rhinanthus minor</i>	-	-	-	+	+
<i>Ranunculus acris</i>	-	-	-	+	+
<i>Leontodon autumnalis</i>	-	-	-	+	-
<i>Campanula patula</i> ssp. <i>patula</i>	-	-	-	-	+
<i>Briza media</i>	-	-	-	+	-
<i>Plantago media</i>	-	-	-	1	-
<i>Trifolium hybridum</i> ssp. <i>hybridum</i>	-	-	-	+	-
<i>Galium verum</i>	-	-	-	+	+
<i>Knautia arvensis</i> ssp. <i>arvensis</i>	-	-	-	+	-
<i>Alopecurus pratensis</i> ssp. <i>pratensis</i>	-	-	-	+	-
<i>Daucus carota</i>	-	-	-	-	+

Table 8  
(continued)

<i>Euphrasia rostkoviana</i>	-	-	-	+	+
<i>Rumex acetosella</i>	-	-	-	-	+
<i>Stachys officinalis</i>	-	-	-	-	1
<i>Plantago lanceolata</i>	-	-	-	+	+
<i>Festuca pratensis</i>	-	-	-	+	+
<i>Linum catharticum</i>	-	-	-	-	+
<i>Viola declinata</i>	-	-	-	+	-
<i>Trisetum flavescens</i>	-	-	-	-	+
<b>Aliae</b>					
<i>Aegopodium podagraria</i>	+	-	-	-	-
<i>Lamium maculatum</i>	+	-	-	-	-
<i>Urtica dioica</i>	+	-	-	-	-
<i>Impatiens noli-tangere</i>	+	+	-	-	-
<i>Salix caprea</i>	+	-	-	-	-
<i>Aruncus dioicus</i>	1	-	-	-	-
<i>Carex remota</i>	+	-	-	-	-
<i>Tussilago farfara</i>	-	-	+	-	-
<i>Prunella vulgaris</i>	-	+	+	+	+
<i>Cirsium palustre</i>	-	-	+	-	-
<i>Lysimachia vulgaris</i>	-	+	-	-	-
<i>Chaerophyllum aromaticum</i>	-	-	+	-	-
<i>Stellaria nemorum</i>	-	+	-	-	-
<i>Circaea lutetiana</i>	-	+	+	-	-
<i>Salvia glutinosa</i>	-	+	+	-	-
<i>Athyrium filix-femina</i>	-	-	+	-	-
<i>Galeopsis speciosa</i>	-	+	-	-	-
<i>Dryopteris filix-mas</i>	-	-	+	-	-
<i>Lolium perenne</i>	-	-	-	-	+
<i>Medicago lupulina</i>	-	-	-	-	1
<i>Fragaria vesca</i>	-	-	-	+	+
<i>Pteridium aquilinum</i>	-	-	-	-	+
<i>Teucrium chamaedrys</i>	-	-	-	+	-
<i>Euphorbia cyparissias</i>	-	-	-	-	+
<i>Cruciata glabra</i>	-	-	-	+	+
<i>Vicia sepium</i>	-	-	-	+	+
<i>Dianthus carthusianorum</i>	-	-	-	-	+
<i>Linaria vulgaris</i>	-	-	-	+	-

Place and date of relevés: Rel. No. 1 Bistrița river, at the confluence with the Colbu river (Zugreni Gorges area), 27<sup>th</sup> July, 2000; rel. No. 2-3 – along the Bistrița river (Zugreni Gorges area), 27<sup>th</sup> July, 2000; rel. No. 4-5 – around the Zugreni hut (Zugreni Gorges area), 29<sup>th</sup> July, 2000.



11. Ass. *Petasitetum hybridi* (Dostal 1933) Soo 1940

**Area.** This association is settled down on silts, especially in those shady places, on the right bank of the Bistrița river.

**Synecology, structure and floristic composition.** Those phytocoenoses are, sometimes, monodominant, and often there are only a small number of meso-hygrophilous plant species, like the next ones: *Filipendula ulmaria*, *Cirsium oleraceum*, *Telekia speciosa*, *Equisetum palustre* and so on.

This association has a protective role for the river banks, by fixing the silts and by the fact that vegetation withhold a part of the materials carried away by the water flow (Table 8, rel. No. 2–3).

12. Ass. *Festuco rubrae-Agrostetum capillaris* Horv. 1951

**Area.** This association occupies small areas inside this natural reserve, around the Zugreni hut.

**Synecology, structure and floristic composition.** That meadow is edified by *Festuca rubra* and *Agrostis capillaris*. The floristic composition is relatively rich in plant species. This meadow has a high fodder value, being used as a pasture land (Table 8, rel. No. 4–5).

13. Ass. *Telekio speciosae-Alnetum incanae* Coldea (1986) 1990 (= Ass. *Alnetum incanae* auct. roman) -subass. *matteuccietosum* Soó 1962, Lungu 1971

**Area.** This is a vegetal association which covers mostly the banks of the Bistrița river, inside the Zugreni Gorges.

**Synecology.** The dominant species is *Alnus incana*, making a canopy between 0.6–0.7; the heights of the trees are between 8 and 10 m. The characteristic species for this association is *Telekia speciosa*, a carpathian-balcanic floristic element. This species gives a regional feature to this vegetal association, unlike those phytocoenoses edified by *Alnus incana* in the vegetation of the Central and Western Europe.

**Structure and floristic composition.** Here and there, in the herb layer, the dominant species is *Matteuccia struthiopteris*, which makes a vegetal subassociation, namely subass. *matteuccietosum* Soó 1962, Lungu 1971. This subassociation is a pretty rare one in the vegetation of Romania, being settled down only in the mountain area, along the banks of the rivers (Table 9, rel. No. 1–3).

Table 9

Ass. *Telekio speciosae - Alnetum incanae* Coldea (1986) 1990 subass. *Matteuccietosum* Soó 1962, Lungu 1971 (rel. No. 1–3); Ass. *Spiraeo-Coryletum* Ujv. 1944 (rel. No. 4–5). Rel. No. 4–5 – Rarău Mountains (Zugreni Gorges area), 28<sup>th</sup> of July, 2000

Altitude, m.s.l.	700	700	700	760	760
Exposure	–	–	–	S	S
Slope, in degrees	–	–	–	25	25
Canopee	0.6	0.7	0.5	0.9	0.9
Height of the trees, m	8	7	8	13	14

Table 9  
(continued)

Diameter of the trees, cm	20	25	25	25	25
Coverage of the herb layer, %	55	60	60	15	15
Surface of the relevé, sq. m.	100	100	100	400	400
No. of the relevé	1	2	3	4	5
<b>Characteristic species for association</b>					
<i>Alnus incana</i>	3	3	3	–	–
<i>Tilia cordata</i>	–	–	–	3	4
<i>Corylus avellana</i>	–	–	–	2	1
<i>Spiraea chamaedryfolia</i>	–	+	–	–	+
<b>Dif. subas.</b>					
<i>Matteuccia struthiopteris</i>	2	2	1	–	–
<b>Alno-Padion</b>					
<i>Aconitum deganii</i> ssp. <i>paniculatum</i>	+	–	–	–	–
<i>Carex pendula</i>	+	+	–	–	–
<i>Impatiens noli-tangere</i>	1	1	1	+	+
<i>Lysimachia nummularia</i>	+	+	+	–	–
<i>Caltha palustris</i>	+	–	–	–	–
<i>Ranunculus repens</i>	+	–	+	–	–
<i>Galeopsis speciosa</i>	–	+	–	+	–
<i>Stellaria nemorum</i>	–	–	+	–	–
<i>Cirsium oleraceum</i>	+	1	–	–	–
<i>Poa trivialis</i>	–	–	1	–	–
<i>Carex remota</i>	+	–	–	–	–
<i>Angelica sylvestris</i>	–	+	–	–	–
<i>Filipendula ulmaria</i>	+	–	–	–	–
<i>Geranium phaeum</i>	+	+	–	–	+
<i>Circaea lutetiana</i>	+	+	+	+	–
<i>Chaerophyllum hirsutum</i>	+	–	–	–	–
<i>Equisetum telmateia</i>	–	–	+	–	–
<i>Scirpus sylvaticus</i>	–	–	+	–	+
<i>Ribes uva-crispa</i>	+	–	+	–	–
<b>Symphyto-Fagion</b>					
<i>Symphytum cordatum</i>	–	+	–	+	–
<i>Aconitum moldavicum</i> ssp. <i>moldavicum</i>	+	–	–	+	–
<i>Campanula latifolia</i>	–	–	–	+	–
<i>Phegopteris connectilis</i>	–	–	–	+	+
<i>Silene dioica</i>	+	–	–	–	+
<b>Fagetalia</b>					
<i>Fagus sylvatica</i>	–	–	–	+	–
<i>Acer pseudoplatanus</i>	–	+	–	+	+
<i>Daphne mezereum</i>	–	–	+	+	+
<i>Salvia glutinosa</i>	+	+	+	+	+
<i>Athyrium filix-femina</i>	–	+	–	–	+

Table 9  
(continued)

<i>Stachys sylvatica</i>	+	–	+	–	+
<i>Mercurialis perennis</i>	–	–	–	+	–
<i>Dryopteris filix-mas</i>	–	–	–	+	+
<i>Moehringia trinervia</i>	–	–	–	+	+
<i>Paris quadrifolia</i>	–	–	–	–	+
<b>Quercio-Fagetea</b>					
<i>Scrophularia nodosa</i>	–	+	–	+	–
<i>Glechoma hirsuta</i>	+	–	+	–	–
<i>Geum urbanum</i>	+	+	–	+	+
<i>Mycelis muralis</i>	1	–	–	+	–
<i>Vicia sylvatica</i>	–	–	–	+	–
<i>Oxalis acetosella</i>	–	–	–	+	+
<i>Galium schultesii</i>	–	–	–	+	+
<i>Lilium martagon</i>	–	–	–	+	–
<i>Asarum europaeum</i>	–	–	–	–	+
<i>Actaea spicata</i>	–	–	–	–	+
<i>Cirsium erysithales</i>	–	–	–	+	–
<i>Maianthemum bifolium</i>	–	–	–	+	+
<i>Dactylis glomerata</i> ssp. <i>aschersoniana</i>	–	–	–	+	–
<b>Vaccinio-Piceetea</b>					
<i>Picea abies</i> juv.	–	–	–	+	+
<i>Sorbus aucuparia</i> juv.	–	–	–	+	–
<i>Hieracium rotundatum</i>	–	–	–	–	+
<i>Streptopus amplexifolius</i>	–	–	–	+	–
<i>Luzula luzuloides</i>	–	–	–	–	+
<b>Adenostyletalia</b>					
<i>Senecio nemorensis</i> ssp. <i>fuchsii</i>	1	–	–	+	–
<i>Thalictrum aquilegiifolium</i>	+	–	–	+	+
<b>Salicetalia</b>					
<i>Salix purpurea</i>	+	–	–	–	–
<i>Salix fragilis</i>	–	+	–	–	–
<b>Aliae</b>					
<i>Urtica dioica</i>	–	+	+	+	+
<i>Prunella vulgaris</i>	+	+	+	–	–
<i>Bellis perennis</i>	+	+	+	–	–
<i>Rumex sanguineus</i>	+	–	–	–	–
<i>Glechoma hederacea</i>	+	–	–	–	–
<i>Rubus idaeus</i>	+	–	–	–	–
<i>Aegopodium podagraria</i>	+	+	–	–	–
<i>Fragaria vesca</i>	–	+	–	–	–
<i>Lysimachia vulgaris</i>	–	–	+	–	–
<i>Mentha longifolia</i>	–	–	+	–	–
<i>Potentilla anserina</i>	–	+	+	–	–

Table 9  
(continued)

<i>Trifolium repens</i> ssp. <i>repens</i>	+	+	+	-	-
<i>Dactylis glomerata</i> ssp. <i>glomerata</i>	-	+	-	-	-
<i>Chaerophyllum aureum</i>				-	+
<i>Galeopsis tetrahit</i>	+	-	-	-	-
<i>Campanula patula</i> ssp. <i>patula</i>	-	+	-	-	-
<i>Alopecurus pratensis</i> ssp. <i>pratensis</i>	-	+	-	-	-
<i>Vicia sylvatica</i>	+	-	-	-	-
<i>Typhoides arundinacea</i>	+	-	-	-	-
<i>Alchemilla vulgaris</i> s.l.	+	-	+	-	-
<i>Potentilla reptans</i>	+	-	-	-	-
<i>Valeriana tripteris</i>	-	-	-	+	-
<i>Gentiana asclepiadea</i>	-	-	-	+	+
<i>Lamium stramonium</i>	-	-	-	+	-

Place and date of relevés: rel. No. 1-3 – Banks of the Bistrița river (Zugreni Gorges area), 27<sup>th</sup> July, 2000.

14. Ass. *Spiraeo-Coryletum* Ujv. 1944 (= Ass. *Corylo-Tilietum cordatae* Vida 1959).

**Area.** The phytocoenoses of this association are settled down at the base of the Rarău Massif, making transition towards the next vegetal association. Although the surfaces with those phytocoenoses are small, they are making a relatively well closed vegetation, though it is quite heterogeneous from the coenotic point of view. This association has been described also by Vida from the Parâng Mountains (1959) and from the Retezat Mountains (the valley of Râul Mare), Țarcu Mountains, Godeanu Mountains and Cernei Mountains (N. Boșcaiu, 1971).

**Synecology, structure and floristic composition.** It seems that this vegetation type has a relatively recent origin, as results of some pre-existent dissemination of hazel-tree and lime-tree; that kind of dissemination is favored by the stress of the anthropogenic factor over the spruce forests in that region. In this evolution phase, that kind of vegetation seems to be in the climax stage (Table 9, rel. No. 4-5).

15. Ass. *Betulo-Pinetum* Burduja et Ștefan 1982 (= Ass. *Leucobryo-Pinetum* Matuszk. 1962, *betuletosum pendulae* (Burduja et Ștefan 1982) Coldea 1991).

**Area.** The phytocoenoses of this association are settled down only on the slopes, more or less steep, of the Rarău Massif, inside the Zugreni Gorges. The inclination of the slopes is between 25 and 35 degrees. The soil is superficial, acidophilous, skeletal, being interrupted by the numerous rocks existing there.

**Synecology, structure and floristic composition.** The density of the stands with birch and red pine trees is between 0.6 and 0.9. The heights of the trees are between 12 and 16 m. Beside the edifier plant species, there are others, like: *Picea*

*abies*, *Acer pseudoplatanus*, *Sorbus aucuparia* and so on. The shrub layer is well represented by *Chamaecytisus ratisbonensis*, *Vaccinium myrtillus*, *Vaccinium vitis-idaea* and so forth. The herbaceous layer makes coverages between 5% and 35%.

Regarding the origin of these pine stands one asserts they are diluvian relics, being maintained there from the pleistocene era. These phytocoenoses represent, sometimes, transition stages towards the zonal vegetation (here, the spruce forests).

This association plays an important eco-protective function for those lands on the slopes (Table 10, rel. No. 1–4).

Table 10

Ass. *Betulo-Pinetum* Burduja et Ștefan 1982 (rel. No. 1–4); Ass. *Hieracio rotundati-Piceetum* Pawl. et Br.-Bl. 1939 (rel. No. 5–6).

Altitude, m.s.l.	790	840	850	830	1400	1200
Exposure	N-E	N-E	N-E	N-E	N-E	N-E
Slope, in degrees	30	25	30	30	30	25
Canopee	0.8	0.7	0.9	0.6	0.7	0.9
Height of the trees	12	13	16–18	16	25	22
Diameter of the trees, cm	8–25	8–25	8–25	8–25	35	45
Coverage of the herb layer, %	25	35	5	50	25	15
Coverage of the regeneration layer, %	6	8	6	7	5	5
Surface of the relevé, sq. m.	400	400	400	400	400	400
No. of the relevé	1	2	3	4	5	6
<b>Characteristic species for association</b>						
<i>Pinus sylvestris</i>	2	3	4	+	–	–
<i>Betula pendula</i>	2	–	1	4	+	–
<i>Picea abies</i>	+	1	1	+	4	5
<i>Hieracium rotundatum</i>	–	–	+	–	+	+
<b>Dicrano-Pinion</b>						
<i>Orthilia secunda</i>	+	+	–	–	–	–
<i>Chamaecytisus ratisbonensis</i>	+	–	–	–	–	–
<b>Vaccinio-Piceetalia et Vaccinio-Piceetea</b>						
<i>Asplenium trichomanes-ramosum</i>	+	+	–	–	–	–
<i>Hieracium umbellatum</i>	+	+	–	–	–	–
<i>Sorbus aucuparia</i>	–	+	+	+	–	+
<i>Melampyrum sylvaticum</i>	1	+	–	–	+	+
<i>Luzula luzuloides</i>	–	–	+	2	+	–
<i>Cruciata glabra</i>	–	–	+	–	–	–
<i>Clematis alpina</i>	–	–	+	–	+	–
<i>Maianthemum bifolium</i>	–	–	+	–	1	1
<i>Phegopteris connectilis</i>	–	–	+	–	+	–
<i>Vaccinium myrtillus</i>	–	–	–	2	1	1
<i>Vaccinium vitis-idaea</i>	–	–	–	+	+	–
<i>Silene dioica</i>	+	–	–	–	–	+
<i>Homogyne alpina</i>	–	–	–	–	+	–
<i>Calamagrostis villosa</i>	–	–	–	–	1	+
<i>Veronica officinalis</i>	–	–	–	–	+	–

Table 10  
(continued)

<i>Soldanella hungarica</i> ssp. <i>major</i>	-	-	-	-	-	+
<i>Gymnocarpium dryopteris</i>	-	-	-	-	+	+
<i>Luzula sylvatica</i>	-	-	-	-	+	+
<i>Dryopteris dilatata</i>	-	-	-	-	+	-
<i>Campanula patula</i> ssp. <i>abietina</i>	-	-	-	-	+	+
<i>Lycopodium annotinum</i>	-	-	-	-	+	-
<i>Huperzia selago</i>	-	-	-	-	+	-
<i>Oxalis acetosella</i>	-	-	-	-	1	1
<i>Calamagrostis arundinacea</i>	+	-	+	+	+	-
<b>Quercu-Fagetea</b>						
<i>Symphytum cordatum</i>	-	-	-	-	-	+
<i>Pulmonaria rubra</i>	-	-	-	-	-	+
<i>Lonicera xylosteum</i>	+	+	+	-	+	+
<i>Cardaminopsis arenosa</i> ssp. <i>borbasii</i>	+	-	+	-	-	-
<i>Salvia glutinosa</i>	+	+	-	-	-	+
<i>Rubus idaeus</i>	+	+	-	-	-	-
<i>Veronica urticifolia</i>	-	+	+	+	+	+
<i>Ribes uva-crispa</i>	-	-	+	-	-	-
<i>Brachypodium sylvaticum</i>	-	-	+	-	-	-
<i>Rosa pendulina</i>	-	-	+	-	-	-
<i>Galeopsis speciosa</i>	-	-	+	-	-	-
<i>Galium schultesii</i>	-	-	+	-	-	-
<i>Viola reichenbachiana</i>	-	-	+	-	-	-
<i>Campanula persicifolia</i>	-	-	+	+	-	-
<i>Fagus sylvatica</i>	-	-	+	-	-	1
<i>Actaea spicata</i>	-	-	+	-	-	-
<i>Corylus avellana</i>	-	-	+	-	-	-
<i>Daphne mezereum</i>	-	-	+	-	+	+
<i>Tilia cordata</i>	-	-	+	-	-	-
<i>Campanula trachelium</i>	-	-	+	+	-	-
<i>Acer pseudoplatanus</i>	-	-	+	-	-	+
<i>Tanacetum corymbosum</i>	-	-	+	-	-	-
<i>Cirsium erysithales</i>	-	-	+	-	-	-
<i>Polygonatum verticillatum</i>	-	-	+	-	+	+
<i>Athyrium filix-femina</i>	-	-	-	-	1	1
<i>Ranunculus carpaticus</i>	-	-	-	-	-	+
<i>Streptopus amplexifolius</i>	-	-	-	-	-	+
<i>Mycelis muralis</i>	+	+	+	-	-	+
<i>Lamiastrum galeobdolon</i>	-	-	-	-	-	+
<i>Epilobium montanum</i>	-	-	-	-	+	+
<i>Dryopteris filix-mas</i>	-	-	-	-	+	-
<b>Asplenietea</b>						
<i>Silene nutans</i> ssp. <i>dubia</i>	+	+	+	+	-	-
<i>Cystopteris fragilis</i>	+	-	-	-	-	-
<i>Polypodium vulgare</i>	-	+	+	-	+	-

Table 10  
(continued)

<i>Valeriana tripteris</i>	-	+	-	-	+	-
<i>Spiraea chamaedryfolia</i>	+	-	+	+	-	+
<i>Valeriana montana</i>	-	-	+	-	-	-
<i>Asplenium trichomanes</i> ssp. <i>trichomanes</i>	-	-	+	-	-	-
<b>Thlaspietalia</b>						
<i>Gymnocarpium robertiana</i>	-	+	-	-	-	-
<i>Galium album</i>	-	-	-	+	-	-
<b>Elyno-Seslerietea</b>						
<i>Poa rehmannii</i>	1	1	-	-	-	-
<b>Trifolio-Geranietea</b>						
<i>Bupleurum falcatum</i>	+	-	-	-	-	-
<i>Seseli libanotis</i>	+	+	-	-	-	-
<b>Festuco-Brometea</b>						
<i>Carlina vulgaris</i>	+	-	-	-	-	-
<i>Chamaecytisus hirsutus</i>	-	+	-	-	-	-
<i>Jovibarba globifera</i> ssp. <i>globifera</i>	+	+	-	-	-	-
<i>Sedum maximum</i>	-	+	-	-	-	-
<i>Campanula sibirica</i> ssp. <i>sibirica</i>	-	+	-	-	-	-
<i>Festuca rupicola</i>	-	-	-	+	-	-
<i>Scabiosa columbaria</i> ssp. <i>columbaria</i>	-	-	-	+	-	-
<i>Biscutella laevigata</i>	-	-	-	+	-	-
<b>Adenostyletalia</b>						
<i>Senecio nemorensis</i> ssp. <i>fuchsii</i>	-	-	-	-	+	+
<i>Rosa pendulina</i>	-	-	-	-	-	+
<i>Cicerbita alpina</i>	-	-	-	-	1	-
<i>Adenostyles alliariae</i> var. <i>kernerii</i>	-	-	-	-	+	-
<b>Aliae</b>						
<i>Solidago virgaurea</i> ssp. <i>virgaurea</i>	-	+	-	+	-	+
<i>Fragaria vesca</i>	+	+	+	-	+	+
<i>Valeriana officinalis</i> ssp. <i>officinalis</i>	-	-	+	-	-	-
<i>Hieracium argillaceum</i>	-	-	+	-	-	-
<i>Dianthus tenuifolius</i>	-	-	-	+	-	-
<i>Gentiana asclepiadea</i>	-	-	-	-	+	-
<i>Rubus idaeus</i>	-	-	-	-	+	+
<i>Populus tremula</i>	-	-	-	-	-	+

Place and date of relevés: rel. No. 1-4: Rarău Mountains (Zugreni Gorges area), 28<sup>th</sup> July, 2000; rel. No. 5-6 the Bistrița Mountains (Pietrosul Bistriței Peak), 29<sup>th</sup> July, 2000.

#### 16. Ass. *Hieracio rotundati-Piceetum* Pawl. et Br.-Bl. 1939

**Area.** This association represents, as a matter of fact, the spruce forests from Zugreni Gorges; the spruce stands is characteristic for the high belt of vegetation in the mountain areas in the Eastern Carpathians.

**Synecology.** The canopy is between 0.7 and 0.9, and the heights are between 15m and 25m. Those spruce forests belong to the quality class I–II, being framed out into the 1<sup>st</sup> group of protective class vegetation (they extract only those trees which are fallen down by the strong winds or are dried); the age of those stands is between 80 and 160 years.

**Structure and floristic composition.** In those spruce forests, there are sporadically met, beside *Picea abies*, other plant species, like the next ones: *Abies alba*, *Sorbus aucuparia*, *Acer pseudoplatanus*, *Fagus sylvatica*, *Betula pendula*, *Populus tremula* and so on. The soils are prevalently umbric, rich in humus. The herbaceous layer covers the soil between 15% and 25% (Table 10, rel. No. 5–6).

### CONCLUSIONS

1. In the natural reserve “Zugreni Gorges” there are some rare and endemic plant species (in the Romanian vascular flora), such as: *Euonymus nana*, *Leontopodium alpinum* and so on. On Pietrosul Bogolin peak (ca. 1 650 m.s.l.), there is a local endemic species, namely *Pietrosia laevitomentosa*;
2. The vegetation inside this natural reserve is dominated by the phytocoenoses of the next associations: *Betulo-Pinetum* and *Hieracio rotundati-Piceetum*;
3. Also, there is a strictly endemic vegetal association, namely ass. *Sempervivo soboliferae-Andryaletum laevitomentosae*.

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