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PROF. DR. KAREL DOMIN:

The Plant Associations of the Valley of Radotín.

Introductory Remarks.

The valley of Radotín is from the geobotanical standpoint a really ideal territory for detailed sociological and ecological studies. Although of no great extent it has, however, an exceptional number of natural and seminatural associations; besides it is floristically very rich and remarkable in its evolution, as it is a meeting point of Pannonian, Hercynian and dealpine elements, and even submountain mixed woods reach our region although it is of no great elevation. For the study of edaphic and microclimatic factors this territory is really classical; moreover it is possible to study here secondary influences on the original plant covering and the rapid formation of secondary associations, which appear to be often already stabilised and natural; but one can trace also the succession of different plant communities, the penetrant effect of exposure, so that this small territory offers an inexhaustible multitude of geobotanical problems to be solved. Most of the associations are here developed either in typical form or fragmentary, but there are also many initial and transitionary stages. Associations of limestone soils are, of course, predominant, and we find them here in best development; but there are besides on non-calcareous soil Hercynian associations, the contrast of which to the others is astonishing. The plant communities developed here at the present time are mostly natural, it is true, but very often not autochtonous. It is therefore one of the most interesting tasks to try to reconstruct the original plant covering out of its remains preserved to this day. This, I think, may lead us to general results, very important for the reconstruction of the original plant covering of the Central Bohemian Siluro-Devonian massif. Of the successions the most remarkable one is surely the gradual change of the dealpine mountain Seslerieta into a Pannonian steppe. In places we find these two genetically antagonistic and also ecologically essentially different associations in close proximity.

Very far-reaching is the influence of exposure. We observe this in the general physiognomy (for instance steppes and semi-steppe meadows on slopes facing *S* or *SE* and woods on the opposite northern slopes) as well as in the detailed distribution, as for instance on the rocky tooth-like projection above Kalina's mill, a classic example of how the exposure under otherwise quite unchanged conditions causes entirely different habitats.

Our territory is a wonderful example of a Siluro-Devonian calcareous mountain system, through which flows a brook, the erosion of which gave origin to a narrow and deep valley, in places resembling a canyon. The valley of Radotín is situated not far from Prague in a south-westerly direction and runs into the wide valley of the river Berounka, a tributary of the Vltava. Radotín, near the mouth of the brook Radotínský potok, is 200 *m* and the valley itself

from 250 to 350 *m* above sea-level; the steep and often rocky slopes attain a height of even more than 100 *m*.

In this study, which is to be followed by a detailed monography, is included the valley from Radotín to behind Kalina's second mill. Its beginning (or more correctly the end of the valley) starts from Radotín in a north-western direction, near the hill Homolka it bends to the east, and by the pond behind the first mill of Kalina, where to the north and north-east an interesting side valley branches off in the direction towards Zadní Kopanina, it turns south-west.

Several side valleys divide our territory into distinct plateaus, of which one of the largest extends between Radotín and Kosoř (the so-called Velký háj). This mountain plateau drops steeply into the valley of Radotín and yet more steeply on its northern side into the narrow and deep valley of Kosoř. Facing this plateau, on the north-east side of the main valley, rises the Malý háj and Hradiště, which extends as far as opposite Homolka, a rounded hill with the orchard „Višňovka" near the bend of the main road.

Around Homolka the way branches off to Lochkov; quite near is the mill of Jan Mašek, formerly Emanuel Mašek. From there the valley of Radotín turns more to the east, continues as far as the mill „u Šarbochů" and further on along the brook, accompanied on the road by a prominent row of *Populus pyramidalis*, under a very steep and high rocky slope on the northern side to the quarry of Bárta & Tichý, continuing further to Cikánka and then to Špaček's mill and the nearby Kalina's mill, where there is a little pond. Here the valley turns to *SW* and continues, narrow and romantic, to the second Kalina mill.

Limestone is of course the predominant rock and non-calcareous schists occur only to a very small extent. On the plateaus are usually more or less sandy alluvian deposits and their influence manifests itself in the more acid soils on which Hercynian vegetation has settled.

Years ago I have chosen the valley of Radotín for a monographical geobotanical survey, and Dr. Alfred Hilitzer and Dr. Alois Zlatník took upon them the task of studying the microclimatic and edaphic conditions. As the survey of the whole territory is not yet finished, I give at least a preliminary Synopsis of the plant associations according to the innumerable sociological analyses I have made. The sociological conditions of this territory are surely very remarkable and give us splendid opportunity for the discussion of many a geobotanical problem.

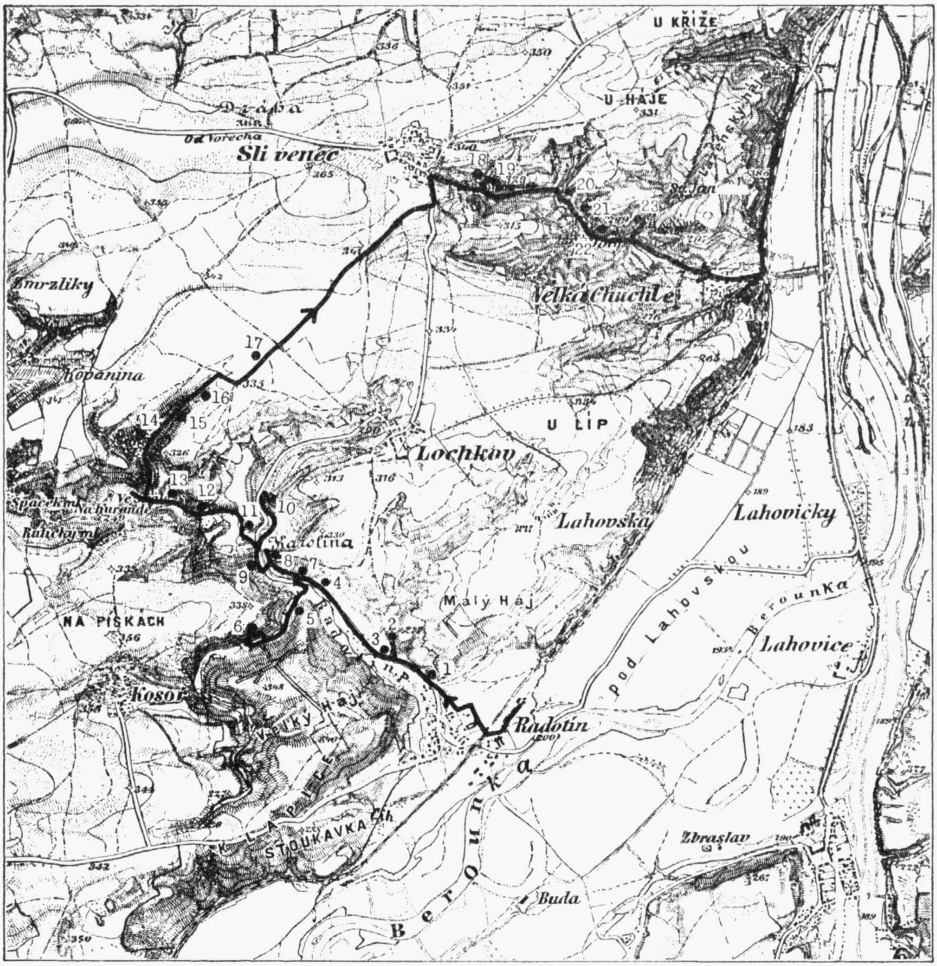
The sociological methods I used, I explained already in my book on the subject*); the frequence, as far as it is stated, is given in a scala of 10 degrees, which I have explained in my paper „Festucetum carpaticae".**)

For the scientific evaluation of the plant covering of our territory the sociological methods must be adapted to the changeability of the habitat, often to be observed on the smallest area, and to the corresponding change of fragmentary or transitional associations.

The usual statistical analyses do not give a clear picture of this or that community, as they include partly incomplete association-individuals, partly abnormal types and such into which penetrate elements out of adjacent associations. This is of course not the case in other territories in which the individual associations are

*) K. DOMIN „Problems and methods of Plant Sociology", Prague 1923 (in Czech language with English Summary).

**) K. DOMIN „Festucetum carpaticae in the Tatras of Biela", Bull-Intern. de l'Acad. des Sciences de Bohême 1925.



A Topographical map of the valley of Radotín.
(By courtesy of the Government Geolog. Institut.)

spread over extensive areas, so that they themselves were able to develop fully. Sometimes, however, this or that association is well developed even on a small area, showing most of its characteristic components, which happens, however, usually only when the habitat and with it the vegetation are not influenced by the adjacent plant community. In this manner we sometimes find fully developed grassland associations (for instance Festucetum vallesiacae, Caricetum humilis, Stipetum capillatae, Cladonietum rangiformis stepposum and others) on a calcareous sunny southern slope, even in cases when some association is confined on a small space. If, however, some of those associations occupy small enclosures in a xerophilous wood, then the habitat is

influenced by shrubs and trees which not seldom brings about a mixture of the constituents of two or more associations.

The minimi-area of the grassland associations is usually quite small (1 m^2), but nevertheless my analyses include either the whole association-individual or at least that part of it where the association was typically developed. One example may suffice to show the effect of enlarging the analysed area on the constitution of the association. On the edge of the plateau of the Velký háj opposite Kosoř on the gentle southern (resp. south-southwestern) slope on rather rocky ground with a thin layer of humus a nearly, but not entirely closed Caricetum humilis shows on an area of one square meter the following composition:

Carex humilis covers nearly $^2/_3$ of the overgrown surface.

Teucrium chamaedrys covers nearly $^1/_3$ of the overgrown surface.

Festuca sulcata in scattered tufts.

Fairly abundantly scattered are: *Potentilla arenaria*, *Sedum aere*, *S. boloniense*.

Scattered: *Pulsatilla nigricans*, *Thymus Löwyanus* var. *stenophyllus*, *Erysimum crepidifolium*.

Rarely scattered: *Arabis auriculata*, *Sanguisorba minor*, *Centaurea rhenana*.

Solitary: *Medicago minima*, *Alyssum calycinum*, *Helianthemum ovatum*.

Having enlarged the analysed area from 1 m^2 to 4 m^2 and afterwards to 8 m^2, I did not ascertain even then any new species. Only after yet much greater enlargment appeared *Salvia pratensis*, *Medicago falcata* and *Arabis hirsuta*.

In other associations, however, only an analysis of an extensive area can give a true picture of their composition, especially so in wood communities.

The rocky ridge near the first MAŠEK'S mill (opposite Hradiště) shows in a very instructive manner how a varied mosaic of associations and their variants (resp. societies) can develop itself on a comparatively small area. I was able to distinguish here the following communities:

1. A community of rock plants of the southern slope (without *Sesleria calcaria*, with *Stipa* etc). This community represents in reality an association type.
2. A mossy community of rock plants of the northern slope (with *Sesleria*).
3. A more xerophilous and sparsely mossy community of rock plants of the northern slope, with *Sesleria*, characteristic for the upper zone.
4. A community on stony rubble.
5. A community on slope rubble.
6. Closed *Seslerietum* on the northern slope.
7. Semiclosed Seslerietum with very plantiful *Primula officinalis* and *Campanula persicifolia*.
8. Semiclosed Seslerietum with very plentiful *Anemone silvestris*.
9. Semiclosed xerophilous Seslerietum with *Helianthemum canum*.
10. Shrubby thickets with plentiful herbs of a weed character.
11. Open hazel woods.
12. Shrubby *Carpinus* — *Quercus* ridge woods.

Very often it happens that allied communities are combined into an association type which seems to be an integral unit, although it is a combination of independent associations which are interspersed according to the change of the habitat. In consideration of this fact I tried to separate such association types into their true constituents.

Synopsis of the Plant Associations.

A. **Woodland communities.**

I. HERCYNIAN.

These floristically poor and monotonous communities are everywhere to be found on poor non-calcareous soils. Detailed study convinced me of the secondariness of the spruce forest (more extensive only on the plateau between Radotín valley and Kosoř and its slopes) as well as of the pine forest. It seems that the spruce is not at all autochtonous in our territory, whereas the pine *(Pinus silvestris)* seems to be so, but surely without having grown in pure growths; it must have grown scattered on rocks and on rocky slopes or intermixed with oaks and other deciduous trees. A characteristic Hercynian forest community is doubtlessly represented by the Hercynian deciduous woods, which surely must have been originally more widely distributed. Forest culture replaced them in part by coniferous forest, and in the wake of the latter a secondary heath vegetation gained foothold. On the whole one may say that the common pine *(Pinus silvestris)* is not so destructive for the original vegetation of the Hercynian woods as the spruce *(Picea excelsa)*. Even on limestone the spruce forest in time brings about a considerable change in the soil and light conditions, and with it of course also a change in the undergrowth. Sometimes we observe in close proximity pine forest, oak woods and mixed pine and oak growths, all with practically the same undergrowth, so that sociological analyses show nearly the same result. The spruce forest is very destructive to the herbaceous undergrowth of the woods; this is due partly to the acidity of the needles, partly to the deep shade, very injurious especially in spring.

Proceeding from the analyses of the undergrowth I have no doubt whatever that there were originally in our region also on non-calcareous soil woods with a rather rich herbaceous undergrowth without heath types. But most of these woods were so impoverished by the edaphic conditions getting worse and worse, that I have been till now unable to analyse a really typical growth. On the plateau between Radotín and Kosoř (Velký háj) there are at least fragments or atypical growths of such woods. Thus there occur in one of these fragmentary woods, formed by oak and white beech, *Luzula nemorosa* in great abundance; next in abundance is *Stellaria holostea*. further there are *Poa nemoralis, Orobus vernus, Galium silvaticum, Lilium martagon, Anemone nemorosa, Symphytum tuberosum, Ranunculus auricomus, Vicia silvatica* (rare) and others.

Such a forest type can originate only on the plateau there, where leaves are accumulating and cannot be carried away on account of the flatness of the ground; therefore there is more leaf-mould conducive to the growth of wood plants.

The chief Hercynian wood associations (natural and secondary) are as follows:

1. **Hercynian spruce forests.**

This is a secondary community, as the spruce *(Picea excelsa)* is not autochtonous in our region. Especially young spruce forests have a decisive influence upon the undergrowth. To a great extent the ground is usually covered with moss (mostly common Hercynian Bryophyta); the most characteristic vascular plants are here: *Festuca ovina, Deschampsia flexuosa, Agrostis vulgaris, Vaccinium myrtillus, Luzula nemorosa, Anemone nemorosa, Gnaphalium silvaticum,*

Antennaria dioica, Rumex acetosella. On the whole one may say that these spruce forests are of the same sociological constitution as the subxerophilous spruce forests in the lower parts of the Brdy mountains.

On the slope above Špaček's mill — where there is a strip of spruce forest in the midst of calcareous associations — I found a very remarkable and quite different type of Picetum. The young forest is mostly quite bare, without any undergrowth, but approximately in the middle part of it there is a luxuriant mossy undergrowth (consisting chiefly of *Hylocomium triquetrum)*, in which portion there are growing: of woody plants scattered *Carpinus betulus, Crataegus monogyna, Daphne mezereum, Cotoneaster integerrima, Viburnum opulus, Berberis vulgaris, Sorbus aria* and solitary *Rhamnus cathartica,* of herbaceous plants *Cirsium pannonicum* is very abundant, scattered are *Cirsium acaule, Primula officinalis, Chrysanthemum corymbosum, Anemone silvestris, Polygonatum officinale, Teucrium chamaedrys, Clinopodium vulgare, Galium boreale* and *G. silvaticum,* rarely *Melica nutans* and *Asperula tinctoria.*

Of course this spruce forest does not belong to the association of Hercynian spruce forests, but it is likewise not in conformity with some of the forest communities on calcareous soil. It is a new community brought forth by the altered conditions of environment.

2. Hercynian Pine Forests.

These also are a secondary community. Where they occupy the place of the original Hercynian woods, they usually show nearly the same undergrowth as the latter, and therefore I give their analyses when writing of those woods. The most prominent plant of their undergrowth is usually *Festuca ovina;* sometimes they show also the character of the heath or they are quite bare with but a little moss.

The secondary pine forest on calcareous soil has nothing in common with Hercynian pine forests. In it we find more or less modified limestone-, forest-, as well as open communities. We find them well developed for instance on Hradiště (opposite Mašek's first mill) and also along the upper edge of the slope opposite Bárta's quarry. Here we find for instance a secondary highstemmed pine forest (on limestone) with a Seslerietum calcariae as undergrowth, with abundant *Primula officinalis,* with *Chrysanthemum corymbosum, Brachypodium pinnatum* and with a very rich bushy undergrowth *(Cornus mas, Corylus avellana, Cotoneaster integerrima, Lonicera xylosteum, Sorbus torminalis, Ligustrum vulgare).* As is to be seen, there is not a single species of those characteristic for the Hercynian forest communities present here.

On Hradiště we find on limestone also cultivated Pinetum austriacae with white beech *(Carpinus betulus).* The undergrowth is partly secondary, partly consisting of elements of the original community, which was undoubtedly a shrubby wood; even *Sambucus ebulus* — growing gregariously along the brook below Hradiště — penetrated so far as this Pinetum. But open spaces are of course also rather plentiful; there we find either Seslerieta or a luxuriant subxerophilous vegetation with *Cirsium eriophorum* and *C. acaule* (both very abundant); very abundant are also *Hieracium canofloccosum* and *Anthericum ramosum,* abundant *Teucrium chamaedrys, Primula officinalis, Thlaspi montanum Campanula persicifolia;* scattered are *Ononis repens, Hypericum hirsutum, Epipactis rubiginosa* and others.

Also this forest community is, of course, not a Hercynian one.

3. Hercynian Subxerophilous Woods.

These woods — in which the oak predominates but which are usually mixed (especially with white beech and common pine) — are in Central Bohemia commonly distributed on non-calcareous soil; I was the first to point them out as an independent association. This association is without the slightest doubt an original one, although it was of course not spared by the influences of culture. But as the undergrowth is very poor and modest in its demands, the composition of the association very often does not change even when another tree is introduced by culture. Only the spruce can have a penetrating influence on the change in this association, whereas the common pine, not casting so much shadow on the ground, does not destroy all the undergrowth of these woods.

In the valley of Radotín calcareous wood communities are of course predominant, but nevertheless our Hercynian wood communities occur also rather plentifully, being, however, restricted to non-calcareous soils. Such soils are either washed out soils, schistous rocks or alluvial layers lying often on plateaus on limestone. In some places the undergrowth has not changed when these deciduous woods have been replaced by cultivated pine forest. For this reason I do not separate these pine forests from the respective deciduous Hercynian woods. In general the composition appears, on the basis of 12 analyses of different growths, as follows:

Woody plants:

Quercus (*sessilis* and *robur* in varying proportion) forms most often the principal part of the growth (pure or mixed Hercynian oak forest, Quercetum hercynicum).

Carpinus betulus interspersed to plentiful, rarely missing.

Pinus silvestris is either missing or more or less interspersed, sometimes predominant and forming secondary Hercynian pine forests.

Here and there interspersed (sometimes missing): *Sorbus torminalis, S. aria* (intruding), *Cornus sanguinea, C. mas* (intruding), *Acer campestre, Rubus* sp., *Crataegus oxyacantha* or *C. monogyna, Rosa gallica, R. Jundzillii, R. canina* (or allied species), *Salix capraea, Daphne mezereum* (intruding), *Tilia platyphylla, Populus tremula, Juniperus communis.* These shrubs have a very low constancy as they were found in 12 analyses with a few exceptions only once or twice.

Grasses and grasslike plants:

a) with high constancy:

Festuca ovina is the most important through its constancy (100%) as well as through its high dominance.

Deschampsia flexuosa with a constancy of 80% but no great dominance.

Agrostis vulgaris with a constancy of 50%.

Luzula nemorosa with a constancy of 50%, sometimes also with considerable dominance.

Poa nemoralis with considerable constancy (50%) but without influencing much the physiognomy.

Anthoxanthum odoratum with a constancy of 30% but with a negligible dominance.

Carex digitata with the same constancy.

b) with low constancy:

Melica nutans, Brachypodium pinnatum, Luzula campestris and *Carex montana* in two or three analyses, *Calamagrostis arundinacea, Brachypodium silvaticum, Poa pratensis, Phleum phleoides, Holcus lanatus, Festuca rubra* only in one analysis.

Herbs:

a) with high or medium constancy:

Chrysanthemum corymbosum
Melampyrum pratense
Platanthera bifolia
} with a constancy of 60%

Hieracium with a constancy of 80%, only, of course, when including different species, that is *H. laevigatum, H. murorum, H. vulgatum* (with non-spotted leaves), *H. silvestre, H. pilosella.*

Veronica officinalis
Campanula persicifolia
} with a constancy of 50%

Fragaria vesca
Cephalanthera alba
Campanula rotundifolia
Genista germanica
Calluna vulgaris
Vaccinium myrtillus
Silene nutans
} with a constancy of 30%.

b) with a low constancy:

α) in two analyses represented:

Anemone nemorosa
Antennaria dioica
Betonica officinalis
Convallaria majalis
Cytisus nigricans
Galium silvaticum
Galium silvestre
Hypericum perforatum
Melampyrum nemorosum
Peucedanum oreoselinum
Pimpinella saxifraga
Potentilla alba
Primula officinalis
Trifolium alpestre
Veronica chamaedrys

β) only in one analysis were registered:

Arabis hirsuta
Asarum europaeum
Astragalus glycyphyllus
Campanula patula
Digitalis ambigua
Eryngium campestre
Fragaria viridis
Galium vernum
Galium boreale
Galium verum
Genista tinctoria
Hepatica triloba
Hypericum montanum
Orobus niger
Orobus vernus
Polypodium vulgare
Potentilla opaca
Pulmonaria obscura
Sanguisorba minor
Serratula tinctoria
Stellaria holostea
Symphytum tuberosum
Teucrium chamaedrys
Trifolium medium
Viola silvatica
Viola Riviniana

Bryophyta and lichens:

The undergrowth ist often very mossy, in other cases the mosses are nearly or quite missing. Very abundant, even dominant are sometimes common Hercynian species. Very common are:

Brachythecium velutinum
Catharinea undulata
Dicranum scoparium
Dicranum undulatum
Hylocomium splendens
Hypnum cupressiforme
Hypnum Schreberi
Mnium undulatum
Plagiochila asplenioides
Polytrichum commune
Polytrichum juniperinum
Webera nutans

Of lower constancy are:

Barbula sp.
Bryum sp. (especially *capillare*)
Ceratodon purpureus
Dicranella heteromala
Dicranum fulvum
Eurhynchium striatum
Fissidens sp. (especially *decipiens*)
Hylocomium triquetrum
Lophocolea bidentata
Lophozia sp.
Mnium affine
Plagiothecium sp.
Racomitrium canescens

Of lichens we find:

Cladonia alcicornis
Cladonia fimbriata
Cladonia furcata
Cladonia pyxidata
Cladonia silvestris
Parmelia physodes
Peltigera canina

The association of the Hercynian mixed oak forest — with *Festuca ovina* as the leading plant of the undergrowth — is floristically exceedingly poor, but in the neighbourhood of rich wood communities on limestone it is uncommonly striking through the contrast it offers. The above list refers to analyses of rather extensive growths, because we could not got a true picture of the composition of this association by analysing the usual quadrats. It is of course possible to distinguish some variant of this Hercynian wood association. Typical growths are subxerophilous, very poor, often only with a very few species on an extensive space. In some places there penetrate into the undergrowth mesophilous indifferent wood plants, sometimes — though exceptionally — even species from more humous soils, and in this manner can originate transitional types to the more humous woods of non-calcareous soil.

We can study these Hercynian woods very well on the plateau extending from the rocky tooth-like projection with *Saxifraga aizoon* above the valley of Zadní Kopanina. The slopes there have choice limestone communities (bushes, woods, Seslerieta, Cariceta humilis and different steppe- and semi-steppe — meadows), but the very moment we reach the plateau we observe a striking change. The cause of this change is of course the sandy-clayey alluvium. The mostly poor and barren forests are formed either by common pine (Pinetum silvestris) or by oak (Querceta sessilis and roburis) very often nearly without any undergrowth. A constant companion is *Festuca ovina* which, in our territory, is strictly avoiding limestone, but in parts even this grass practically disappears, whereas it is elsewhere dominant. The undergrowth, however, is above all quantitavely and qualitatively defined by the access of light

and the quantity of humus, and though these forests generally are fairly well lighted, the above mentioned relations vary and therefore the character of the undergrowth is changeable. But it would be a mistake for this reason to distinguish several associations; one might better speak of different degrees of evolution and construct out of the whole the character of the undergrowth, which, of course, in many places is for the most part suppressed but might make its appearance in another stage of evolution. In one place where there is a gentle slope, the above mentioned alluvium extends also over the slope and there we find developed a dense and often pure Calluneta with the usual Hercynian mosses and lichens. Also *Deschampsia flexuosa* is usually interspersed but not plentiful. Generally, however, these barren Hercynian forests go only as far as the edge of the plateaus and with the beginning of the slope begins also at once a rich limestone vegetation.

On the plateau there are pine forests, oak forests and mixed growths of both. Most of them are very barren, even tufts of *Festuca ovina*, elsewhere abundant, are usually rare and in the undergrowth there is nothing if not occasionally a solitary *Campanula rotundifolia* or a fine colony of *Rosa gallica*. We walk for instance through a pine forest, where nothing grows, then through an oak forest with relatively abundant *Festuca ovina*, in the undergrowth, further on appear also *Deschampsia flexuosa* (not abundant), here and there a colony of *Brachypodium pinnatum*, very scattered some *Hieracium (H. vulgatum, H. murorum, H. laevigatum)*, in places rather abundantly *Trifolium alpestre*, solitary *Platanthera bifolia*, abundantly and in robust individuals *Cephalanthera alba*, not frequent are colonies of *Luzula nemorosa*, scattered occur *Chrysanthemum corymbosum* and *Campanula persicifolia*, rarely *Galium silvestre* and *Hypericum perforatum*. In one place, where oak and pine are mixed, grows rather abundantly *Peucedanum oreoselinum*, a remarkable species for our territory, as it evades limestone and is found scattered on a few localities in Hercynian oak or pine forests with quickly drying coarse-grained substratum, which substitutes the sandy soil on which *Peucedanum oreoselinum* often grows elsewhere in Bohemia. I must emphasize, however, that the above enumeration of species results from an analysis of a forest in the length of about 2 *km*, so that there can be no question of a defined minimi-area.

There are of course also Hercynian woods with richer undergrowth; thus I have analyses showing 19, 26, 27 and one even 31 species, besides the shrubs and the sporophytes. Very interesting is the oak forest on the plateau towards Kosoř with abundant (very often even closed) undergrowth. The growth of trees (rather tall) consists of *Quercus sessilis* and *Q. robur* (the latter less abundant). The undergrowth is formed by the exceedingly abundant *Luzula nemorosa* (nearly a true Luzuletum) and the abundant to very abundant *Festuca ovina*. Otherwise there are only a few species: two *Melampyrum* (especially *M. pratense*, less of *M. nemorosum*), scattered *Hieracium murorum, H. silvestre*, *Genista germanica*, here and there *Stellaria holostea*, *Vaccinium myrtillus*, not frequently *Calluna vulgaris*, *Platanthera bifolia*, *Anemone nemorosa*, solitary are tufts of *Poa nemoralis*. Of mosses and lichens there are hardly any, only *Hylocomium Schreberi* forms in places bigger cushions. It is an exceedingly poor association, and even when we extend the analysis over extensive ground, the number of species does not increase.

In general it is possible to distinguish three edaphic variants of this association, namely:

a) Xerophilous, on dry soil with very little humus. This is the type of Zadní Kopanina.

b) Subxerophilous, on slightly better soil (see above).

c) Mesophilous, on more humous soil with a greater number of indifferent wood herbs (see list).

4. Deciduous woods on non-calcareous soil

(Hercynian woods with herbaceous undergrowth).

The last variant of the preceding forest association changes on richer humus and less dry substratum into a mesophilous wood type with rich, sometimes even very rich herbaceous undergrowth, out of which disappear wholly or nearly so all types of xerophilous character. In this way are formed woods, oak groves, white beech forests or mixed growths which in their undergrowth are very near to the usual type of woods in this territory, of course with the difference that all characteristic limestone species are missing.

We find a not very extensive wood of this description on the plateau above Kalina's mill, in a rocky gap where humus is abundant and the earth damper. There are growing both oaks *(Quercus sessilis* and *Q. robur),* hazel *(Corylus avelana),* white beech *(Carpinus betulus),* maple *(Acer platanoides),* pear trees run wild *(Pirus communis),* then *Ribes alpinum, Cotoneaster integerrima* and abundantly *Daphne mezereum,* of herbaceous plants very abundantly *Hepatica triloba,* scattered *Orobus vernus, Asarum europaeum, Neottia nidus avis, Galium silvaticum,* solitary *Poa nemoralis, Lilium martagon, Cephalanthera alba, Anthericum ramosum.* But this growth is not quite typical, as there is also calcareous detritus brought down; that is the reason why we sometimes come across a solitary *Sesleria calcaria.*

The adjacent, richly flowering clearing, however, already shows Hercynian character (there occur even *Vaccinium myrtillus* and *Platanthera bifolia*) and yet more so does the neighbouring oak grove, where we find gregariously *Poa nemoralis* and *Festuca ovina* and rather abundantly *Melica nutans.*

II. CALCIPHILOUS.

a) Mesophilous to subxerophilous.

5. Humous deciduous woods.

This wood type is to be found in characteristic development only on good deep moist humus, but, of course, it changes its character with the slowly changing conditions of the habitat. Its boundaries are sharp only there, where the change of the habitat is also abrupt.

As a specially typical example I am quoting the wood in the main valley near its bend close to the little pond near Kalina's mill. It is developed here only in the lowest part of the slope where the soil is stony (limestone) but filled up with a rather rich layer of leaf-mould. The exposure is south — southeast. The constitution (according to 4 analyses) is as follows:

Woody plants: it is a white beech-hazel wood, in places with rather many bushes in the undergrowth, elsewhere without them. Along the border grow solitary high-trunked oaks, the leaves of which help to form humus.

Corylus avellana 7
Carpinus betulus 5—6
Ligustrum vulgare 2
Ribes alpinum 2
Lonicera xylosteum 2
Acer campestre 2
Cornus mas 0

Grasses: mostly missing, only in places rather conspicuous

Melica picta (locally gregariously)
Melica nutans 1
Poa nemoralis 2
Bromus asper 1—2

Herbs: often form a continuous or nearly continuous growth which, however, in places becomes looser. Characteristic for this wood association is its richness in spring-herbs and the considerable quantity of summer-weeds.

a) Wood herbs:

Corydalis cava 6
Ficaria verna 6
Stellaria holostea 4
*Veronica * triloba* 4
Adoxa moschatellina 3
Allium scorodoprasum 3
Anemone nemorosa 3
Anemone ranunculoides 3
Asarum europaeum 2—3
Gagea pratensis 3
Gagea lutea 3
Hepatica triloba 3
Lamium maculatum 3
Omphalodes scorpioides (locally gregariously)
Orobus vernus 3
Phyteuma spicatum 3
Pulmonaria obscura 3
Ranunculus auricomus 3
Viola odorata 2—3
Corydalis digitata 2
Gagea minima 2

b) Herbs of a weed character:

Aegopodium podagraria 3
Anthriscus silvester 3
Chaerophyllum temulum 3
Galium aparine 3
Geum urbanum 3
Campanula rapunculoides 2
Chelidonium majus 2
Taraxacum officinale 2

Here and there penetrate into this association or into its border one or the other species out of the higher woods with somewhat subxerophilous character as for instance *Clematis recta, Primula officinalis, Chrysanthemum corymbosum.*

A very fine humous wood was also above Radotín along the way to Kosoř (with *Gagea minima, G. arvensis, G. lutea, Corydalis fabacea, Ficaria verna, Anemone nemorosa, A. ranunculoides, Myosotis sparsiflora* etc,), but it no longer exists.

The wood, the analysis of which was given above, is so typical that it suffices as example for this association.

In places, where there is greater moisture, it is replaced by a more hygrophilous type, which, however, it is hardly possible to consider as a special association. It could be regarded as such if it had a more extensive habitat in our territory and would thus be able to develop itself fully. But as it is, it is composed of different elements and usually we observe in it the influence of adjacent communities. As an example I take the small ravine on the steep wooded slope between Špaček's and Kalina's mills. This ravine is moist, and steep, and overgrown with a wood; a brook flows through it, forming rather large layers of travertine and only in the upper part disappearing. In the brook grows everywhere in large quantities *Hypnum commutatum* becoming more or less incrusted with limestone, then in abundance *Pellia calycina,* also *Mar-*

chantia polymorpha and *Acrocladium cuspidatum*, and on moist rocks, over which usually water is running, are bright cushions of *Webera annotina; Mnium undulatum* grows here only infrequently.

The wood has the following composition:

Woody plants: *Corylus avellana* is the most abundant, but we find scattered also *Carpinus betulus, Tilia platyphylla, Acer pseudoplatanus, Crataegus, Ribes alpinum, Lonicera xylosteum, Cornus sanguinea, Acer campestre;* plentiful is *Viburnum opulus.*

Herbaceous plants: the leading plant is the extraordinaly abundant and often very gregarious *Ranunculus lanuginosus* (8); of species not growing in the above analysed wood *Oxalis acetosella* (5), *Rubus saxatilis* (4—5), *Viola mirabilis* (4), *Lamium luteum* (4), *Solanum dulcamara* (3), *Lactuca muralis* (3), *Actaea spicata* (in the upper parts abundant), *Geranium Robertianum* (in places gregariously), *Vicia sepium* (3), *Galium silvaticum* (3), *Hypericum hirsutum* (3), *Campanula trachelium* (3), *Epilobium angustifolium* (1), of the species common to both types *Pulmonaria obscura* (4), *Asarum europaeum* (4), *Hepatica triloba* (scattered in drier places), *Melica nutans* (3), *Aegopodium podagraria* (5), *Galium aparine* (3), *Campanula rapunculoides* (1). Of rather subxerophilous species penetrate *Clematis recta* (1), *Primula officinalis* (1) and *Digitalis ambigua* (1).

We observe then that both types differ fundamentally as follows:

a) in the hygrophilous type are absent many characteristic spring plants of humous woods *(Corydalis, Gagea, Ficaria, Adoxa* and others);

b) it exhibits again species missing in the other type; sociologically significant are especially *Ranunculus lanuginosus* and *Oxalis acetosella.*

As I did not find this type elsewhere in our territory, I mention it for the time being here, although it will probably prove to be an independent association, differing from that of humous woods.

6. Submountain mixed deciduous woods.

This forest community appears remarkable and noteworthy from many points of view. Judging from its fragments, present in good many places, it must have been originally of a much wider extent, accompanying humous, cooler and moister northern or north-western slopes. This ancient community is one of the most memorable on the Central Bohemian limestone massif, where it was once widely spread either as mixed beech wood or as mixed deciduons wood. It continues from the region of Beroun and Karlštejn, where it was most fully developed, gradually becoming more restricted nearly as far as Prague. In the valley of Radotín it is to this day in places well preserved, but its remnants in the valley of St. Prokop close to Prague show us that it must have reached the very centre of Bohemia. This association can be regarded as a parallel to the dealpine associations of the Central Bohemian limestone hills and ravines and one may suppose that its highest development coincides with the more humid postglacial period. Subfossil plants of our travertines show that its charakteristic trees were some time ago much more plentiful than now. It strikes me nevertheless as being insufficiently justified to conclude from this fact that the climate of Central Bohemia became naturally drier and warmer and thereby less congenial for this wood association. It seems to me more likely that the

environment and especially the microclimatic conditions have suffered a considerable change from the far-reaching deforestation, from forest culture and other antropic influences, and the climate is thereby tending towards a more arid type, favouring the expansion of more xerophilous associations instead of the more hygrophilous and mesophytic communities.

In the valley of Radotín these mixed submountain deciduous woods are even now in different places rather well preserved, especially so on the slope behind Kalina's mill. Here and there, it is true, the virgin growth was in part or wholly replaced through forest culture by various other trees, but the characteristic undergrowth is as yet nearly the same.

Upon the strength of a good many analyses of typical growths as well as of such modified through the activity of man I shall try now to give a general picture of those submountain woods:

Woody plants: the sociological analyses give of course only an image of the present, very often already secondary growth. In some places we find to-day a high-trunked white beech wood, although we learn from the virgin growth as well as from the sometimes solitarily preserved old trees in secondary growths and old tree stumps that the composition was formerly different and surely on the whole uniform. But I am not inclined to say that the original forest was an unmixed beech wood or mixed beech wood with the beech in predominance, as the beech influence on the undergrowth, even if manifest, is not so far-reaching as it would certainly otherwise be (I may for instance mention that *Asperula odorata* seems to be completely missing). It seems to me highly probable that the virgin woods of this association consisted of a mixture of *Fagus silvatica*, *Tilia platyphylla*, *Acer pseudoplatanus*, *Acer platanoides*, *Carpinus betulus* with perhaps a few other trees scattered into them. The percentual share of the above mentioned trees, among which were perhaps also oaks (*Quercus sessilis* and *Q. robur*), can hardly be evaluated now; it seems, however, probable that their proportional frequency was varying. The common pine (*Pinus silvestris*) and the spruce (*Picea excelsa*), now scattered in places, are without any doubt of later introduction. All the above trees are in some growths preserved in old specimens, while in others some of them are missing.

The shrubby undergrowth is on the whole a modest one, very often none or hardly any. *Daphne mezereum* is, however, usually rather plentifully scattered. Of other woody plants I ascertained as solitary *Sorbus torminalis*, *S. aria*, *Corylus avellana*, *Cornus mas*, *Berberis vulgaris* and *Viburnum opulus*. Here and there grows *Hedera helix*, but never influences the physiognomy of the undergrowth.

Herbs and grasses, specifically characteristic for this association (the numbers indicate the constancy according to the ten degrees of the scale):

Arabis pauciflora 10
Aconitum vulparia 10
Bromus asper 6
Bupleurum longifolium 10
Dactylis Aschersoniana 9
Lilium martagon 7
Viola mirabilis 10

Other grasses and grasslike plants:

Melica nutans 10
Carex digitata 8
Poa nemoralis 5
Triticum caninum 2
Luzula nemorosa 1
Brachypodium pinnatum 1

Other herbs:

Asarum europaeum 10
Galium silvaticum 10
Hepatica triloba 10
Mercurialis perennis 10
Anemone nemorosa 9
Primula officinalis 8
Chrysanthemum corymbosum 7
Campanula trachelium 6
Lamium luteum 5
Melampyrum nemorosum 5
Pulmonaria obscura 5
Stellaria holostea 5
Arabis hirsuta 4
Astragalus glycyphyllus 4
Campanula persicifolia 4
Cephalanthera alba 4
Convallaria majalis 4
Hypericum hirsutum 4
Coronilla varia 3
Dentaria bulbifera 2
Erysimum odoratum 2
Galium vernum 2
Hieracium murorum 2
Hypericum perforatum 2
Lactuca muralis 2
Neottia nidus avis 2
Ranunculus auricomus 2
Senecio nemorensis 2
Turritis glabra 2
Actaea spicata 1
Ajuga genevensis 1
Campanula rapunculoides 1
Corydalis digitata 1
Fragaria collina 1
Heracleum spondylium 1
Impatiens noli tangere 1
Lamium maculatum 1
Laserpitium latifolium 1
Majanthemum bifolium 1
Melampyrum pratense 1
Myosotis silvatica 1
Mellitis melissophylla 1
Orobanche rubens 1
Polygala vulgaris 1
Polygonatum officinale 1
Solanum dulcamara 1
Symphytum tuberosum 1
Thlaspi montanum 1
Veronica chamaedrys 1
Viola collina 1
Viola Riviniana 1
Viola silvatica 1

The Bryophyta are rather insignificant, especially if we do not count those growing on roots and tree trunks and which are in reality strangers in this association. In the above mentioned very typical growth behind Kalina's mill I noted *Fissidens taxifolius, F. decipiens, Mnium cuspidatum, Hylocomium triquetrum, Camptothecium lutescens, Hypnum cupressiforme, Rhodobryum roseum, Brachythecium glareosum, B. velutinum, Madotheca platyphylla.*

The species of high constancy specifically characterize this wood association. As regards the species with low constancy (10—30%) they are mostly accidental, some of them are nevertheless significant. Such are for instance some beech plants *(Dentaria bulbifera, Actaea spicata, Impatiens noli tangere)*, characteristic for beech woods of submountain and mountain sites, which are surely remarkable in this territory of xerophilous vegetation; of interest is further the dealpine *Laserpitium latifolium* as well as some rather rare wood species as *Mellitis melissophylla* and *Thlaspi montanum*. The latter — a very common plant in our whole region — is, however, in this association more or less of an intruder. The very abundant *Erysimum odoratum* in the growth above Kalina's mill spread here undoubtedly after selective felling of the trees and the opening of the wood canopy and letting in of light.

Some analyses show special types (variants or societies) of these submountain woods; but some of these variants are due to human interference. In the beginning of the main valley of Radotín on the north eastern slopes we find in the upper part a Hercynian vegetation, but the lowest zone was formerly occupied in a narrow belt by the above association. I found here yet in 1915

on deep humous soil in a predominantly white beech forest a choice vegetation as a remnant of the original forest type. In its rich undergrowth I noted nearly all characteristic species of humous woods; thus there grew here for instance abundantly also *Dactylis Aschersoniana*, rather abundant were *Lilium martagon* and *Bupleurum longifolium*, besides occurred there also *Hesperis runcinata* (on its only known locality in our territory!) and *Vicia pisiformis*.

At the present day we meet only fragments of this association, as for instance on the plateau of Velký háj. There I discovered among subxerophilous to mesophilous woods of the usual calcareous type around a small limestone rock a substantially different forest type recalling the described submountain woods. Instead of oaks and white beeches, constituing the surrounding woods, we find here dominant the rather plentiful *Tilia platyphylla* and *Acer pseudoplatanus*, solitary even *Fagus silvatica* and *Prunus avium* run wild, of shrubs rather abundantly scattered *Daphne mezereum*, scattered *Viburnum opulus* and still rarer *Lonicera xylosteum*. In the undergrowth — in places with carpets of *Hylocomium triquetrum* — grew in masses *Hepatica triloba* and *Asarum europaeum*, very abundant were *Mercurialis perennis* and *Lilium martagon*, abundant to very abundant *Melica nutans*, *Carex digitata*, *Actaea spicata*, *Galium silvaticum*, scattered *Viola mirabilis*, *Pulmonaria obscura*, *Primula officinalis*, *Digitalis ambigua*, *Orobus vernus*, only here and there occurred *Hedera helix* and *Majanthemum bifolium*, solitary *Stellaria holostea*, *Hierochloe australis*, *Hieracium murorum*, *H. canofloccosum*.

This community resembles very much the type of mixed beech woods, but it seems more probable that it is a fragmentarily developed variant of our association which is on account of its small area devoid of some of the most characteristic species of the submountain mixed woods. One can, of course, presume that each individual growth of this association was in its virgin stage of the same composition. In some places surely there were variants (societies) conditioned either by the proportion of leading trees or the local conditions of the environment, and perhaps also by the interference of adjacent communities.

7. **White beech woods** (Carpinetum).

I mentioned already that it is impossible to distinguish wood associations by the present predominant trees as the wood canopy is very often secondary. This is demonstrated in a very convincing manner by the present white beech woods, representing according to their undergrowth different associations. Speaking of the Carpineta I wish to point out a quite specified limestone wood community, in which the white beech is the dominant tree and which has an undergrowth of a certain ecological and floristical character. The plants accompanying humous moister woods (as *Corydalis*, *Gagea* and similar) are here missing, species of humous drier soils are rather abundant and many are the woodland species of a subxerophilous character, most of which can grow on sunny openings and here and there penetrate also into the woods whith a rich humus, but have their chief distribution in this forest community. It is quite natural that many of them thrive on clearings and even on such which originated by the felling of a more humous and moist wood because through the cutting the conditions of light are changed in their favour.

White beech woods, which we find in our territory on non-calcareous soil, are entirely different from this association as well in the physiognomy as in the floristical composition of their undergrowth.

It is open to discussion whether the Carpineta are an original and natural forest community. I am inclined to believe that they are secondary, occupying the place of formerly mixed woods (very likely with white beech and oak and maybe also with some other trees and shrubs). The present white beech woods are on the whole rather well characterized, notwithstanding some variation in the composition of their undergrowth, which is also decidedly influenced by soil conditions. If there is only a small quantity of dry humus, the herbaceous undergrowth becomes scarce and finally disappears, or the herbs are replaced by grasses *(Poa nemoralis)* which are never dominant in the typical growth. The white beech woods are gradually connected through intermediate types partly with humous partly with submountain and also with subxerophilous hazel woods. Nevertheless all these associations are in their typical form so well characterized that it would be hardly right to doubt their reality. As the factors of the habitat are changing gradually, it is no wonder that also the forest types sometimes pass by degrees one into the other. We have here therefore an example of well-defined associations, but often without sharp boundaries.

The constitution ot the Carpineta is according to several analyses the following:

Woody plants: white beech *(Carpinus betulus)* form a pure or nearly unmixed growth. Sometimes oaks or common pines are interspersed, but of course only secondarily. In the shrubby undergrowth we find usually rather plentiful *Ligustrum vulgare*, scattered *Acer campestre* and *Corylus avellana;* solitary are *Cornus sanguinea, C. mas, Lonicera xylosteum, Sorbus torminalis, Viburnum opulus* or also *Tilia platyphylla.*

Grasses and grasslike plants: of the true wood-grasses accompanies this association always *Melica nutans*, often also *Poa nemoralis* (gregariously only sometimes in a degraded type), sometimes there grows also *Dactylis Aschersoniana.* Among sedges is rather constant *Carex digitata*, rarer *C. muricata,* of more xerophylous plants grow here sometimes on openings and lighter places *Carex humilis, Luzula campestris* and even *Sesleria calcaria.*

Herbs:

a) True wood plants of humous soil:

Galium vernum (often very gregariously)
Galium silvaticum
Hepatica triloba
Pulmonaria obscura
Asarum europaeum
Stellaria holostea
Orobus vernus
Lamium luteum
Anemone nemorosa
Symphytum tuberosum
Polygonatum multiflorum
Lilium martagon
Cephalanthera alba
(Vicia pisiformis)

b) Subxerophilous wood plants (species in brackets are more or less accidental):

Primula officinalis
Silene nutans
Crepis praemorsa (only here and there)
Clematis recta
Melampyrum nemorosum
Orobus niger
Chrysanthemum corymbosum
Coronilla varia
Hieracium vulgatum var. *maculatum*
Hieracium murorum
Campanula persicifolia
Campanula trachelium
Myosotis silvatica
Viola hirta
Thlaspi perfoliatum
Veronica chamaedrys

(Ajuga genevensis)
(Arabis hirsuta)
(Astragalus glycyphyllus)
(Epipactis latifolia)
(Erysimum crepidifolium)
(Galium boreale)
(Genista germanica)
(Genista tinctoria)
(Majanthemum bifolium)
(Myosotis stricta)
(Turritis glabra)
(Viola collina)

The composition of this association varies rather according to local habitat conditions. The Carpineta of our region are mostly regularly coppiced which, of course, greatly influences their physiognomy and the undergrowth. Where these woods pass from limestone soil to the plateau with poor alluvial layers, we meet sometimes — under the effect of a gradually changing habitat — a mixed transitional type between the described association and the Hercynian woods. In their typical form, however, both associations are distinctly different.

8. **Oak woods.**

The oak woods of our territory differ sociologically and ecologically so widely among themselves that it is impossible to combine them in one association. They belong partly to the Hercynian oak woods (see above), partly to the preceding association (they are sometimes mixed with white beech). A more natural character is shown in our territory by the more xerophilous oak woods on calcareous soil, rather substantially different from the *Carpinus*-association. The true wood plants (mesophilous and growing in deeper humus), enumerated in the above association, are very much reduced in number, whereas many xerophilous types appear and therefore the undergrowth attains a quite different structure.

These hillock oak woods (mixed) may be taken as a natural association, which in the course of time has been modified by forest culture. Some are high, but not very high-trunked, and in case there is enough humus, they approach the white beech type. More often, however, they show a markedly xerophytic character or they combine two or three communities into one unit. For the oaks are sometimes low, branched already from the base and nearly shrubby; therefore there are many open spaces in the wood where a xerophilous vegetation was enabled to gain foothold. If such openings are numerous and rather wide, there originates a kind of wood-steppe. Thus is formed an interesting community which it would be possible to divide in two or three floristically and ecologically characterized associations; in reality, however, these pass so gradually and completely one into the other that we may take them for a single association, formed by a natural complex of several interspersed microassociations.

Such gradation we find on many places. If we ascend for instance from the second Mašek's mill up the woody slope (where we meet submountain mixed woods) to the plateau, we reach first a white beech wood with the usual ombrophilous undergrowth *(Orobus vernus, Stellaria holostea, Anemone nemorosa, Asarum europaeum, Lamium luteum*, etc.), but further on there extend already on drier and shallow calcareous soil mixed oak woods, where the trees hardly attain a height of 2 meters and have widely spreading branches already near the ground. In semi-shaded places there grow abundantly *Euphorbia angulata, Thlaspi montanum, Lilium martagon, Laserpitium latifolium, Convallaria majalis, Carex digitata,* not so abundantly *Primula officinalis, Serratula tincto-*

ria, Luzula nemorosa, but on small openings there are semi-steppe flowering meadows with abundant *Echium vulgare*, with plentifully scattered *Myosotis suaveolus* and with a number of choice xerophilous species of which we shall learn later on; of woody plants there grows scattered *Juniperus communis.* In places, although rarely, the oak wood is dense, shady, richer in humus and there we come across species like *Symphytum tuberosum, Orobus niger, Daphne mezereum* and similar.

On the plateau of the Velký háj (between Radotín and Kosoř) we find, of course on different habitats, all oak and other wood types close together. The non-calcareous alluvium is overgrown with Hercynian *Quercus — Carpinus* — association, on limestone detritus again we see fine white beech woods, whereas on the limestone ridge, which rises gently over the plateau, the more xerophilous character of the vegetation is expressed by the fact that the white beech is on the retreat and the ground is being occupied by hillock oak woods, bushes and open grassy places.

In this rather open oak wood there is a scattering of white beech; the dominant tree is *Quercus pubescens* besides the less plentiful *Q. sessilis* (also hybrids between both species have been found). Of the woody plants grow here also abundantly *Cornus mas, Acer campestre, Crataegus (monogyna* or *oxyacantha), Cotoneaster integerrima.* On the open spaces have their abode *Veronica prostrata, V. spicata, Teucrium chamaedrys, Stachys recta, Helianthemum ovatum, Bupleurum falcatum, Thymus praecox, Asperula glauca, Polygonatum officinale, Centaurea axillaris, Phleum phleoides*, in half-shaded places *Thlaspi montanum, Clematis recta, Peucedanum cervaria, Dictamnus albus, Primula officinalis, Asperula tinctoria, Silene nutans, Betonica officinalis, Carex Michelii.*

This open xerophilous mixed oak wood passes on the gentle slope with richer humus into a mixed shady oak wood (with white beeches, also *Sorbus aria, Ligustrum vulgare*) and in its undergrowth are more or less abundant *Melica nutans, Hierochloe australis, Carex digitata, C. Michelii, Mercurialis perennis, Lilium martagon, Hepatica triloba, Orobus vernus, Primula officinalis, Mellitis melissophylla, Pulmonaria obscura, Galium silvaticum, Chrysanthemum corymbosum, Arabis pauciflora* and similar.

A plant sociologist — without seeing the locality! — would be surely inclined to regard such a community as an association type with the associations partially only fragmentarily developed. But such types are in Central Bohemia of no rare occurrence on limestone and especially on natural localities but slightly influenced through the interference of man. Rather than as an association type we can regard such a community as a complex association which, of course, is not identical with an association in the usual sense. This complex association can extend over a somewhat extensive area, but notwithstanding we find often on a single quadrat (1 m^2) the representatives of its two or three constituents.

In the same region (Velký háj), but on a different locality, can be seen a noteworthy Quercetum pubescentis. The tree growth is high-trunked, the undergrowth rich, mostly herbaceous and nearly contiguous. Of the shrubs we observe *Ligustrum vulgare, Sorbus torminalis, Cornus mas, Cotoneaster integerrima, Corylus avellana.* The undergrowth has the following composition:

Grasses and sedges:

Melica nutans 4—5
Hierochloe australis 2—3
Carex Michelii 3
Carex montana 3
Carex digitata 2

Herbs:

Chrysanthemum corymbosum 6
Stellaria holostea 6
Crepis praemorsa 5
Peucedanum cervaria 5
Thlaspi montanum 4—5
Asperula glauca 3
Dictamnus albus 3
Hepatica triloba 3
Polygonatum multiflorum 3
Viola hirta 3
Arabis pauciflora 2—3
Bupleurum falcatum 2
Polygonatum officinale 2
Arabis hirsuta 1
Betonica officinalis 1
Lilium martagon 1
Orobus niger 1
Potentilla alba 1

Mosses are of no great importance. In the further continuation, in a young wood, the type of this oak wood changes somewhat; abundantly grow here *Serratula tinctoria, Galium silvaticum, Silene nutans, Potentilla opaca* and along the cut through the woods are often to be seen *Euphorbia angulata, Polygala comosa, Thesium montanum, Potentilla alba, Arabis pauciflora* and others.

In wood communities of such changeable, but notwithstanding on the whole very pronounced character, the usual sociological methods are of no great help. The analyses must be adapted to the peculiarity of the vegetation, otherwise the results will not give a true picture of this or that plant community. The mixed oak woods have a good many types showing a gradual transition from the mesophilous to the xerophilous, from humous and deep soils to shallow rocky grounds.

9. **Open hazel woods on limestone slopes** *(Coryletum avellanae).*

This community occupies so to say the position halfway between woodland and xerophilous bushy thickets. Unmixed hazel woods as developed sometimes in our territory, are surely a secondary formation, but the mixed bushy hazel woods seem to be natural or at least semi-natural. They can be so dense and closed that they harbour a herbaceous undergrowth similar to one or the other of the above mentioned wood associations. Rather peculiar are, however, loose mixed hazel woods, the habitat of which varies between two extremes, that is between open, sunny, and dry places and such in deep shadow, with richer humus and greater moisture. Corresponding with this is the herbaceous undergrowth of such woods rather heterogenous, but as a whole so characteristic that this type can be very well separated from all preceding. We know, of course, also transitional types, but this is of no consequence, as all wood associations of the valley of Radotín form by means of gradual transitions a continuous chain, starting with the xerophilous scrub and oak woods and ending with the hygrophilous alder groves.

First of all I give the analysis of these hazel woods on the northern slope of the limestone ridge branching off near the first Mašek's mill. The slope is very high and steep, in the lower part often with rubble, covered by irregular bushy growth, in the upper part, however, with well preserved shrubby hazel

woods of wide extent; in places these are, of course, interrupted by small openings, occupied usually by Seslerietum; the uppermost zone is rocky with the usual sparsely scattered rocky vegetation.

In the open hazel wood (Coryletum) are interspersed shrubs, particularly *Cornus sanguinea* (on drier places especially towards the rocky ridge also *Cornus mas*), further *Lonicera xylosteum* (scattered), *Ribes alpinum* (abundantly scattered), *Berberis vulgaris*, *Rosa* sp., *Cotoneaster integerrima* (all three scattered) and here and there appears also *Tilia platyphylla*, very often only as a richly branched bush. Abundantly scattered we find also *Cytisus nigricans*.

The analysis of the undergrowth shows the following result:

Primula officinalis 6—7
Campanula persicifolia 6
Carex digitata 5—6
Asperula glauca 5
Melampyrum nemorosum 5
Thlaspi montanum 5
Clematis recta 4—5
Chrysanthemum corymbosum 4—5
Dictamnus albus in the upper zone 4—5, in the lower 1
Asperula tinctoria 4
Hieracium murorum 3—4
Viola hirta 3—4
Viola collina 3
Anthericum ramosum 3
Arabis arenosa 3
Digitalis ambigua 3
Laserpitium latifolium 3
Lotus corniculatus 3
Polygonatum multiflorum 3
Ranunculus bulbosus 3
Vicia sepium 3
Hieracium canofloccosum 2—3
Lamium luteum 2—3
Thesium montanum 2—3
Arabis hirsuta 2
Cephalanthera alba 2
Coronilla varia 2

Mosses are in places abundant, but only common species, principally *Hylocomium triquetrum* a *H. splendens*.

This growth can be regarded as a classical example of hazel woods without extreme species of humous woods or open xerophytic places. Larger openings are occupied by Seslerietum, but *Sesleria calcaria* as well as *Centaurea axillaris* penetrate here and there even into shadow. Towards the upper rocky ridge these hazel woods disappear and instead of them we see either rocky communities or xerophytic flowering growths (with *Helianthemum canum*, *Stachys recta*, *Anemone silvestris*, *Anthyllis vulneraria*, *Primula officinalis* (var.), *Peucedanum cervaria*, *Potentilla opaca* and others), which locally penetrate into the hazel woods. Elsewhere on open places *Geranium sanguineum*, *Polygonatum officinale*, *Trifolium alpestre*, *Polygala comosa*, *Myosotis silvatica*, *Pulsatilla nigricans* and similar have their abode.

In other localities these bushy hazel woods pass either into scrubs or into deciduous woods with their undergrowth resembling the white beech type.

10. Hygrophilous woods and alder groves.

I mentioned already (see p. 15) a wood on a steep slope near Špaček's mill with mostly hygrophilous undergrowth (with dominant *Ranunculus lanuginosus*), which might be classified under this heading. Essentially different are deciduous woods in the bottom of the valley on wet soil with a high underground-waterlevel; these woods are either mixed or composed of alder, but in both cases with nearly the same undergrowth.

A rather characteristic alder wood (A l n e t u m g l u t i n o s a e) is at the brook Radotínský potok near Kalina's mill. Its composition is as follows:

W o o d y p l a n t s: *Alnus glutinosa* dominant, but near the brook grows locally more plentifully *A. incana* (not indigenous). *Sambucus nigra* is in the undergrowth abundant to very abundant, while *Acer campestre*, *Cornus sanguinea*, *Evonymus europaea*, *Ribes alpinum* are scattered.

L i a n a s: *Humulus lupulus* 6.

G r a s s e s:

Poa trivialis 5
Festuca gigantea 4
Poa palustris 3
Brachypodium silvaticum 3 (locally gregariously)
Dactylis glomerata 3
Glyceria fluitans 1

H e r b s: the rich herbaceous undergrowth is formed partly by weeds, partly by common hygrophilous and some wood herbs. According to this it can be classified as follows:

a) Plants of a weed character:

Aegopodium podagraria 5
Anthriscus silvester 5
Alliaria officinalis 5
Chaerophyllum bulbosum 5
Glechoma hederacea 5
Geum urbanum 4
Lampsana communis 4
Urtica dioica 4
Galium cruciata 3
Galium aparine 3
Heracleum spondylium 3
Plantago major 3
Rumex conglomeratus 3
Rumex obtusifolius 3
Chelidonium majus 1
Taraxacum officinale 1
Stellaria media 1

b) Hygrophilous plants:

α) Wood plants:

Ranunculus lanuginosus 4
Stellaria nemorum 4
Stachys silvatica 3—4
Impatiens noli tangere 2

β) Others:

Cirsium oleraceum 4
Cerastium vulgatum 3
Filipendula ulmaria (*concolor* as well as *discolor*) 3
Lycopus europaeus 3
Lysimachia nummularia 3
Mentha aquatica 3
Mentha longifolia 3
Myosotis palustris 3
Polygonum lapathifolium 3
Symphytum officinale 3
Caltha palustris 2—3
Bidens tripartitus 2—3
Geranium palustre 1

c) Wood plants:

Lamium maculatum 5
Asarum europaeum 3—4
Omphalodes scorpioides 3—4
Anemone nemorosa 3
Anemone ranunculoides 3
Campanula trachelium 3
Pulmonaria obscura 3
Viola odorata 3
Oxalis acetosella 2—3
Moehringia trinervia 1

Mosses: only *Mnium undulatum* grows in places gregariously.

These alder woods, although of no great extent, show very peculiar ecological features. The herbaceous undergrowth is, however, not strictly bound to the dominant tree, as the decisive factor is the underground water. Therefore it is natural that a similar community appears also in hygrophilous woods with other trees, although the different growths sometimes represent different societies. Thus for instance there is in the main valley near Cikánka along the brook a shrubby wood of this composition: *Salix* sp. div. (abundantly), *Sambucus nigra* (scattered), *Cornus sanguinea* and *Alnus glutinosa* (both scattered), *Acer campestre* (infrequently); in places climbs very abundantly *Humulus lupulus*.

The undergrowth is very rich, herbaceous, hygrophilous; very abundant are *Lamia* and *Viola odorata*, the latter in a curious form, adapted to the wet habitat. In varying frequency we find here:

Viola odorata
Lamium maculatum
Lamium album
Lamium purpureum
Anthriscus silvester
Aegopodium podagraria
Angelica silvestris
Chaerophyllum aromaticum
Chaerophyllum temulum
Alliaria officinalis
Geum urbanum
Chelidonium majus
Glechoma hederacea
Ficaria verna
Arctium spec. div.
Cirsium palustre
Cirsium lanceolatum
Ranunculus acer
Ranunculus repens
Rumex obtusifolius
Rumex crispus
Hypericum quadrangulum
Dactylis glomerata

This type differs from the first by the absence of the hygrophilous forest plants and the true wood plants, but otherwise is closely allied to it. As this association is conditioned first of all by the underground-waterlevel and not by the dominant tree, its herbaceous undergrowth — hardly changed — sometimes escapes from the alder grove and appears independently on open places.

B. **Shrubby associations** (*thickets*, fruticeta).

For sociological analyses these communities in our territory are hardly appropriate. That is not to be wondered at! Not only that the shrubby communities are connected by transitions with some wood or open associations and that they are frequently secondary, but often they are neither sociologically nor ecologically uniform and even a quite small growth represents in reality a mosaic of several promiscuous tiny associations. This mosaic is, it is true, a good character of these bushy growths, but it is hardly possible to analyse them with the usual sociological methods. Just as in some other communities, here also the habitat is not homogenous. It really could not be such so long as the thicket is not quite uniformly dense, which is the case only exceptionally and then on but a small area. Usually the shrubby growth is more or less irregular and therefore there are open and half-open places where the light has access and influences also the edaphic character of the habitat; on the other hand there are places with deep or light shadow. Such a habitat is therefore in its microclimate and soil conditions a motley conglomerate and from this depends also the promiscuity of the growth. Where the openings are larger, we

find among the thickets more or less fragmentarily developed grassland associations, for instance Stipetum capillatae, Caricetum humilis, Brachypodietum pinnati, Festucetum vallesiacae; if the openings are small, they are notwithstanding partially shaded and this interference is shown by the composition of the vegetation.

Shrubby growths in our territory are frequently secondary or they represent stages of a succession tending from open grassland and herb communities towards wood communities. In some places, however, a thicket can be also a climax association and not only an initial or transitional stage of a certain succession series. This is sometimes the case on rocky ground, on dry limestone ridges with shallow soil, where already the woods change into a nearly shrubby type (see above), till at last the habitat permits only the development of scrub. Usually, however, the fruticeta are either secondary (for instance Prunetum spinosae and mixed shrubby growths with *Prunus spinosa, Rosa* sp. div., *Crataegus,* etc. along the highroads and pathways) or only stages of a certain succession.

The shrubby communities can be classified according to the degree of xerophilness and the substratum (limestones and non-calcareous soils). Very troublesome is, however, the grouping of shrubby associations on account of the various transitions, the different variants and the non-stability of the growths. This is the cause why I describe for the present only some concrete growths leaving the question open which of them are well-defined associations and which only stages in the usual succession. One should, however, keep in mind that a growth of the same composition can be on one place the final community and on an other place only a transitional stage.

11. Mixed subxerophilous thickets on limestone slopes.

Out of different analyses I choose as an especially typical growth the scrub on the slope above Špaček's mill, which is of rather wide extent, covering the lower part of the fairly steep northern (resp. north-northeastern) declivity above the brook Radotínský potok. The growth is shrubby, semi-open with rich semi-xerophilous vegetation occupying the open spaces. The composition is as follows:

Woody plants: *Cornus sanguinea* (7) is most abundant, very abundant are *Ligustrum vulgare* (6) and *Corylus avellana* (5), scattered *Acer campestre* (3), *Prunus spinosa* (3, locally gregariously), *Rosa* sp. (3), *Crataegus monogyna* (3), *Carpinus betulus* (3); rather plentifully occurs *Cytisus nigricans* (4); solitary appears *Acer pseudoplatanus* (1) in a bushy form.

Grasses and grasslike plants: they are not at all prominent and this fact has its significance for the aspect of the vegetation. All in all I could ascertain:

Sesleria calcaria 3—4
Carex digitata 3—4
Avena pubescens 1—2

Herbs:

Primula officinalis 6
Bupleurum falcatum 5
Melampyrum nemorosum 5
Trifolium medium 5
Helianthemum ovatum 4—5
Thlaspi montanum 4—5
Anemone silvestris 4
Campanula persicifolia 4
Chrysanthemum corymbosum 4
Fragaria collina 4
Leontodon hispidus 4
Salvia pratensis 4

Sanguisorba minor 4
Veronica teucrium 4
Achillea collina 3
Anthericum ramosum 3
Anthyllis vulneraria 3
Asperula tinctoria 3
Aster amellus 3
Centaurea jacea 3
Chrysanthemum leucanthemum 3
Clinopodium vulgare 3
Cirsium acaule 3
Fragaria vesca 3
Hieracium vulgatum var. *maculatum* 3
Knautia arvensis 3
Linum catharticum 3
Polygala vulgaris 3
Potentilla opaca 3
Viola hirta 3
Carlina vulgaris 2—3
Pimpinella saxifraga 2—3
Teucrium chamaedrys 2
Vincetoxicum officinale 2
Euphorbia cyparissias 1
Hieracium murorum 1
Stachys recta 1

Bryophyta: of mosses there are rather many; the growth is continuous and partly so because of the abundant mosses, especially of *Hylocomium triquetrum*, which is by its dominance the leading species. Besides there grow: *Hylocomium splendens, Thuidium abietinum, T. tamariscinum, Rhodobrgum roseum, Hypnum cupressiforme, Scleropodium purum, Homalothecium sericeum, Fissidens taxifolius.*

Of lichens I noted only *Cladonia furcata.*

This very characteristic scrub passes higher up on the slope into a shrubby wood with a greater number of ombrophilous plants *(Hepatica triloba, Anemone nemorosa, Symphytum tuberosum).* Yet higher up grow scattered also *Digitalis ambigua, Lilium martagon, Viola mirabilis.*

12. **Xerophilous mixed scrub on calcareous soil.**

I already mentioned the difficulties in differentiating the individual types of the shrubby communities. In the preceding paragraph I fixed the *Cornus sanguinea—Ligustrum—Corylus* type, which is relatively slightly xerophilous and even in its herbaceous constituents rather homogenous. But we find on limestone partly more xerophilous, partly submesophilous types (the latter approaching the hazel and white beech woods), partly a type combining in its herbaceous plants xerothermic species (on openings) as well as shade-seeking wood herbs.

As a distinct type I mention a xerophilous scrub in which usually occur *Cornus mas, Cotoneaster integerrima, Quercus pubescens,* not seldom also *Berberis vulgaris,* whereas *Corylus* as a rule and *Cornus sanguinea* most often are missing, but *Ligustrum vulgare* is usually abundant. In the undergrowth grow subxerophilous and wood plants, joined on openings by xerothermic elements which can associate into small steppe meadows.

On the plateau Velký háj opposite Kosoř I analysed extensive subxerophilous thickets of this kind, formed by *Cornus mas, Ligustrum vulgare* and *Quercus pubescens* as dominant species, accompanied by *Cotoneaster integerrima, Crataegus, Berberis vulgaris, Acer campestre, Sorbus torminalis* and *Pirus communis* run wild.

The analysis of the undergrowth gives the following result:

a) The undergrowth proper, which forms an integral part of the association:

Stellaria holostea 6
Primula officinalis 4—5
Asperula tinctoria 3—4
Chrysanthemum corymbosum 3—4
Clematis recta 3
Hepatica triloba 3
Orobus vernus 3
Veronica chamaedrys 3
Veronica teucrium 3
Viola hirta 3
Ajuga genevensis 2—3
Melica nutans 2—3
Polygala comosa 2—3
Peucedanum cervaria 2
Potentilla opaca 2
Ranunculus bulbosus 2
Turritis glabra 2
Carex muricata 1—2

b) Open half-shaded places which are the abode of a xerothermic vegetation and where semi-steppe meadows are formed. Here we find for instance:

Asperula glauca
Aster linosyris
Bupleurum falcatum
Carex humilis
Euphorbia cyparissias
Geranium sanguineum
Inula hirta
Potentilla arenaria
Pulsatilla nigricans
Salvia pratensis
Stachys recta
Thymus praecox

Other analyses show again a different sociological aspect, although it seems possible to find certain features in common. According to the formation of the shrubby growth one can often trace in the herbaceous and grassy components of this scrub a far-reaching gradation from xerothermic (on dry open places steppe-) elements to the species of humous shady woods that find a home in the shadow of the shrubs where more leaves accumulated and formed enough of leaf-mould. In a superficial analysis of such mixed growth we get a strange mixture of all kinds of ecological elements and it is quite possible to see in such an analysis *Carex humilis, Potentilla arenaria* and *Thymus praecox* side by side with *Viola hirta, Hepatica triloba* and *Asarum europaeum.* First of all, however, this community is a true abode for species having a predilection for light shadow as for instance *Chrysanthemum corymbosum, Primula officinalis, Clematis recta* and similar. Here and there grows in the scrub gregariously *Lithospermum purpureo-coeruleum,* on more open spaces *Dictamnus albus, Polygonatum officinale, Myosotis suaveolens* and others.

On the ridge behind Homolka on limestone gravel alternate xerophilous scrub with grassland associations. Here for instance blackthorn grows gregariously and in this Prunetum spinosae took root *Centaurea axillaris, Teucrium chamaedrys, Coronilla varia, Melica ciliata* and on the border of the shrubs grows also fairly plentifully *Aster amellus;* but in the vicinity we see a small Stipetum capillatae and next to it a Caricetum humilis, further again rather extensive thickets with dominant *Cotoneaster integerrima* (in it also *Lonicera xylosteum* and *Ligustrum vulgare*) and in this scrub one observes *Trifolium alpestre* (very gregariously) and *Chrysanthemum corymbosum* (abundantly), but behind this thicket extends a fragmentary Brachypodietum pinnati (with *Briza media, Lactuca viminea, Asperula tinctoria,* etc.), then there are atypical grassy flowering pastures with plentiful *Brunella grandiflora,* here and there also with *Oxytropis pilosa* and yet further a scrub with *Berberis, Crataegus, Cotoneaster,* etc.

It is evident that in such a case a sociologist must analyse with the utmost care to avoid completely confusing results.

13. Prunetum fruticosae on non-calcareous schists.

Thickets on non-calcareous soil are in our territory of no great extent and without hardly any exception either secondary or only stages of evolution. A very interesting shrubby community along the tourist path on the rather steep declivity above Radotín is formed by *Prunus fruticosa*. This community grew up on a sunny, already some time ago deforestated slope on which crumbling schists in places project to the surface. Here the original community must have been represented by Hercynian deciduous woods, but after they were felled, the rain carried most of the scarce humus away and on sunny slopes with shallow soil settled shrubs accompanied by a rather xerophilous vegetation, higher up on better soil the vegetation usual on clearings gained foothold.

I have been observing these thickets many years and even though their sociological character changed somewhat during this time, the general composition is the same, as they are protected by the extreme habitat, the exposure as well as the rocky substratum being important factors.

The composition of the community is the following:

Woody plants: *Prunus fruticosa* (9) and *Rosa gallica* (5); scattered *Cytisus nigricans* (3).

Grasses: mostly entirely missing, in places *Poa pratensis* (3) rather abundantly.

Herbs:

Teucrium chamaedrys 4—5
Geranium sanguineum 4—5
Chrysanthemum corymbosum 4
Asperula cynanchica 4
Trifolium alpestre 4
Bupleurum falcatum 3—4
Asperula glauca 3
Campanula persicifolia 3
Centaurea rhenana 3
Eryngium campestre 3
Erysimum crepidifolium 3
Genista germanica 3
Genista tinctoria 3
Hieracium murorum 3
Hypericum perforatum 2—3
Myosotis stricta 3
Peucedanum cervaria 3
Potentilla argentea 3
Sedum reflexum 3
Seseli glaucum 3
Silene nutans 3
Thymus ovatus 3
Verbascum lychnitis 3
Veronica chamaedrys 3
Sedum boloniense 2
Stellaria holostea 2

This community shows many positive and negative features and is rather well-fixed, as its habitat is preserving its extreme type and surely will continue to do so yet for a long time.

14. Mesophilous thickets on non-calcareous ground.

We met in the preceding community with a xerophilous shrubby type on non-calcareous soil and it would be possible to enumerate also other analogous subxerophilous communities, but I omit mentioning these in this synoptical study, because they are not well-defined associations. As the second extreme I mention, however, thickets on rocky substratum of algonkian schists on localities surrounded by forest and on a habitat with greater moisture and rich

moss growths. The most typical association-individual of this type I analysed in the very beginning of the main valley of Radotín, on its northern side above the brook. I found here amid secondary young spruce forests, nearly without any undergrowth, a rocky bushy slope, in open places covered with a luxuriant flowering vegetation. Its composition is as follows:

Woody plants: *Cornus sanguinea, Corylus avellana, Crataegus oxyacantha, Ligustrum vulgare, Evonymus europaea* and *Ribes alpinum* in varying frequence.

Grasses and grass-like plants:

Poa nemoralis 3
Avena pubescens 3
Festuca rubra 3
Festuca ovina 3
Luzula nemorosa 1
Luzula campestris 1

Herbs:

Chrysanthemum corymbosum 4—5
Chrysanthemum leucanthemum 4—5
Clinopodium vulgare 4
Silene nutans 4
Veronica chamaedrys 4
Veronica teucrium 4
Campanula persicifolia 3—4
Cirsium eriophorum 3
Clematis recta 3
Digitalis ambigua 3
Epilobium montanum 3
Fragaria vesca 3
Fragaria elatior 3
Galium mollugo 3
Stellaria holostea 3
Fragaria viridis 1

Bryophyta: semi-open places are richly mossy. Predominant are here cushions of *Hylocomium triquetrum,* abundantly appear *Hypnum cupressiforme* and *Homalothecium sericeum,* scattered are *Lophozia barbata, Plagiochila asplenioides, Schistidium apocarpum.*

C. **Grassland Communities.**

15. **Valley-meadows and mesophytic meadows.**

On the bottom of the valley of Radotín along the brook there are often meadows which we may consider as artificial or cultivated. There were doubtless originally also swampy meadows with Cyperaceae *(Carex, Scirpus)* in predominance, but in the course of time they disappeared and left only a few insignificant remnants. Now there extend here mostly cultivated hay-meadows, the composition of which is rather changeable. A slight elevation of the ground causes of course a considerable change in the growth. Also the meadow culture is not without influence on the meadow types and we can not therefore identify the latter with true associations. Seeing that I have relatively but few analyses I give only examples of such meadows, the detailed analysis of which I reserve for the monography of this valley.

1. **Dactylis-Lolium type.** I analysed a meadow of this type in the near vicinity of Kalina's mill with the following result:

Grasses and grass-like plants:

Dactylis glomerata 8
Lolium perenne 6
Lolium multiflorum 4
Arrhenatherum elatius 4

Bromus mollis 4
Phleum pratense 1—4
Poa pratensis 1
Cynosurus cristatus 1—2
Festuca pratensis 1—2

Papilionaceous:

Trifolium repens 5
Trifolium hybridum 4
Trifolium pratense 4
Medicago sativa 3—4
Medicago media 3—4
Medicago lupulina 1—2
Vicia sepium 2—3
Lotus corniculatus 2
Lathyrus pratensis 1

Others:

Cerastium vulgatum 5
Bellis perennis 5
Ranunculus acer 4
Ranunculus repens 4
Crepis biennis 3—4
Galium mollugo 3—4
Tragopogon pratensis 3—4
Achillea millefolium 3
Chrysanthemum leucanthemum 3
Geranium pratense 3
Heracleum spondylium 3
Rumex acetosa 3
Cichorium intybus 2
Galium verum 2
Rumex crispus 2
Taraxacum officinale 2
Equisetum arvense 1
Plantago media 1

2. **The Arrhenatherum type** (resp. *Arrhenatherum — Dactylis — Trisetum* type).

Following the valley, after it turns behind the little pond, we observe several meadow types, differentiated above all according to the undergroundwaterlevel. In the depression next to the little pond is a Caricetum, further on in the valley extend cultivated meadows, in the lower part of the *Festuca pratensis* type and in a slightly higher position, in a long narrow strip, of the *Arrhenatherum* type. We observe how a difference of only a few *cm* already has a penetrating influence on the meadow growth. The composition of the *Arrhenatherum* type is as follows:

Grasses:

Arrhenatherum elatius 8
Dactylis glomerata 6
Trisetum pratense 5
Agrostis alba 3
Festuca pratensis 2
Alopecurus pratensis 1—2

Papilionaceous:

Trifolium pratense 4
Trifolium repens 2
Medicago lupulina 3
Lathyrus pratensis 3
Vicia sepium 3

Others:

Pastinaca sativa 6
Achillea millefolium 4
Galium mollugo 4
Galium verum 4
Geranium pratense 4
Tragopogon orientalis 4
Crepis biennis 3
Heracleum spondylium 3
Plantago media 3
Potentilla reptans 3
Rumex acetosa 3
Chrysanthemum leucanthemum 2
Equisetum arvense 1
Symphytum officinale 1

This type is only a variant of the preceding one. In both there are no mosses.

3. **Festuca pratensis type,** mentioned already above, borders on the preceding type; the boundaries between them are somewhat sharp, what is surely of interest. *Festuca pratensis* grows regularly over the whole expanse of this meadow and is still more dominant than *Arrhenatherum* in the preceding type.

Grasses and grass-like plants:

Festuca pratensis 9
Holcus lanatus 6
Agrostis alba 4
Scirpus silvaticus 4
Juncus compressus 3
Carex Goodenoughii 3
Carex hirta 1
Juncus conglomeratus 1
Phragmites communis 1

Papilionaceous:

Trifolium hybridum 4—5
Trifolium repens 3
Trifolium pratense 2—3

Others:

Angelica silvestris 5
Cirsium oleraceum 5
Cirsium canum 0—4
Ranunculus acer 4—5
Galium uliginosum 4
Cerastium vulgatum 3—4
Colchicum autumnale 3—4
Caltha palustris 3
Euphrasia Rostkoviana 3
Galium verum 3
Myosotis palustris 3
Centaurea jacea 2
Bellis perennis 1

4. **Briza media type.** In the valley before the mill Suchý mlýn there is on an absolutely flat piece of ground, but very little elevated above the moister valley-meadows, a meadow of a different, rather mesophilous type. Its composition is as follows:

Grasses:

Briza media 6—7
Arrhenatherum elatius 4
Festuca elatior 3
Trisetum flavescens 3
Dactylis glomerata 3

Papilionaceous:

Medicago lupulina 5—6
Medicago falcata 4—5
Trifolium pratense 3
Lotus corniculatus 3
Lathyrus pratensis 3
Medicago sativa 1

Others:

Salvia pratensis 5—6
Potentilla reptans 5
Centaurea jacea 4—5
Ranunculus bulbosus 4—5
Cerastium vulgatum 4
Chrysanthemum leucanthemum 4
Galium verum 4
Leontodon hispidus 4
Pastinaca sativa 4
Achillea millefolium 3
Bellis perennis 3
Crepis biennis 3
Daucus carota 3
Euphrasia Rostkoviana 3

Geranium pratense 3
Heracleum sphondylium 3
Leontodon autumnalis 3
Plantago lanceolata 3
Plantago media 3
Rumex acetosa 3
Tragopogon orientalis 3
Veronica chamaedrys
Cirsium acaule 2
Equisetum arvense 1—2
Taraxacum officinale 1—2
Colchicum autumnale 0

Bryophyta: only *Camptothecium lutescens* appears oftener.

The meadow is rich in flowers and its aspect in the early summer depends upon the innumerable *Salvia pratensis*. Further, towards the above mentioned mill, extends a similar type, but *Salvia pratensis* is there missing or only scarcely scattered. Rarely appears here also *Carum carvi*.

16. Swampy and marshy meadows.

Such type is to be found principally near the ponds and in the wettest depressions of the valley-meadows. Close to the pond behind Kalina's mill we see a *Carex acutiformis* type. Otherwise one can regard Cariceta and Scirpeta silvatici as representatives of these communities, but I leave their analyses for the future. In some places we come across transitional types between marshes and hygrophilous lowland-meadows. In the rear portion of the valley of Radotín, behind the last pond, there is a wet meadow, the aspect of which is dominated by the innumerable *Cirsium canum*, in which company there grow *Angelica silvestris, Lychnis flos cuculi, Filipendula ulmaria, Geranium pratense, Chrysanthemum leucanthemum, Galium verum, Rumex acetosa, Carex hirta, C. Goodenoughii, C. Schreberi*, etc.

17. Reed-swamp and brook-bank communities.

Also these communities will be for the time being only superficially mentioned. In the last pond in the valley we see for instance in shallow water an extensive consociety of *Equisetum limosum* and near its border there grow also *Phragmites communis, Carex gracilis, Symphytum officinale, Filipendula ulmaria, Scrophularia alata, Solanum dulcamara, Mentha longifolia* and others.

The community of hygrophilous plants accompanying the banks of brooks (rivers and ponds) are to be seen on different places in the main valley of Radotín, but very often they are not fully developed or in fact partly destroyed through the activity of man. Near Špaček's mill we find for instance associated *Mentha longifolia, M. aquatica, Myosotis palustris, Ranunculus repens, Lycopus europaeus, Poa trivialis, Phalaris arundinacea,* and all these species are also otherwise rather common. Here and there grow also *Scrophularia alata* and *Cardamine amara* gregariously.

On the foot of Hradiště opposite the entrance into the valley of Kosoř we see a hygrophilous community which gained foothold on the wet travertines forming deposits as much as 1 meter in thickness. There are extensive moss cushions of *Amblystegium filicinum* and in these grows gregariously *Eupatorium cannabinum*, scattered *Equisetum arvense, Tussilago farfara,* and *Mentha longifolia.*

The water communities are, however, very poor as far as the vascular plants are concerned. In places occurs *Potamogeton crispus* very gregariously.

18. Subxerophilous meadows.

Just as the hygrophilous hay-meadows, these meadows also are secondary in our territory and partly artificial. They are of no great extent and sociologically hardly characteristic. Under this heading we can put the meadow type in the rear part of the Radotín valley behind the low-land meadows dominated by *Cirsium canum*, on places where the ground is but slightly elevated over the niveau of the brook. This rather insignificant elevation conditions an entirely different and more xerophilous type of the following composition:

Grasses and grass-like plants:

Avena pubescens 3—4
Festuca ovina 3—4
Poa pratensis 3
Arrhenatherum elatius 2—3
Dactylis glomerata 1—2
Alopecurus pratensis 1—2
Briza media 1
Luzula campestris 2

The aspect, however, is governed not by grasses but by flowering plants; in places the turf is not entirely compact.

Herbs:

Rhinanthus minor 8
Cerastium arvense 5—6
Medicago lupulina 4—5
Myosotis stricta 4
Salvia verticillata 4
Cerastium vulgatum 3—4
Chrysanthemum leucanthemum 3
Plantago media 3
Rhinanthus major 3
Rumex acetosa 3
Saxifraga granulata 3
Valerianella olitoria 3
Veronica chamaedrys 3
Achillea millefolium 2
Arabis hirsuta 2
Cerinthe minor 2
Eryngium campestre 2
Linum catharticum 2
Plantago lanceolata 2
Ranunculus bulbosus 2
Bellis perennis 1—2
Onobrychis viciifolia 1—2
Pastinaca sativa 1—2
Potentilla reptans 1—2
Thlaspi perfoliatum 1—2
Veronica prostrata 1—2

As the soil is rather sandy and dries quickly, the growth is not everywhere closed and was surely less so in a former stage of evolution. This can explain how some annuals and weeds (for instance *Cerinthe*) penetrated into this meadow and maintain themselves to the present time. They are favoured by the fact that the grasses do not form a compact turf.

For the study of the origin of secondary meadows without direct interference of man is of no small interest a secondary meadow amidst Hercynian oak woods on the plateau near the rocky tooth-like projection with *Saxifraga aizoon*. In this oak wood (of the *Festuca ovina* type) there is a nearly circular opening some 16 to 20 steps across and on this enclosure originated naturally a subxerophilous, yet not perfectly fixed flower meadow of this composition:

Grasses and grass-like plants: *Dactylis glomerata* is dominant in one half, *Avena pubescens* in the other half. Besides there occur *Poa pratensis* (3—4), *Festuca ovina* (1), *F. elatior* (1), *Phleum phleoides* (1), *Briza media* (locally near the border), *Carex muricata* (2).

Herbs:

Salvia pratensis 7
Galium verum 6
Ranunculus bulbosus 5
Coronilla varia 4
Trifolium alpestre 4
Euphorbia cyparissias 3—4
Veronica chamaedrys 3—4
Medicago falcata 3
Medicago lupulina 3
Ajuga genevensis 2—3
Centaurea axillaris 2—3
Muscari tenuiflorum 2—3
Chrysanthemum corymbosum 1—2
Chrysanthemum leucanthemum 1—2
Potentilla opaca 1—2
Primula officinalis 1—2
Teucrium chamaedrys 1—2
Thymus Löwyanus 1—2
Cephalanthera alba 1
Crepis biennis 1
Taraxacum officinale 1
Pulsatilla nigricans 0

It will be surely interesting to follow the evolution of this meadow in the near future.

19. **Seslerietum calcariae.**

This very natural association is in our territory of very wide extent, principally on the northern (or north-western) more shaded slopes. But it is questionable whether it is possible to regard all the Seslerieta of the valley of Radotin as a single association. Of about 20 analyses of topographically independent growths I chose first of all 10 typical association-individuals, that is mossy non-xerophytic growths, in which grasses (except the dominant species, of course) and *Carex humilis* are either totally absent or are only sparsely scattered with but little dominance. On the basis of these 10 analyses the constitution of this association is as follows:

Seslerietum calcariae,

as ascertained by analysing 10 typical growths of this association.
(Constancy indicated by numbers).

A. Vascular plants.

Sesleria calcaria 10
Thlaspi montanum 7
Thymus praecox 7
Anthericum ramosum 6
Campanula persicifolia 6
Potentilla opaca 6
Linum catharticum 6
Centaurea axillaris 6
Viola hirta 6
Scabiosa ochroleuca 5
Seseli glaucum 5
Sanguisorba minor 5
Coronilla varia 5
Primula officinalis 4
Stachys recta 4
Asperula cynanchica 4
Anthyllis vulneraria 4
Euphorbia cyparissias 4
Teucrium chamaedrys 3
Cytisus nigricans 3
Cotoneaster integerrima 3
Pimpinella saxifraga 3
Melampyrum nemorosum 3
Galium mollugo 3
Asperula tinctoria 3
Carex digitata 3
Digitalis ambigua 3
Silene nutans 3
Anemone silvestris 3
Lilium martagon 2
Arabis hirsuta 2
Hieracium vulgatum 2
Pulsatilla nigricans 2
Helianthemum canum 2

Chrysanthemum corymbosum 2
Medicago falcata 2
Calamintha acinos 2
Clinopodium vulgare 2
Lotus corniculatus 2
Bupleurum falcatum 2
Hepatica triloba 2
Sedum boloniense 2
Achillea millefolium 1
Arabis arenosa 1
Asplenium trichomanes 1
Asplenium ruta muraria 1
Agrimonia eupatorium 1
Aquilegia vulgaris 1
Botrychium lunaria 1
Briza media 1
Cirsium acaule 1
Centaurea rhenana 1
Carlina vulgaris 1
Cirsium eriophorum 1
Cerastium arvense 1
Cerastium vulgatum 1
Chrysanthemum leucanthemum 1
Festuca vallesiaca 1
Fragaria vesca 1
Fragaria viridis 1
Galium boreale 1
Hieracium bifidum 1
Koeleria gracilis 1
Knautia arvensis 1
Luzula campestris 1
Lactuca perennis 1
Myosotis stricta 1
Potentilla alba 1
Phleum phleoides 1
Peucedanum cervaria 1
Ranunculus bulbosus 1
Ranunculus auricomus 1
Rubus saxatilis 1
Saxifrage aizoon 1
Stellaria holostea 1
Symphytum tuberosum 1
Sorbus aria 1
Thlaspi perfoliatum 1
Veronica chamaedrys 1
Veronica teucrium 1
Veronica spicata 1
Viola collina 1
Viola mirabilis 1
Verbascum lychnitis 1
Vincetoxicum officinale 1

B. Bryophyta and Lichens.

Rhytidium rugosum 7
Hypnum cupressiforme 7
Hycolomium triquetrum 6
Hylocomium splendens 6
Ditrichum flexicaule 5
Hypnum molluscum 4
Camptothecium lutescens 4
Encalypta contorta 3
Tortula sp. 3
Fissidens taxifolius 3
Homalothecium sericeum 3
Hylocomium Schreberi 2
Tortella tortuosa 2
Thuidium abietinum 2
Madotheca platyphylla 2
Lophozia barbata 2
Plagiochila asplenioides 2
Scleropodium purum 1
Grimmia sp. 1
Brachythecium albicans 1
Polytrichum juniperinum 1
Leptogyum lacerum 1
Metzgeria furcata 1
Dicranum undulatum 1
Mnium undulatum 1
Solorina saccata 4
Cladonia pyxidata 5
Cladonia fimbriata 2
Cladonia furcata 2
Peltigera aphtosa 1

From this list we learn the structure of this association, in which *Sesleria calcaria* occurs always with the highest dominance. The growths are very mossy, but the lichens are rather insignificant. If we keep in mind the picture of a typical Seslerietum, only then can we criticize growths of other physiognomy and of other composition, which may be regarded as variants or rather as allied associations.

I shall quote now some typical examples of such Seslerieta.

1. **A mossy and grassy Seslerietum** on the slope above Špaček's mill, exposed to the north:

Grasses:

Sesleria calcaria 9
Festuca sulcata 4—5
Festuca rubra 3—4
Koeleria pyramidata 3—4
Avena pubescens 3—4
Poa pratensis 2

Herbs:

Thlaspi montanum 5
Asperula tinctoria 4
Helianthemum ovatum 4
Linum catharticum 4
Potentilla opaca 4
Primula officinalis 4
Ranunculus bolbosus 4
Sanguisorba minor 4
Thymus praecox 4
Anthyllis vulneraria 3
Calamintha acinos 3
Campanula persicifolia 3
Cerastium vulgatum 3
Euphorbia cyparissias 3
Galium mollugo 3
Lotus corniculatus 3
Medicago lupulina 3
Pimpinella saxifraga 3
Seseli glaucum 3
Anemone silvestris 2
Sedum boloniense 2
Asperula cynanchica 1
Asplenium trichomanes (on stones)
Cirsium acaule 1
Clinopodium vulgare 1
Galium silvestre 1
Ononis spinosa 1
Silene nutans 1

Bryophyta (the mosses and lichens growing only on the surface of rocks I omit as strangers to this association): *Hylocomium splendens, H. triquetrum, Hypnum molluscum, H. cupressiforme, Encalypta contorta.*

Lichens: *Cladonia pyxidata, C. furcata, C. rangiformis, Peltigera rufescens.* This variant is noteworthy for the rather considerable admixture of grasses.

2. **Somewhat mossy Seslerietum with Carex humilis** on the rocky declivities continuing form the pond near Kalina's mill to above Špaček's mill. This growth is rather extensive, not entirely closed, the exposure towards the west, the soil rather deep. Besides *Sesleria calcaria* (10) there is *Carex humilis* (4—5) very abundantly scattered; in places occur interspersed *Brachypodium pinnatum* (1).

Herbs:

Helianthemum canum 4—5
Potentilla arenaria 4—5
Thymus praecox 4
Clinopodium vulgare 3—4
Pulsatilla nigricans 3—4
Asperula cynanchica 3
Scabiosa ochroleuca 3
Teucrium chamaedrys 3
Anthyllis vulneraria 2
Stachys recta 2
Achillea collina 1—2
Anthericum ramosum 1—2
Coronilla varia 1—2
Euphorbia cyparissias 1—2
Geranium sanguineum 1—2
Lactuca perennis 1—2
Medicago falcata 1—2
Seseli hippomarathrum 1—2
Teucrium botrys 1—2
Artemisia campestris 1
Fragaria viridis 1
Hieracium vulgatum 1
Polygonatum officinale 1
Salvia pratensis 1

The growth is only moderataly mossy, the lichens (only *Cladonia fimbriata*) are totally insignificant. Of mosses appears more frequently only *Homalothecium sericeum;* besides there grow *Hypnum cupressiforme* and *Tortula* (two species).

This Seslerietum is of a little more xerophilous character than the usual type, but this is, of course, the consequence of the effect of the rocky ground. Therefore there are missing some species of high constancy as *Thlaspi montanum, Potentilla opaca, Campanula persicifolia, Viola hirta* and others, but instead *Carex humilis* is comparatively abundant and the number of more xerophilous species rather considerable.

A one-sided successionist, of course, would declare such a Seslerietum only as an evolutional stage and he might in a certain sense be right. But where the ground will preserve its character, also this community may remain unchanged for a long period.

3. **A non-mossy, semi-open xerophilous Seslerietum** on the rocky ridge above the second pond in the middle part of the valley of Radotín.

Grasses and grass-like plants: *Sesleria calcaria* (8—9, in a non-closed growth), *Carex humilis* (2—3), *Koeleria gracilis* (2), *Festuca sulcata* (2).

Herbs:

Helianthemum canum 7—8
Potentilla arenaria 6
Thymus praecox 4
Asplenium ruta muraria 3—4
Anthericum liliago 3
Asperula cynanchica 3
Pulsatilla nigricans 3
Seseli glaucum 3
Seseli hippomarathrum 3

Of mosses only *Tortula* is rather abundant.

This growth, which is very low, is pronouncedly xerophytic and can be regarded as a type of an open *Sesleria* rocky steppe, essentially different from the usual Seslerieta.

4. **Sparsely mossy mesophytic Seslerietum without grasses.** The extensive declivity from the ravine to the uppermost part of the slope near Kalina's mill is covered by Seslerieta with more or less abundantly scattered bushes. I analysed the greater part of these Seslerieta, adjacent to the ravine in its lower and middle zone. They are more or less closed, with a northern (or north-northwestern) exposure. Their composition is as follows:

Grasses and sedges:

Sesleria calcaria 8—10
Carex digitata 2

Herbs:

Anthericum ramosum 6—8
Thymus praecox 4—5
Anemone silvestris 4
Asperula tinctoria 4
Hieracium murorum 4
Thlaspi montanum 4
Hepatica triloba 3
Lotus corniculatus 3
Aquilegia vulgaris 2—3
Bupleurum falcatum 2
Campanula persicifolia 2
Carlina vulgaris 2
Chrysanthemum corymbosum 2
Coronilla varia 2
Hieracium vulgatum var. *maculatum* 2
Hieracium bifidum 1—2 (in the upper part)
Melampyrum nemorosum 1

Potentilla opaca 2
Primula officinalis 2
Rubus saxatilis 2
Sanguisorba minor 2
Scabiosa ochroleuca 2
Stachys recta 2
Teucrium chamaedrys 2
Viola hirta 2
Lilium martagon 1

Woody plants: *Cytisus nigricans* 5—6, an important element in this Seslerietum; besides there are scattered other woody plants, for instance rather abundantly *Sorbus aria,* only scattered *Tilia ulmifolia.*

Bryophyta: The growth is strikingly sparsely mossy, although there is a fairly good number of calciphilous species. There grow: *Camptothecium lutescens, Hylocomium splendens, H. triquetrum, H. Schreberi* (scarcely), *Rhytidium rugosum, Hypnum cupressiforme, H. molluscum, H. chrysophyllum, Thuidium abietinum, Eurhynchium* sp., *Fissidens taxifolius, Rhodobryum roseum.*

This Seslerietum is surely a noteworthy type. Except *Anthericum ramosum,* which during its flowering time commands the whole aspect (it grows everywhere at least abundantly scattered, in places is dominant and here and there even more abundant than *Sesleria* itself), this growth is not rich in flowers, but as it was able to develop itself magnificently on its extensive locality, the number of the species is considerable. The total absence of grasses (except the dominant species) is surely noteworthy; also *Carex humilis* and other more xerophytic types as *Potentilla arenaria* and *Helianthemum canum* are missing. Besides, the absence of lichens may be pointed out. In the upper part of the slope the growth becomes of course more xerophilous and there grows in masses *Anemone silvestris,* but the composition is otherwise nearly the same. Not until on the uppermost rocky zone the Seslerietum is replaced by rocky communities with *Sesleria calcaria, Helianthemum canum, Centaurea axillaris;* there are, of course, different lichens in considerable abundance.

In the lower and middle zone are shrubs (also *Corylus avellana*) of no rare occurrence and one may suppose that this Seslerietum, if its evolution will not be disturbed by the interference of man, in further succession will overgrow with shrubs and at last change into a wood as a climax community.

5. **Mossy mesophilous Seslerietum of Cirsium type** in the uppermost zone on the border of the plateau in the main valley about opposite Bárta's quarry. The growth is closed, mossy, the exposure towards north to north-northeast.

Grasses:

Sesleria calcaria 10
Koeleria pyramidata 4
Festuca rubra 3
Brachypodium pinnatum 2

Herbs:

Cirsium pannonicum 7
Cirsium acaule 4
Cirsium Freyerianum 2
Helianthemum ovatum 4
Linum catharticum 4
Sanguisorba minor 4
Anemone silvestris 3—4
Asperula glauca 3—4
Brunella grandiflora 3—4
Potentilla opaca 3—4
Anthericum ramosum 3
Campanula glomerata 3
Chrysanthemum corymbosum 3
Chrysanthemum leucanthemum 3

Coronilla varia 3
Knautia arvensis 3
Lotus corniculatus 3
Trifolium montanum 3
Thymus praecox 2—3
Helianthemum canum 3
Hieracium pilosella 2
Euphorbia cyparissias 1—2
Viola hirta 1—2
Hieracium murorum 1

Bryophyta: *Rhytidium rugosum* very abundant, besides *Thuidium abietinum, Camptothecium lutescens, Hylocomium triquetrum, Hypnum cupressiforme, Scleropodium purum, Mnium affine, Webera nutans, Bryum capillare, Fissidens taxifolius.*

6. **Mossy Seslerietum of Cirsium type** on Hradiště, closed or nearly so, on a northern slope. *Sesleria calcaria* has the highest dominence, other grasses are missing except the scattered *Avena pubescens.*

Anthericum ramosum 6
Cirsium acaule 6
Cirsium eriophorum 4
Cirsium pannonicum 2
Fragaria collina 4
Ranunculus bulbosus 4
Galium silvestre 3—4
Campanula persicifolia 3
Epipactis rubiginosa 3
Primula officinalis 3
Sanguisorba minor 3
Thymus praecox 3
Viola hirta 3
Agrimonia eupatorium 2
Brunella grandiflora 2
Clinopodium vulgare 2
Hieracium canofloccosum 2
Hieracium murorum 2
Centaurea axillaris 1—2
Carlina vulgaris 1

Bryophyta: The growth is not so mossy as in the preceding Seslerietum, but notwithstanding mosses are abundant enough, especielly *Hylocomium splendens;* besides there occur *Hypnum cupressiforme, Rhytidium rugosum, Fissidens taxifolius, Lophocolea bidentata, Madotheca platyphylla, Lophozia barbata.*

20. **Stipetum capillatae.**

The grassy associations (including Caricetum humilis) form a group of nearly allied communities, differing in their typical constitution already by their physiognomy, but passing through atypical growths, variants, societies and consocieties into a continuous chain which, however, is not simple, as there are many abnormalities and variations, so that an enemy of plant sociology could easily doubt the reality of the chief associations themselves. We must, however, take into consideration that the habitat changes often on the smallest area and becomes thereby a variegated mosaic, the result of which are the many fragmentary and atypical growths. Having analysed ecologically and sociologically a good many typical as well as atypical growths, I am convinced that we are justified in distinguishing Seslerietum calcariae, Stipetum capillatae, Festucetum vallesiacae, Caricetum humilis and Brachypodietum pinnati as independent associations, although the floristical (but not the sociological!) constitution of these communities is very similar or sometimes nearly the same. In Stipetum capillatae there grow usually *Carex humilis* as well as *Andropogon ischaemum,* but notwithstanding I am not inclined to regard this association as a variant of Caricetum humilis or vice versa. The robust and tall *Stipa capillata* influences the habitat in quite a different manner than

the low and compact tufts of *Carex humilis* and therefore there is always a certain difference in these two associations sociologically as well as ecologically and in their physiognomy.

Stipeta capillatae occur in our territory scattered on sunny limestone slopes and are not seldom sharply defined. The dominance of *Stipa capillata* is usually very high (about 10), that of *Andropogon ischaemum* mostly about 3 and of *Carex humilis* 1—4.

The constitution of this association is according to my analyses as follows (the numbers indicate the constancy):

Grasses and sedges:

Stipa capillata 10
Andropogon ischaemum 10
Carex humilis 9
Koeleria gracilis 6
Festuca vallesiaca 5
Melica ciliata 1
Poa pratensis 1

Herbs:

Potentilla arenaria 10
Helianthemum canum 9
Centaurea rhenana 8
Eryngium campestre 7
Achillea collina (resp. *pannonica*) 6
Sanguisorba minor 6
Scabiosa ochroleuca 6
Teucrium chamaedrys 6
Thymus praecox 6
Teucrium botrys 5
Asperula cynanchica 4
Salvia pratensis 4
Seseli hippomarathrum 4
Anthericum liliago 3
Calamintha acinos 3
Convolvulus arvensis 3
Pulsatilla nigricans 3
Sedum album 3
Sedum boloniense 3
Echium vulgare 2
Euphorbia cyparissias 2
Hieracium pilosella 2
Medicago falcata 2
Medicago minima 2
Muscari tenuiflorum 2
Sedum sexangulare 2
Stachys recta 2
Alyssum calycinum 1
Carlina acaulis 1
Cirsium acaule 1
Fragaria viridis 1
Hieracium murorum 1
Lactuca perennis 1
Pimpinella saxifraga 1
Thlaspi perfoliatum 1
Trifolium striatum 1
Verbascum lychnitis 1

Bryophyta and lichens are often entirely missing which is an important negative feature of our association. As the ground is not rarely stony there are present on stones and rocks species (as for instance *Caloœdema candidum, Toninia coeruleo-nigricans, Schistidium apocarpum,* etc.) that can not be regarded as constituents of this community. Sometimes, although rarely, grows here *Rhytidium rugosum,* here and there also *Encalypta vulgaris, Pterygoneurum cavifolium, Collema* sp., *Tortula montana, Dermatocarpon rufescens.*

21. **Andropogonetum ischaemi.**

For the time being I leave the question open whether it is justificable to regard Andropogonetum ischaemi (or Ischaemetum as it is sometimes called) as a distinct association. *Andropogon ischaemum* is surely a very com-

mon and abundant grass in our territory, its abundance being especially striking in the late summer. Notwithstanding I am rather doubtful about its title to an association. Very often it is a variant of Brachypodietum pinnati, or the grassy communities with very abundant to dominant *Andropogon ischaemum* are secondary, as is very often the case also in other parts of our Republic. But in a few cases the Andropogoneta appear natural enough as for instance on the steep and high slopes opposite Velký háj in the beginning of the Kosoř side valley. There we observe the following stratification of the plant covering:

1. Hercynian vegetation on the plateau with alluvial deposits.
2. Lichen steppes (Cladonietum rangiformis stepposum) on shallow stony and rocky ground of the uppermost zone.
3. Rocky steppes on horizontally stratified limestone rocks.
4. Rock communities on compact and steep rocks.
5. Andropogonetum on deep stony clay soil.
6. Brachypodieta, which are sometimes next to Andropogoneta, sometimes in a lower strip.
7. Xerophilous bushy thickets on stony ground.
8. Bushy woods in the lowest zone.

These Andropogoneta are formed by a nearly pure growth of *Andropogon ischaemum*, growing there in robust and nearly contiguous tufts. *Thymus praecox* is abundant as well as *Convolvulus arvensis* and *Campanula rapunculoides*, scattered are *Eryngium campestre*, *Agrimonia eupatorium*, *Sanguisorba minor*, *Fragaria viridis*, rather scarce *Euphorbia cyparyssius*, *Teucrium chamaedrys*, *T. botrys*, *Coronilla varia*, *Salvia pratensis*; here and there penetrate into this community blackthorns (*Prunus spinosa*) in dwarf form and *Rubus caesius*. There are no mosses whatever and also *Brachypodium pinnatum* is wanting. The growth is not closed. As these Ischaemeta repeat themselves, one would be induced to regard them as a proper association, specially so as they are perfectly natural and on ground without any secondary influences. But the neighbouring Brachypodieta have a very similar structure. They are often nearly closed, but without any mosses; *Andropogon ischaemum* is interspersed, *Helianthemum canum* rather abundant, *Agrimonia eupatorium* abundantly scattered, whereas *Euphorbia cyparissias*, *Eryngium campestre*, *Convolvulus arvensis*, *Sanguisorba minor*, *Fragaria viridis*, *Thymus praecox*, *Helianthemum ovatum*, *Salvia pratensis* and *Cirsium acaule* are mostly scarce. In parts (towards the rocks) grows abundantly enough *Anthericum liliago*, solitarily appear here *Rosa sepium* and *Prunus spinosa* in dwarf form.

There is consequently no essential difference between the two communities, except that in the first mentioned *Brachypodium pinnatum* is missing.

Both communities are, of course, initial stages and in further succession they will probably be replaced by thickets.

22. Festucetum vallesiacae.

This association, in which the leading grass (replaced sometimes partly by *Festuca sulcata*) has a dominance of 7 to 10, is scattered on sunny limestone slopes and all in all rather frequent. It is typically developed also on the diabase hill in the main valley. The growth is usually closed, but may be also more

or less open (rocky Festucetum vallesiacae of a peculiar physiognomy). The composition of this association is — on the basis of 10 analyses — as follows:

Grasses and sedges:

Festuca vallesiaca 10
Koeleria gracilis 10
Phleum phleoides 6
Andropogon ischaemum 4
Carex humilis 4
Festuca sulcata 3
Avena pubescens 2
Avena pratensis 1
Poa pratensis 1
Melica ciliata 1

Herbs:

Seseli hippomarathrum 10
Potentilla arenaria 9
Euphorbia cyparissias 8
Dianthus Carthusianorum 7
Medicago falcata 7
Sedum boloniense 7
Thymus praecox 7
Centaurea rhenana 6
Salvia pratensis 6
Thymus Löwyanus 6
Achillea collina (or *pannonica*) 5
Coronilla varia 5
Echium vulgare 5
Eryngium campestre 5
Asperula cynanchica 4
Hieracium pilosella 4
Pimpinella saxifraga 4
Sanguisorba minor 4
Stachys recta 4
Teucrium chamaedrys 4
Verbascum lychnitis 4
Anthyllis vulneraria 3
Centaurea axillaris 3
Medicago minima 3
Taraxacum laevigatum 3
Thlaspi perfoliatum 3
Alyssum calycinum 2
Anthericum ramosum 2
Arenaria serpyllifolia 2
Hieracium cymosum 2
Inula hirta 2
Medicago lupulina 2
Seseli glaucum 2
Trifolium alpestre 2
Anthericum liliago 1
Arabis hirsuta 1
Asperula glauca 1
Calamintha acinos 1
Carduus nutans 1
Cerastium arvense 1
Convolvulus arvensis 1
Crepis rhoeadifolia 1
Cuscuta minor 1
Erysimum odoratum 1
Helianthemum canum 1
Hieracium setigerum 1
Lactuca viminea 1
Muscari tenuiflorum 1
Myosotis suaveolens 1
Plantago lanceolata 1
Pulsatilla nigricans 1
Ranunculus bulbosus 1
Sedum album 1
Sedum sexangulare 1
Silene nutans 1
Teucrium botrys 1
Thesium linophyllum 1
Thlaspi montanum 1
Tragopogon majus 1
Veronica spicata 1
Veronica teucrium 1

Bryophyta: usually not abundant. The highest constancy has *Hypnum cupressiforme,* in several analyses was found *Thuidium abietinum* and *Rhytidium rugosum,* less frequently *Homalothecium sericeum, Hylocomium splendens, H. Schreberi, Tortella tortuosa, Tortula montana, Ortotrichum cupulatum, P. anomalum, Grimmia pulvinata.*

Lichens: of these were ascertained *Cladonia furcata, C. alcicornis, C. pyxidata, C. cariosa, C. fimbriata, Parmelia hypoclista, Cornicularia aculeata, Peltigera malacea.*

23. Avenetum pratensis.

This community is developed on some places of the declivity of the steep ridge between „u Šarbochů" and Bárta's quarry. Alhough always of very small extent, it usually is sharply defined from the neighbouring associations, mostly Brachypodietum pinnati, sometimes also Seslerietum. *Avena pratensis* equally predominates, *Carex humilis* appears abundantly enough interspersed; of herbs are *Potentilla arenaria* and *Helianthemum canum* the two most abundant, *Thymus praecox* and *Linum catharticum* abundant, whereas *Centaurea axillaris* and *Scabiosa ochroleuca* are scarce.

These growths, however, represent in my opinion not an independent association, but more likely are only a special abnormal type of Caricetum humilis, although there are doubtlessly some relations to the adjacent rocky Seslerietum; *Sesleria calcaria,* however, is always missing.

24. Brachypodietum pinnati.

This community is frequent in our territory on rather deep clay calcareous soils. Its growths are mostly secondary, having occupied sunny slopes of a certain soil character after the trees or bushes had been cleared. I succeeded notwithstanding in finding one growth of an undoubtedly natural origin, which will be described later on. Sometimes *Andropogon ischaemum* is rather abundant in this association, dominating its aspect late in the summer, but also such communities (*Brachypodium-Andropogon* type) are to be regarded only as a variant of our rather remarkable association.

The composition is according to 10 analyses as follows:

Grasses and sedges:

Brachypodium pinnatum 10
Carex humilis 7
Andropogon ischaemum 4
Koeleria gracilis 4
Festuca vallesiaca 4
Poa pratensis 4
Stipa capillata 2
Phleum phleoides 2
Avena pratensis 2
Festuca sulcata 2
Festuca pseudovina 1
Carex Schreberi 1

Herbs:

Euphorbia cyparissias 9
Sanguisorba minor 8
Achillea collina (resp. *pannonica*) 7
Cirsium acaule 7
Fragaria viridis 7
Hieracium pilosella 7
Salvia pratensis 7
Thymus praecox 7
Coronilla varia 6
Helianthemum canum 6
Potentilla arenaria 6
Teucrium chamaedrys 6
Eryngium campestre 5
Medicago falcata 5
Pimpinella saxifraga 5
Anthericum liliago 4
Carlina vulgaris 4
Centaurea rhenana 4
Helianthemum ovatum 4
Ononis spinosa 4
Scabiosa ochroleuca 4
Seseli hippomarathrum 4
Agrimonia eupatorium 3
Bupleurum falcatum 3
Centaurea scabiosa 3
Daucus carota 3
Dianthus Carthusianorum 3
Knautia arvensis 3
Leontodon hispidus 3
Lotus corniculatus 3

Pulsatilla nigricans 3
Stachys germanica 3
Echium vulgare 2
Inula hirta 2
Picris hieracioides 2
Salvia verticillata 2
Seseli glaucum 2
Taraxacum corniculatum 2
Verbascum lychnitis 2
Anthericum ramosum 1
Arabis hirsuta 1
Artemisia campestris 1
Asperula cynanchica 1
Asperula glauca 1
Centaurea axillaris 1
Clinopodium vulgare 1
Fragaria vesca 1
Inula conyza 1
Medicago lupulina 1
Medicago minima 1
Melilotus officinalis 1
Oxytropis pilosa 1
Plantago lanceolata 1
Plantago media 1
Polygonatum officinale 1
Potentilla opaca 1
Sedum boloniense 1
Taraxacum officinale 1
Vicia hirsuta 1
Viola arenaria 1
Viola hirta 1
Vincetoxicum officinale 1

Bryophyta and lichens: in many growths missing, in none very significant. In all I could ascertain the following species: *Thuidium abietinum*, *Rhytidium rugosum*, *Camptothecium lutescens*, *Pterygoneurum curvifolium*, *Tortella tortuosa*, *Hypnum cupressiforme*, *Collema* sp., *Parmelia conspersa* var. *hypoclista*, *Cladonia silvatica*.

As already mentioned Brachypodieta are usually a natural but not an original plant community. If we ascend from Špaček's mill to the rocky ridge, steeply sloping into the main valley, we can descend from the plateau into the steep slope, falling beneath compact perpendicular rocks with a cave. This western slope, accessible with difficulty and untouched by man and animals is covered by a closed Brachypodietum which is not only natural but also original. Its composition is as follows:

Grasses and sedges:

Brachypodium pinnatum 10
Carex humilis 5
Festuca vallesiaca 3
Avena pratensis 3
Koeleria gracilis 3
Phleum phleoides 1—2

Herbs:

Clinopodium vulgare 7
Helianthemum ovatum 5—6
Teucrium chamaedrys 5
Coronilla varia 4
Fragaria viridis 3—4
Achillea collina 3
Arabis hirsuta 3
Centaurea scabiosa 3
Cirsium acaule 3
Leontodon hispidus 3
Thymus praecox 3
Euphorbia cyparissias 1—2
Lotus corniculatus 1—2
Pimpinella saxifraga 1—2
Sanguisorba minor 1—2
Scabiosa ochroleuca 1—2
Seseli glaucum 1—2
Seseli hippomarathrum 1—2
Centaurea axillaris 1
Hieracium pilosella 1
Verbascum lychnitis 1

Of mosses only *Rhytidium rugosum* grows in places more abundantly.

This Brachypodietum is of a less xerophilous character than is usually the case. The growth is dense and tall but notwithstandimg *Carex humilis* is

abundantly scattered in it, although at first glance invisible, as it is hidden by the luxuriant grassy growth. It is likely that there was originally — at a rather distant period — a Caricetum humilis which, however, in its succession gave place to Brachypodietum; this happened probably after there accumulated a deeper layer of calcareous detritus.

25. Caricetum humilis.

This community is quite common on rocky and stony limestone places with shallow soil (of the rendzina type); it is ecologically very peculiar and often represents a special type of rocky steppe. The growth is usually semi-open, or open, only sometimes closed. In some habitats Caricetum humilis seems to be a climax community, but on others it probably passes in the course of further succession into other communities, for instance in a Stipetum capillatae or a Festucetum. Ecologically this association is usually pronouncedly xerophytic, although here and there on wood openings we meet Cariceta of small extent, which harbour a good many subxerophilous or even mesophilous plants. As special variants of Caricetum humilis the following two are rather remarkable:

a) Caricetum humilis with abundant *Festuca vallesiaca;*

b) Caricetum humilis with very abundant *Stipa capillata.*

The constitution of this association is on the basis of 10 analyses the following:

Grasses and grass-like plants:

Carex humilis 10
Koeleria gracilis 7
Stipa capillata 6
Festuca sulcata 4
Phleum phleoides 4
Festuca vallesiaca 3
Brachypodium pinnatum 3
Andropogon ischaemum 2
Melica ciliata 2
Stipa Joannis 2
Poa pratensis 2
Bromus inermis 1
Sesleria calcaria 1

Herbs:

Helianthemum canum 8
Potentilla arenaria 8
Thymus praecox 8
Pulsatilla nigricans 7
Teucrium chamaedrys 7
Centaurea rhenana 6
Seseli hippomarathrum 6
Artemisia campestris 5
Centaurea axillaris 5
Inula hirta 5
Medicago falcata 5
Anthericum liliago 4
Aster linosyris 4
Helianthemum ovatum 4
Salvia pratensis 4
Sanguisorba minor 4
Scabiosa ochroleuca 4
Sedum boloniense 4
Stachys recta 4
Anthericum ramosum 3
Arabis hirsuta 3
Centaurea scabiosa 3
Eryngium campestre 3
Euphorbia cyparissias 3
Hieracium pilosella 3
Muscari tenuiflorum 3
Sedum acre 3
Sedum album 3
Taraxacum laevigatum 3
Alyssum montanum 2
Anemone silvestris 2
Asperula cynanchica 2

Bupleurum falcatum 2
Calamintha acinos 2
Falcaria Rivini 2
Teucrium botrys 2
Thesium linophyllum 2
Thlaspi perfoliatum 2
Verbascum lychnitis 2
Achillea collina 1
Alyssum calycinum 1
Anthyllis vulneraria 1
Arabis auriculata 1
Asperula tinctoria 1
Asperula glauca 1
Aster amellus 1
Chrysanthemum corymbosum 1
Coronilla varia 1
Dianthus Carthusianorum 1
Echium vulgare 1
Erysimum crepidifolium 1
Fragaria viridis 1
Hieracium cymosum 1
Hieracium echioides 1
Hieracium laevigatum 1
Lactuca perennis 1
Lathyrus albus 1
Linum catharticum 1
Medicago minima 1
Orobanche lutea 1
Oxytropis pilosa 1
Peucedanum cervaria 1
Plantago media 1
Polygonatum officinale 1
Potentilla opaca 1
Seseli glaucum 1
Thlaspi montanum 1
Thymus Löwyanus var. *stenophyllus* 1
Trifolium alpestre 1
Vincetoxicum officinale 1

Woody plants:

Berberis vulgaris 1
Cotoneaster integerrima 1
Cytisus nigricans 1
Juniperus communis 1
Prunus fruticosa 1

Bryophyta: as the ground is often rocky or stony, there is not seldom interspersed a special rocky association of calciphilous mosses of a xerophytic character; besides these species, which are not in reality constituents of Caricetum humilis, I observed the following:

Hypnum cupressiforme 7
Rhytidium rugosum 6
Tortula montana 6
Thuidium abietinum 5
Tortella tortuosa 4
Brachythecium sp. 2
Camptothecium lutescens 2
Dicranum fulvum 2
Thuidium tamariscinum 2
Schistidium apocarpum 2
Ceratodon purpureus 1
Racomitrium canescens 1

Lichens: of lichens is physiognomically prominent the genus *Cladonia*, in the following species: *C. rangiformis* 5, *C. furcata* 5, *C. alcicornis* 4, *C. fimbriata* 3, *C. cariosa* 3, *C. pyxidata* 2, *C. silvestris* 2; besides there grow: *Parmelia conspersa* var. *hypoclista* 2, *Collema* sp. 2, *Bacidia muscorum* 1. Other species inhabit the rocks and the surface of the stones, thus for instance *Toninia coeruleo-nigricans, T. (Thalloderma) candida,* etc.

Cariceta humilis and Seslerieta are usually well-defined and there are sharp boundaries between them, but notwithstanding we find some growths of Cariceta (for instance in the valley of Zadní Kopanina) rich in flowers and with rather abundantly scattered *Sesleria calcaria,* which, however, seems to be on the retreat. The Seslerieta normally inhabit the more humid and less arid northern slopes, whereas the Cariceta accompany the sunny, dry and warm southern sides.

26. Subxerophilous meadows on non-calcareous soil.

We already became acquainted (see p. 34—35) with secondary subxerophilous meadows on non-calcareous soils. Only exceptionally in our territory we come across such grass-flower communities, which give the impression of being natural as for instance on the plateau above the first Mašek's mill towards Kosoř. On the plateau itself there are clayey and sandy alluvial deposits and these extend in places even on to the gentle slope near the border of the plateau, which descends into the main valley of Radotín. There we find extensive growths of bushy white beech woods and of hazel (with oaks, common maples and hawthorns among them) and in these thickets are smaller or larger openings. On these enclosures meadows of the following composition gained foothold:

Grasses and grass-like plants:

Briza media 7—8
Avena pubescens 3—4
Festuca ovina 3
Phleum phleoides 3
Sieglingia decumbens 3
Luzula campestris 2—3
Agrostis vulgaris 2
Anthoxanthum odoratum 2
Brachypodium pinnatum 2
Poa pratensis (angustifolia) 1—2

Herbs:

Helianthemum ovatum 6
Leontodon hispidus 5
Trifolium medium 5
Chrysanthemum leucanthemum 4
Brunella laciniata 3
Centaurea jacea 3
Hieracium pilosella 3
Lotus corniculatus 3
Plantago media 3
Potentilla opaca 3
Trifolium montanum 3
Brunella vulgaris 2
Euphorbia cyparissias 2
Fragaria viridis 2
Melampyrum pratense 2
Pimpinella saxifraga 2
Galium verum 1
Linum catharticum 1
Medicago lupulina 1

Bryophyta: *Hylocomium triquetrum* and *H. Schreberi* abundantly enough.

Besides there are some other variants of these meadows, characteristic for more acid soils, but I confine myself to this single example which is the result of analyses of three openings not far apart.

27. Xerophilous flower-communities of limestone slopes.

These communities are in our territory widely spread on sunny dry slopes, but are changeable in their character, forming gradual transitions partly to Caricetum humilis, Festucetum vallesiacae, Brachypodietum pinnati and Stipetum capillatae, partly to the rock vegetation and lastly to the xerophilous bushy woods. A confirmed successionist would hardly hesitate to designate all such communities as transitional stages. But the geomorphological formation of our valley guaranties the perpetual existence of such habitats that will harbour these communities for an unlimited period, although in other places the same communities may be only transitional and of much shorter duration. One may say in general that these communities are characterised by their unclosed growth as well as by the comparatively small abundance of grasses and of *Carex humilis*, which neither govern the aspect nor form a compact turf. I therefore

look upon the xerophilous flowering communities as a distinct association, although in some cases there is hardly any doubt that — supposing an undisturbed succession — the growth in the course of time will become closed by means of grasses resp. *Carex humilis*, or that it will be replaced by bushes which could pass finally into xerophilous shrubby woods as climax association. I may, however, emphasize the fact that there are habitats insuring by their edaphic and microclimatic conditions the undisturbed existence of these communities for a very long period.

All in all these communities are rather heterogenous. Sometimes they are also secondary, having been formed in the place of thickets or xerophilous woods, the habitat of which, after the clearing of the original woody growth, changed in such a manner that closed grassy associations could not gain foothold on the locality. With respect to this heterogenous character of these communities I confine myself only to some selected examples.

a) The extensive open slope of the Velký háj facing Kosoř, with exposure towards south to east. As the grassy joining element is missing, the growth is not quite closed and the flowering xerophilous herbs predominate. During the flowering time of *Anthericum* the aspect is determined by the white star-like flowers of this beautiful plant. On the slope grow scattered bushes, as follows: *Cornus mas, Cotoneaster integerrima, Quercus pubescens, Juniperus communis, Berberis vulgaris, Ligustrum vulgare, Prunus fruticosa, Rosa gallica* and other roses, *Crataegus.*

Herbs:

Aster linosyris 8
Anthericum liliago 5—8
Helianthemum canum 6
Potentilla arenaria 6
Pulsatilla nigricans 5—6
Teucrium chamaedrys 5—6
Seseli hippomarathrum 5—6
Stachys recta 5
Thymus praecox 5
Linum austriacum)* 4—5
Salvia pratensis 4—5
Achillea pannonica 4
Asperula glauca 3
Aster amellus 3
Bupleurum falcatum 3
Centaurea rhenana 3
Chrysanthemum corymbosum 3
Dictamnus albus 3
Euphorbia cyparissias 3
Gentiana ciliata 3
Geranium sanguineum 3
Inula hirta 3
Lactuca perennis 3
Medicago falcata 3
Scabiosa ochroleuca 3
Vincetoxicum officinale 3
Gentiana amarella 2—3
Anthericum ramosum 2
Polygonatum officinale 2
Hieracium pilosella 1—2
Inula salicina 1
Inula conyza 1

Grasses and sedges:

Carex humilis 5
Stipa Joannis 2—3
Stipa capillata 1—2

This shows approximately the features of this community. A detailed study of the rather extensive area covered by this growth demonstrates, however, that the plant covering, given above as a whole, is differentiated according to the conditions of its habitat. On the plateau above the slope there are woods

*) Introduced.

passing slowly into xerophilous thickets, further there is in the uppermost zone of the slope on stony ground a Caricetum humilis and below it richly flowering unclosed growths with dominant *Anthericum liliago* and with very abundant to abundant *Carex humilis* (in this community herbs are predominant, namely *Potentilla arenaria,* both *Helianthema, Teucrium chamaedrys, Pulsatilla nigricans*). This community, rich in flowers, lacks *Brachypodium pinnatum* (like Caricetum) and occupies stony ground with very shallow soil. Below, on deep clayey or deeper stony soil extends a not quite closed and flowery Brachypodietum pinnati of the *Anthericum liliago* type. *Aster linosyris,* dominant in the upper community, disappears, *Carex humilis* is only scattered and other herbs occur in changed frequency. I was able to follow the evolution of this Brachypodietum during a period of twenty years and in the course of these years *Brachypodium pinnatum* increased in quantity in such a manner that it seems highly probable that the present community will be replaced in a near future by a true Brachypodietum and in a far-distant time probably by xerophilous shrubby communities. I am convinced as well that in the uppermost zone, however, near the edge of the slope, Brachypodietum is not a probable future stage of the succession on account of the configuration of the locality, which will keep its character for an indefinite period of time. It is, however, easily to be imagined that Caricetum humilis will occupy this strip and that the xerophilous scrub near the border of the plateau will advance towards the slope. One can therefore theoretically reconstruct as final communities, which may in the course of time replace the present flowering unclosed plant covering on this locality, Caricetum humilis on stony, rocky and shallow soil and Brachypodietum pinnati below it on deep clay soil. Already at the present time we see there Caricetum humilis in different types: thus for instance a semi-closed growth with dominant *Potentilla arenaria* (7), further with *Pulsatilla nigricans* (4), *Helianthemum canum* (4), *Anthericum liliago* (4), *Thymus praecox* (3), *Helianthemum ovatum* (3), *Oxytropis pilosa* (2—3), *Seseli hippomarathrum* (2), *Inula hirta* (2), *Peucedanum cervaria* (1) and *Aster linosyris* (1). Besides we observe growths with *Carex humilis* in lesser dominance (4—5) and with very abundant *Aster linosyris* and *Potentilla arenaria,* abundant *Pulsatilla nigricans* and scattered *Scabiosa ochroleuca.* These growths will pass in the course of further succession into typical Caricetum humilis.

b) In best development we find flower communities of the limestone slopes in the valley of Radotín near Šubert's mill on the southern declivity above the little pond. The ground is stony, shallow, the growth one of grasses and flowers, closed or semi-open; in the spring time the aspect is commended by the very abundant and regularly scattered *Anthericum liliago.*

The composition is as follows:

Grasses and grass-like plants:

Koeleria gracilis 4
Festuca vallesiaca 4
Stipa capillata 3—4
Agropyrum repens 3
Andropogon ischaemum 3 (locally)
Brachypodium pinnatum 2
Melica ciliata 1
Stipa Joannis 1
Carex humilis

Herbs:

Anthericum liliago 6—7
Artemisia campestris 6
Potentilla arenaria 5
Seseli hippomarathrum 5

Medicago falcata 4—5
Calamintha acinos 4
Fragaria viridis 4
Teucrium chamaedrys 4
Orobanche lutea 3—4
Coronilla varia 3
Cuscuta minor 3
Echium vulgare 3
Eryngium campestre 3
Euphorbia cyparissias 3
Hieracium pilosella 3
Lactuca viminea 3
Pulsatilla nigricans 3
Sedum boloniense 3—4
Sedum sexangulare 3—4
Sedum album 3
Achillea pannonica 3
Alyssum calycinum 3
Bupleurum falcatum 3
Centaurea axillaris 3
Centaurea rhenana 3
Centaurea scabiosa 3
Sanguisorba minor 3
Thlaspi perfoliatum 3
Agrimonia eupatorium 2
Dianthus Carthusianorum 2
Lactuca perennis 2
Tragopogon campestris 2

Woody plants: here and there *Prunus spinosa* and *Rosa* sp. scattered.

Bryophyta: Tortula montana and *Schistidium apocarpum* are rather abundant, *Rhytidium rugosum* and *Thuidium abietinum* are only scattered.

Lichens: none.

When we ascend this slope we see the gradual change of the habitat (which becomes more xerothermic), and hand in hand with this change goes also the composition of the plant covering, which passes by degrees into a stony steppe of the *Potentilla arenaria—Carex humilis—Helianthemum canum* type with *Andropogon ischaemum* abundant enough; *Anthericum liliago,* however, is also plentiful here; solitarily occurs *Orobanche arenaria,* a parasite on *Artemisia campestris.* In the highest zone appear lichen steppes that will be described later on.

c) If we ascend up the above mentioned slope to the border of the plateau and then continue our way near the margin of the woods towards the locality of *Saxifraga aizoon,* again we observe different types of grass-flower steppes, the aspect of which is determined in the springtime by the abundantly scattered *Anthericum liliago,* which, however, penetrates also into different other communities, thus for instance into the calciphilous Cladonietum and into Caricetum and Brachypodietum. On the upper part of the slope extend steppes which, however, do not correspond with any of the above described associations, as they are composed of a mixture of *Stipa capillata, Festuca vallesiaca* and *Carex humilis* in varying proportion, with abundantly scattered *Orobanche lutea,* locally also with *Anthericum liliago* or in places with abundant *Muscari tenuiflorum.*

The *Muscari tenuiflorum* type characterises first of all the transitional zone between the open slope and the woods of the plateau. In this zone occur scattered bushes and also small groups of trees. In places the growth of *Muscari* is so dense that it looks as if it had been sown. From the analysis of the most compact growth — a veritable Muscarietum — around and also beneath an oak tree *(Quercus sessilis)* results the following structure of this community:

Grasses:

Poa pratensis (narrow-leaved) 5
Festuca vallesiaca 3—4
Phleum phleoides 3—4

Herbs:

Muscari tenuiflorum 10!
Medicago falcata 6
Salvia pratensis 6
Trifolium alpestre 6
Fragaria viridis 4
Galium verum 4
Chrysanthemum corymbosum 3
Helianthemum ovatum 3
Sanguisorba minor 3
Teucrium chamaedrys 3
Trifolium montanum 3
Linum catharticum 2
Coronilla varia 1

Bryophyta: in places these growths are rather mossy; the moss-carpets are formed especially by *Rhytidium rugosum* with *Hylocomium Schreberi* and *Thuidium alietinum.*

This community, of course, differs totally from those described above (*a* and *b*). I mention it on this place only because it can not be regarded as a well-defined association. On drier places *Muscari* becomes less gregarious and then spreads partially into steppe-meadows and partially on to the slopes of the *Anthericum* type.

d) In the rear part of the valley of Radotín on the sunny side there are slopes bearing locally a rich flowering semi-open or hardly closed vegetation. One of these growths was dominated by the exceedingly abundant *Centaurea rhenana* + *Seseli glaucum;* with them are associated the rather abundant *Anthericum liliago* and the very abundant *A. ramosum* (this species passes from limestone on to schists with a deep clay soil), further very abundantly *Helianthemum canum, Aster linosyris, Pulsatilla nigricans,* abundantly *Oxytropis pilosa,* scattered *Hieracium setigerum, Geranium sanguineum, G. columbinum, Inula hirta, Thesium linophyllum* and near the border of the xerophilous woods also *Peucedanum cervaria.* Grasses are not prominent, although *Brachypodium pinnatum* is scattered.

e) A very interesting community is to be found in the upper part of the slope of Hradiště (approximately opposite the entrance into the Kosoř valley). On stony ground (rubble) without humus on an open south-western slope we see there an unclosed growth of the following composition:

Grasses, Bryophyta and lichens: none whatever.

Herbs:

Bupleurum falcatum 7—9
Sanguisorba minor 4
Asperula cynanchica 3
Pimpinella saxifraga 3
Galeopsis angustifolia 2—3
Sedum album 2—3
Thymus praecox 1—6*)
Melilotus officinalis 2
Teucrium botrys 2
Daucus carota 1
Eryngium campestre 1
Euphorbia cyparissias 1
Melilotus albus 1
Stachys germanica 1

This community, different again substantially from the preceding, is characteristic for rubbles and rubbly-clayey places, and we come across it in different variants on many places in our territory, although it is not seldom developed only fragmentarily. It is, of course, only an initial commmnity, passing in later succession into other associations, most often into Brachypodietum

*) Only in the upper part very abundantly.

pinnati. This succession can be demonstrated very instructively on Hradiště, where we see in close proximity on rubbly places the above community, on deeper clay soil typical Brachypodieta and here and there different transitional stages between the two.

On rubbles without clay on the surface there usually grows gregariously *Teucrium chamaedrys.*

The following community on a limestone rubble in the lower part of the northern slope of the ridge branching off near the first Mašek's mill is an other example of a similar community:

Saxifraga tridactylites 7
Seseli hippomarathrum 7
Thymus praecox 6
Arenaria serpyllifolia 3
Sedum album 3
Arabis hirsuta 2—3
Asperula cynanchica 2—3
Sesleria calcaria 2—3
Potentilla arenaria 2 (mostly trifoliolate)
Sedum acre 2

From mosses there grows in masses *Schistidiium apocarpum* (7), abundantly enough *Grimmia* sp. and only scattered *Polytrichum juniperinum.*

Solitarily penetrates into this community *Koeleria gracilis* (var. *glabra* f. *latifolia*, in small tufts). The growth is unclosed and more than half of the surface is bare. The species, growing in other associations, occur here in ecologically different forms.

The following community, growing on limestone rubble in the lower part of the same slope, is another example of a similar type: *Teucrium botrys* (7—8), *Bupleurum falcatum* (5—6), *Arabis arenosa* (5), *Galeopsis angustifolia* (4), *Sanguisorba minor* (3), *Thlaspi perfoliatum* (3), *Viola hirta* (3).

28. **Subxerophilous flower-growths on non-calcareous slopes.**

We do not have many of these in our territory; they represent of course either initial or transitory communities, but under special habitat conditions they may exist for a long time. We find them beautifully developed above Radotín on schistous slopes along the touristic path to Kosoř. The path leads through a deep cut and is therefore bordered by steep, low banks, formed by schistous rubbles. On the left hand the slope is more overgrown and mostly shrubby (see Prunetum fruticosae, p. —), on the right hand (exposure *SW* and *W*) on the steep bank, covered with schistous rubbles appears the first stage in the settling of vegetation in this form: the greater part is bare, the plants are very scattered, not covering even the twentieth part of the surface; the frequence is therefore given relatively:

Woody plants: *Prunus fruticosa* principally along the border, but sometimes also in the centre; just so *Rosa gallica; Cytisus nigricans* very abundantly scattered.

Grasses:

Poa pratensis 4
Koeleria gracilis 2
Deschampsia flexuosa

Herbs:

Asperula cynanchica 5
Salvia pratensis 5
Erysimum crepidifolium 4—5
Silene nutans 4—5

Thymus ovatus 4—5
Euphorbia cyparissias 4
Galeopsis angustifolia 4
Sedum reflexum 4
Hieracium pilosella 3
Hieracium murorum 3
Genista germanica 2—3
Sanguisorba minor 2
Seseli glaucum 2
Taraxacum officinale 2
Vicia hirsuta 2
Viscaria vulgaris 2
Hieracium auricula 1
Potentilla argentea 1
Trifolium medium 1

This is of course only the first stage and it will be interesting to follow its further succession.

29. **Callunetum vulgaris.**

Heath-growths are in our territory of very limited extent, confining themselves only to alluvial layers here and there on hill-plateaus and to non-calcareous rocks. They are partly secondary and gained foothold especially there where Hercynian deciduous woods were in culture replaced by coniferous forests, although sometimes small Calluneta are to be found also along the borders and on open enclosures of Hercynian woods.

I analysed only five growths with the following result (the numbers indicate in how many of the analyses one or the other species repeats itself):

Herbs (resp. dwarf shrubs):

Calluna vulgaris 5
Antennaria dioica 4
Genista germanica 3
Hieracium pilosella 3
Hieracium murorum 3
Hieracium vulgatum (with unspotted leaves) 3
Anemone nemorosa 2
Fragaria vesca 2
Galium boreale 2
Galium silvestre 2
Gnaphalium silvaticum 2
Melampyrum pratense 2
Potentilla tormentilla 2
Rumex acetosella 2
Vaccinium myrtillus 2
Veronica officinalis 2
Centaurea jacea 1
Cirsium acaule 1
Daucus carota 1
Galium verum 1
Genista tinctoria 1
Helianthemum ovatum 1
Hieracium silvestre 1
Stellaria holostea 1
Thymus ovatus 1
Trifolium medium 1
Trifolium montanum 1

Grasses and grass-like plants:

Agrostis vulgaris 4
Anthoxanthum odoratum 4
Deschampsia flexuosa 4
Festuca ovina 4
Luzula nemorosa 4
Carex montana 2
Luzula campestris 2
Brachypodium pinnatum 1

Bryophyta: always very abundant, often binding the growth.

Hylocomium Schreberi 4
Polytrichum juniperinum 4
Dicranum scoparium 3
Dicranum undulatum 3
Hypnum cupressiforme 3
Lophocolea bidentata 2
Brachythecium velutinum 1
Camptothecium lutescens 1
Plagiochila asplenioides 1
Racomitrium canescens 1

Lichens: these also sometimes take a great part in the forming of this community, especially *Cladonia* sp. div. (5); *Peltigera canina* only 1.

Already in this enumeration we see clearly the Hercynian character of the heath-community, which it would be possible to differentiate into two types: a more open xerophilous and a less xerophilous with more numerous forest species. Some species, the constancy of which is low (1), would surely show a higher degree of constancy, were there a greater number of analyses on hand. We must bear in mind that most of the analysed growths are of small extent, so that the association could not develop itself fully. The soil is acid, of course.

30. **Calcicole lichen-steppe**

(Cladonietum rangiformis stepposum).

This not as yet described and very remarkable association appears on different places on rocky ground, often on such with a thin layer of clay. It is pronouncedly xerothermic and ecologically as well as floristically distinctly peculiar. Sometimes it is only fragmentarily developed, sometimes again it covers a more extensive area, especially on dry, barren limestone slopes of the highest zone. I give its composition according to five analyses (the numbers indicate in how many of the analyses one or the other of the species was observed).

Lichens:

Cladonia rangiformis 5
Cladonia cariosa 3
Cladonia alcicornis 3
Cladonia foliacea 3
Cladonia silvatica 2
Cladonia furcata 1
Parmelia hypoclista 3
Parmelia Pokornyi 3
Urceolaria scruposa 3
Cetraria islandica 2
Cornicularia sp. 2

Bryophyta:

Rhytidium rugosum 4
Hypnum cupressiforme 3
Racomitrium canescens 2
Thuidium abietinum 1

Herbs:

Helianthemum canum 5
Potentilla arenaria 5
Pulsatilla nigricans 4
Seseli hippomarathrum 4
Thymus praecox 4
Artemisia campestris 3
Centaurea rhenana 3
Medicago falcata 3
Muscari tenuiflorum 3
Teucrium chamaedrys 3
Alyssum calycinum 2
Aster linosyris 2
Sanguisorba minor 2
Sedum boloniense 2
Scabiosa ochroleuca 2
Verbascum lychnitis 2
Anthericum liliago 1
Anthyllis vulneraria 1
Asperula cynanchica 1
Centaurea axillaris 1
Lotus corniculatus 1
Medicago minima 1
Pimpinella saxifraga 1
Salvia pratensis 1

Grasses and grass-like plants:

Carex humilis 4
Festuca vallesiaca 4
Koeleria gracilis 4
Andropogon ischaemum 2

Phleum phleoides 2	*Stipa capillata* 1
Festuca sulcata 1	*Stipa Joannis* 1

We of course get the true picture of this association by completing these analyses with the frequency of the leading species. Characteristic is the great dominance of *Cladonia,* especially of *C. alcicornis.* Grasses and grass-like plants assert themselves usually only little; of herbs *Potentilla arenaria* and *Helianthemum canum* always show great dominance, in one case also *Artemisia campestris* and in another *Aster linosyris. Seseli hippomarathrum* and *Thymus praecox* are also sometimes very abundant.

31. Rocky limestone steppes.

As a characteristic type we have already met the open rocky steppe Caricetum humilis. But we observe very often on rocky ground growths in which xerothermic herbs predominate, whereas grass types (especially *Carex humilis* and *Festuca vallesiaca*) retreat into the background. These unclosed growths may be considered as the beginning or the transitional stage of the succession tending towards some of the above described associations.

Of such rocky and stony steppes I could give many examples. Usually certain species repeat themselves (with high frequency of herbs especially *Potentilla arenaria, Thymus praecox, Seseli hippomarathrum, Helianthemum* canum), many species are to be found often, while others again grow only in this or that growth.

On the rocky ridge extending from Homolka downwards toward the road we find a typical example of such a rocky steppe. Dominant is here *Potentilla arenaria,* abundant to very abundant are *Seseli hippomarathrum, Thymus praecox* and *Oxytropis pilosa,* scattered grow here *Scabiosa ochroleuca, Sedum album, S. acre, Carex humilis* and *Festuca vallesiaca. Melilotus officinalis* which, when in flower, colours the whole grassy slope of Homolka towards the road, penetrates in places very abundantly also into this rocky community, where also *Stipa pulcherrima* grows solitarily in robust tufts.

Other types of stony and rocky steppes approach xerothermic flowery slopes as we met them before.

Also on the hill plateau rising from the valley of Kosoř above the main valley of the Radotín brook towards the mill „u Šarbochů" we find in the upper zone besides rather extensive and typical *Cladonia*-steppes in which lichens cover about one sixth to a quarter of the surface, alsowide open rocky steppes, especially on horizontally stratified steep rocky slopes. In this growth the principal part is played by *Potentilla arenaria* and *Helianthemum canum,* abundant is *Thymus praecox,* scattered *Anthericum liliago, Salvia pratensis, Teucrium chamaedrys, Sedum boloniense,* more seldom grow here *Centaurea rhenana* and *Artemisia campestris* and also *Sedum album* and *S. sexangulare.* Grasses are scattered in comparatively plentiful tufts. The most abundant is *Festuca vallesiaca* and also *Carex humilis* is scattered to rather abundant, *Stipa capillata* is abundantly scattered, *Koeleria gracilis* only scattered.

As is evident, for these stony steppes is characteristic the promiscuity of species dominant in the above mentioned associations, and then of course the physiognomy of the growth. On the already mentioned places the configuration of the locality is such that here and there one may presuppose succession into a Caricetum humilis or Festucetum vallesiacae; in places, however, we must consider the present growth as a final one for a long time.

32. Vegetation of limestone rocks.

The sociological analysis of rock-communities is of utmost difficulty, as already the habitat always presents a mosaic and besides we meet in part with initial stages as well as with stages of the further succession. Nevertheless it is quite certain that the rock associations in our territory are of an unlimited duration, because if they lose some habitat, where the plant community passes into its climax, there will be other habitats, old as well as new, which will harbour rock communities of the same or very similar constitution as we find them nowadays. Strictly considered it would be necessary to divide the rock communities into a series of associations. There is already a far-reaching difference according to the exposure, as is demonstrated even by small rocky ridges and projections, on which the opposite sides are inhabited by a totally different vegetation. Rocks themselves offer to the plants extreemely varied habitats. There are compact and often perpendicular cliffs and rock-walls, congenial only for lichen communities and some mosses, further narrow or wide clefts where true chasmophytes have their abode and besides the rocks form projections, ledges, steps and cornices covered with shallow or deeper humus, where in places the fragmentarily developed associations, described above, can gain foothold, for instance on northern declivities Seslerieta, on southern Caricetum humilis. Of great consequence is, of course, the angle of steepness of the rocky slopes. On steep rock-walls the true rock vegetation has its domicile, while on less steep rocky slopes some of the above communities are fully developed. As a chasmophyte can appear *Alyssum saxatile* as well as *Pinus silvestris* or *Tilia platyphylla, Asplenium ruta muraria* as well as *Sorbus aria.*

Of the woody rock plants the most characteristic in our territory are *Cotoneaster integerrima* and *Sorbus aria* and then *Juniperus communis,* although out of the clefts and on the steps and prominences here and there grow many other shrubs and trees. For the northern rocky slopes generally *Sesleria calcaria* and *Saxifraga aizoon* (only on two localities) are very characteristic, for the southern *Alyssum saxatile, Dracocephalum austriacum* (only on one locality), *Artemisia campestris.* Other noteworthy rock plants of a wide distribution in our territory are *Artemisia ruta muraria, Helianthemum canum, Thymus praecox, Potentilla arenaria, Centaurea axillaris, Lactuca perennis, Asperula glauca, Stachys recta, Seseli glaucum, Allium montanum, Sedum album.* Occasionally we find on the rocks all the species peculiar to the rocky and stony steppes.

The effect of the exposure is shown very instructively by the vegetation of the prominent tooth-like rocky projection above the little pond near Kalina's mill, the well-known locality of *Saxifraga aizoon.*

On the northern wall of this rocky ridge near the top there are compact rocks, below them small prominences with *Sesleria calcaria* and extensive moss carpets, lower a true rocky Seslerietum, first interrupted by the configuration of the rocks, then continuous. In this Seslerietum occur (besides the characteristic calcicole lichen *Solorina saccata*) *Anthericum ramosum* (abundantly scattered), *Thlaspi montanum* (abundantly), whereas *Campanula persicifolia, Asperula glauca* and *Seseli glaucum* are abundantly scattered, *Thymus praecox, Stachys recta* and *Asperula cynanchica* scattered; of woody plants there grow *Sorbus aria, Cotoneaster integerrima, Berberis vulgaris, Juniperus communis* and *Cytisus nigricans.*

In the upper zone a true rock community is developed. We see there *Sesleria calcaria* abundantly scattered, gregarious *Saxifraga aizoon,* forming extensive cushions and penetrating also into the Seslerietum, further grow

there abundantly to scattered *Seseli glaucum, Lactuca perennis, Asperula glauca, Centaurea axillaris, Hieracium murorum, Sedum album, Asplenium ruta muraria* and only here and there *Cytisus nigricans.* The extensive mossy growths, an integral constituent of this rock association, consist of *Tortula* sp. (gregariously), *Rhytidium rugosum, Encalypta contorta, Grimmia* sp., *Brachythecium albicans, Homalothecium sericeum, Ditrichum flexicaule, Polytrichum* sp., *Camptothecium lutescens, Hypnum cupressiforme* and others; of lichens are associated with them *Cladonia pyxidata* and *C. fimbriata.* On compact rocks we find a lichen association with *Pertusaria lactea* and *Verrucaria rupestris.* There are, however, quite small siliceous corners or edges of hornstone on the limestone rocks, but they suffice to develop a fragmentary lichen association peculiar to the siliceous rocks containing *Parmelia prolixa* and *Rhizocarpon geographicum.*

On the opposite southern declivity of this narrow limestone ridge we find a totally different vegetation. *Sesleria calcaria,* the leading species on the northern slope, is entirely missing as well as *Saxifraga aizoon* and the extensive mossy growths (mosses and lichens are but few and inabundant). Instead we find here *Alyssum saxatile* and *Artemisia campestris,* further *Calamintha acinos, Centaurea axillaris, Lactuca perennis, Sedum album, Asperula glauca.* Directly on rock grow *Lecanora dispersa,* in clefts *Dermatocarpon hepaticum,* of mosses *Grimmia* sp. and *Tortula montana.*

This rock vegetation is to be found on very many places in different combinations. Thus for instance we see above the natural Brachypodietum pinnati (see p. 45) perpendicular or even overhanging rocks above the cave, where grow scattered *Sesleria calcaria, Alyssum saxatile, Sedum album, Asplenium ruta muraria, Cotoneaster integerrima, Sorbus aria* and inabundantly *Melica ciliata,* but from the humus filling up the clefts grow some species that are not really rock plants, as for instance *Hieracium murorum, H. laevigatum, Arabis hirsuta, Euphorbia cyparissias* and *Asperula cynanchica.*

On the rocky ridge above the first Mašek's *mill* we see on the northern to *north-western rocky slope lower down* Seslerietum, and higher up on steeper ground inaccessible for closed vegetation a characteristic rock community. On the rock-walls we find scattered *Sesleria calcaria,* growing out of clefts or on rock-steps, whereas in the wider crevices with richer humus are present many species of the Seslerietum. Vascular plants are on the whole scarce. We find here *Asplenium ruta muraria* (abundantly scattered), *Asperula cynanchica* (only very scattered), *Arabis auriculata* (abundantly scattered), *Arenaria serpyllifolia* (scattered), *Artemisia campestris* (scattered), *Seseli hippomarathrum* (inabundantly). Besides, however, the mosses are very prominent, forming especially in the lower zone, which is not dry, extensive carpets. In the upper drier part they are on the retreat and in their place grow xerothermic vascular plants. Of Bryophyta the more prominent are *Madotheca platyphylla* (very abundantly, often in extensive carpets), *Homalothecium sericeum, Neckera complanata, Anomodon attenuatus, Ortotrichum* sp., *Rhodobryum roseum, Encalypta vulgaris, E. contorta, Tortula* sp., of lichens *Peltigera canina, Ramalina pollinaria,* on rocks *Caloplaca murorum, C. cirrochroa, Placodium saxatile.*

For the association of the calcicole rock lichens and mosses we can mention, the following species are rather common: *Toninia (Thalloedema) candida, T. coeruleonigricans, Cladonia alcicornis, C. cariosa, Parmelia conspersa* var. *hypoclasta, Dermatocarpon hepaticum, Collena* sp., *Bacidia muscorum, Tortula montana, Grimmia* sp., *Ortotrichum anomalum, Homalothecium sericeum, Schistidium apocarpum, Tortella tortuosa, Ceratodon purpureus.* These species,

although they grow side by side, are differentiated according to the microhabitat.

With regard to the very complicated problems of the rock communities I leave its detailed survey for my proposed monography.

33. Rock plant communities on non-calcareous soil.

The non-calcareous rocks are in our territory of very small extent and they harbour practically only a selection of species belonging to other associations. On the slope of Velký háj, towards the beginning of the entrance to the main valley of Radotín there are rather extensive rocks of schists with the following plant community:

Grasses:

Festuca ovina 4
Poa nemoralis 4
Deschampsia flexuosa 3

Herbs:

Thymus ovatus 4—5
Silene nutans 4*)
Thlaspi perfoliatum 4
Calamintha acinos 3
Fragaria vesca 3
Galium mollugo 3
Geranium Robertianum 3
Hieracium pilosella 3
Potentilla opaca 3
Sedum maximum 3
Veronica chamaedrys 3
Fragaria viridis 2
Sedum acre 2
Campanula persicifolia 1

Woody plants: *Ribes alpinum* very scattered, *Corylus avellana* solitarily.

Pteridophyta:

Asplenium trichomanes 4—5
Polypodium vulgare 4
Cystopteris fragilis 3

Bryophyta: *Hypnum cupressiforme, Hylocomium triquetrum, Homalothecium sericeum, Schistidium apocarpum, Lophozia barbata, Plagiochila asplenioides.*

It is manifest that this community is the usual one on semi-shaded rocks of the Hercynian forest region.

D. Weed Communities.

For the general character of the vegetation of every territory weeds — native and alien — are of no small importance, but their sociological study hitherto has unfortunately been very much neglected. If we take for instance only field weeds, we may distingnish among them certain communities not only according the cultivated plant they accompany, but first of all according to the soil and climatic conditions and the respective floristic region. One may, of course, conceive weeds in a narrow or in a very broad sense. There are many species which grow either as weeds or as constituents of certain natural associations. Besides, there are plants which — although not of a weed character — can

*) Rarely also in the glabrous variety.

under circumstances become weeds (facultative weeds). For the rough evaluation of the weed vegetation of our territory I give a list of weeds and plants of a weed character, which, although incomplete, gives at least an idea about the chief constituents of our weed communities.

a) Weeds characteristic for calcareous soil.

Adonis aestivalis: on fields and fallows often abundantly.
Bupleurum rotundifolium: I have seen this species only once (years ago) on a field in not numerous specimens.
Caucalis daucoides: in fields rather common.
Cerinthe minor: abundantly enough.
Crepis rhoeadifolia: here and there along roads and ways and on clayey declivities.
Conringia orientalis: scattered.
Coronopus Ruellii: rather rare.
Diplotaxis tennifolia: on very scattered localities.
Erysimum odoratum: here and there on wood clearings and in light woods, but sometimes also as a weed on secondary places.
Erysimum repandum: very scattered.
Euphorbia exigua: fairly common.
Euphorbia falcata: scattered.
Galium tricorne: very scattered, but in places abundantly.
Lathyrus tuberosus: scattered.
Linaria elatine: rather rare.
Melampyrum arvense: scattered.
Mercurialis annua: common.
Nigella arvensis: on fallows rarely, but on its few localities abundantly.
Nonnea pulla: not rare, especially on green balks often.
Onobrychis viciifolia: scattered.
Reseda lutea and *R. luteola:* here and there.
Scandix pecten veneris: here and there in fields abundantly.
Sclerochloa dura: not often, mostly on ways.
Stachys annua: here and there on fields and fallows, but usually abundantly.
Thymelaea passerina: very rarely and perhaps transitorily.
Tragopogon dubius: scattered.

b) Weeds characteristic for the region of our xerothermic vegetation.

Many of the weeds of this category are more abundant on calcareous and alcaline soils which are especially congenial for the full development of our thermophilous vegetation, although they sometimes occur also on non-calcareous soils.

! *Agropyrum glaucum:* scattered.
Anthemis austriaca: fairly common.
! *Atriplex rosea:* only here and there.
Cardaria draba: very common and gregarious.
Cerastium brachypetalum and *C. semidecandrum:* scattered on dry grassy places.
! *Chenopodium ficifolium:* and *Ch. opulifolium:* here and there.
Chenopodium vulvaria: abundantly enough.
! *Cirsium eriophorum:* on the whole frequently.

Cynoglossum officinale: scattered.
Datura stramonium: rarely and transitorily.
Eryngium campestre: rather common.
! *Erysimum crepidifolium:* very common and often gregarious; very abundantly often on clayey declivities, but also in the secondary *Robinia pseudacacia* forests, along roads, etc.
Falcaria vulgaris: abundantly scattered.
Geranium columbinum: scattered.
! *Geranium molle:* here and there.
! *Hordeum murinum:* common and often gregarious.
Hyoscyamus niger: scattered.
Lactuca scariola and *L. viminea*: scattered, especially on clayey places.
Melandryum noctiflorum: scattered.
Melilotus officinalis and *M. albus:* common, especially the first species in places quite dominant.
Nepeta cataria: on a few places.
Picris hieracioides: throughout the whole territory scattered.
Poa bulbosa: on drier grassy places often.
! *Salvia nemorosa:* scattered.
Salvia verticillata: very common.
Setaria verticillata: not frequent.
! *Sisymbrium Loeselii;* here and there rather abundantly.
Solanum villosum: rarely.
! *Stachys germanica:* scattered.
Thlaspi perfoliatum: very common.

c) Weeds of wide distribution in this country.

Agropyrum repens
Agrostemma githago
Alyssum calycinum
Amarantus retroflexus
Anchusa officinalis
Anthemis cotula
Antirrhinum orontium
Aspera spica venti
Aphanes arvensis
Atriplex patulum
Bellis perennis
Berteroa incana
Bromus mollis
Bromus tectorum
Bromus sterilis
Camelina microcarpa
Campanula rapunculoides
Capsella bursa pastoris (also in the variety *C. apetala*)
Carduus acanthoides
Carduus nutans
Centaurea cyanus
Chenopodium sp. div. (*album, bonus henricus,* etc.)
Cichorium intybus
Cirsium arvense
Cirsium lanceolatum
Daucus carota
Delphinium consolida
Dipsacus silvester
Draba verna
Echium vulgare
Erodium cicutarium
Erysimum cheiranthoides
Euphorbia cyparissias
Euphorbia esula
Euphorbia helioscopia
Euphorbia peplus
Fumaria officinalis
Geranium pusillum
Herniaria glabra
Holosteum umbellatum
Lappa minor
Lappa major
Lappa tomentosa
Leonurus cardiaca
Lepidium campestre
Lepidium ruderale

Linaria minor
Linaria vulgaris
Lithospermum arvense
Lolium perenne
Lycopsis arvensis
Malva neglecta
Malva pusilla
Matricaria chamomilla
Matricaria inodora
Melandryum album
Myosotis arvensis
Neslea paniculata
Onopordon acanthium
Papaver argemone
Papaver dubium
Papaver rhoeas
Plantago lanceolata
Plantago major
Plantago media
Poa sp. div. (*annua*, *compressa*, etc.)
Ranunculus arvensis
Raphanus raphanistrum
Rubus caesius
Sambucus ebulus
Scleranthus annuus
Senecio sp. div.
Setaria viridis
Sherardia arvensis
Silene vulgaris
Sinapis arvensis
Sicymbrium sophia
Solanum nigrum
Sonchus arvensis
Sonchus asper
Sonchus laevis
Spergula arvensis
Spergularia rubra
Stellaria media (also *apetala*)
Stenophragma thalianum
Tanacetum vulgare
Taraxacum officinale
Thlaspi arvense
Tussilago farfara
Valerianella olitoria
Valeriana dentata
Veronica arvensis
Veronica didyma
Veronica hederifolia (also var. *triloba*)
Veronica Tournefortii
Veronica triphyllos
Veronica verna
Vicia angustifolia
Vicia hirsuta
Vicia segetalis
Vicia tetrasperma
Vicia villosa
Viola arvensis

d) Weeds of moister woods and of thickets.

It is open to discussion whether one or the other species of this category ought to be regarded as a true weed or as species belonging to humous or moist woods or to thickets. Not seldom, however, this is of no consequence, as many species have their home in natural as well as in weed communities. As examples of such weeds may be named:

Aethusa cynapium
Alliaria officinalis
Anthriscus silvester
Artemisia vulgaris
Asperugo procumbens
Ballota nigra
Chaerophyllum temulum
Chelidonium majus
Ficaria verna
Galium aparine
Geum urbanum
Glechoma hederacea
Lamium album
Lamium maculatum
Lamium purpureum
Torilis Anthriscus
Urtica dioica

e) Hygrophilous herbs which often spread as weeds.

In this case it is yet more difficult to distinguish weeds, as the whole hygrophilous communities are often secondary. More or less belong under this

heading some species of the genera *Polygonum, Rumex, Juncus, Roripa, Epilobium*, further *Brunella vulgaris, Barbarea vulgaris, Sagina procumbens, Bidens tripartitus*, etc.

f) Aliens.

Some of them are already perfectly naturalized, others again appear on their localities only transitorily. They are mostly annual, but sometimes also perennial or even woody (shrubs and trees). Thus for instance *Pirus communis*, very often run wild in woods as well as on sunny slopes, *Prunus avium* and *P. cerasus*, *Ribes grossularia. Linum austriacum*, now plentiful in two localities, is an introduction, its seeds having been purposely sown; the species, however, in this manner became fully naturalized. *Sisymbrium strictissimum* on the other hand, is our native species, which penetrated into our region naturally but only in the very last time. This plant, formerly very rare in Bohemia, has been spreading itself in the last 15 years for unknown reasons and without human interference; in our territory I came across it already on three localities far apart from each other.

More than one of the species enumerated in the preceding categories is really alien; from a scientific point of view it would be necessary to classify all our species according to the most convenient system of *Thellung*, which, however, is not practicable in this preliminary report. Further on I give an incomplete list of aliens of our territory, either naturalized or only transitorily introduced.

Althaea officinalis: run wild near Kalina's mill.

Armoracia rusticana: here and there run wild or naturalized.

Clematis vitalba: in a hedge near the main road.

Echinops sphaerocephalus: on waste places near the railway-station in Radotín, rather sparsely.

Galinsoga parviflora: in Radotín and in the valley along the main road here and there.

Lathyrus sativus: on the barren stony slope of Hradiště on one place scattered.

Malva crispa: in a grassy ditch along the main road between Radotín and the restaurant „Pod zeleným hájem".

Matricaria suaveolens: common and perfectly naturalized.

Medicago sativa: and *M. media:* common.

Nicotiana rustica: run wild near the border of a field in Radotín.

Oxalis stricta: scattered.

Senecio vernalis: scattered on fields and wood-clearings, occasionally also in light wood.

Silene dichotoma: here and there in fields

Floristical Remarks.

It is only natural that in a Synopsis of associations, constructed upon the strength of individual analyses, some species characteristic for the region are not enumerated or perhaps only in a single analysis, although their distribution may be rather wide. I intend of course to give in my future geobotanical monography of the valley of Radotín a complete list of the Flora, but I may as well quote here at least a few species interesting from this or that point of

view and mentioned before only accidentally or not at all. For quick orientation I arranged them alphabetically.

Arabis auriculata Lam. On calcareous rocks and rocky ridges scattered, in places rather gregariously. It grows in dwarf, medium-sized and rather robust forms.

Anthericum confusum Domin (= *A. liliago* × *ramosum*). With both parents on the very steep calcareous slope above the brook behind the mill „u Šarbochů".

Androsace elongata L. Very gregariously on the slope of Velký háj above the highway to Třebotov. It grows there on non-calcareous schists with a typical Hercynian vegetation. Above, on the plateau of Velký háj, there are deciduous as well as coniferous (mostly spruce) forests; we find here also *Calluna vulgaris* and even Calluneta of no great extent and abundantly appear *Deschampsia flexuosa, Rumex acetosella, Antennaria dioica, Genista germanica, Ajuga genevensis, Luzula campestris, Anthoxanthum odoratum.* The declivity above the highway is occupied by an oak wood, but of course without the typical undergrowth of the calcareous woods. The undergrowth is very modest, in places none whatever; we find there only common Hercynian types, besides the species enumerated above also *Viscaria vulgaris, Veronica campestris, V. verna, Polygala vulgaris, Hieracium vulgatum,* and a little lower down, where *Robinia pseudacacia* appears, grows *Androsace elongata* and also *Carex Michelii.*

Aster amellus L. This species is scattered on many localities, especially on wood openings and in semi-shaded places near thickets, although it grows in places also on open sunny slopes. *Aster linosyris* Bernh. of a distinctly xerothermic character is very common and sometimes very gregarious in steppes of different descriptions (especially in Caricetum humilis) and on sunny slopes with not quite closed vegetation.

Botrychium lunaria Sw. This species is rather noteworthy in our territory. It occurs very rarely in Seslerietum (analogically as in our Carpathian mountains). Until now I have found it only on two places; on the northern slope of the ridge branching off near the first Mašek's mill I have known it for a period of at least twenty years. Years ago it grew also on an old wall in Cikánka, where it maintained itself only some four of five years.

Brunella grandiflora Jacq. In our territory scattered, mostly in atypical short-grass growths on drier calcareous soil. Also *B. laciniata* L. occurs only scattered, although in places abundantly. On Hradiště I discovered also the hybrid *B. grandiflora* × *laciniata.*

Campanula bononiensis L. Only on the border of the plateau extending from the locality of *Saxifraga aizoon* towards Zadní Kopanina. It grows here rather abundantly on grassy semi-steppes with scattered bushes.

Carex Michelii Host. In woods on limestone here and there, especially on the plateau of Velký háj, where it grows on its southern slope above the highway to Třebotov also on schists (see *Androsace elongata*).

Cephalanthera longifolia Fritsch. I discovered this species years ago on the border of Velký háj opposite Kosoř, but it seems to have disappeared there.

Cirsium acaule × *oleraceum.* In the beginning of the side-valley towards Zadní Kopanina. It grew here on a drier place in the wood along the path, resembling in its habit the caulescent form of *C. acaule* (which is rather plentiful on shady places in our territory), but its flowers (and also stigmas) are of a pure white-yellowish colour; the bracts under the flower-heads are rather small.

Cirsium acaule × *pannonicum*. Not seldom on localities where both parents meet.

Cirsium eriophorum × *lanceolatum*. Near the entrance to the side-valley of Kosoř.

Coralliorrhiza trifida Chat. In our territory very rare. I came across it only once in a mixed deciduous wood in Kopanský les.

Crepis praemorsa Tausch. Here and there on light places and clearings of the Velký háj. Also in the wood Kopanský les.

Cuscuta europaea L. In the thickets near Kalina's mill.

Cytisus ratisbonensis Weimm. In a few places. Rather abundantly on steppes near the border of the wooded plateau above Kalina's mill.

Daphne cneorum L. In dry woods near the tourist path leading from the valley of Radotín towards Třebotov and to Černošice. This dwarf shrub grows here rather abundantly, although it was partially exterminated on account of its beauty. This species is in Bohemia a type of non-calcareous soil, showing a predilection for heathy places. In our locality it grows on schists in a pine forest mixed with white beeches, most abundantly near a prominent old oak tree, where also *Potentilla alba* has its abode. Thereby it is a component of the Hercynian vegetation. The woods are of course mostly secondary; we find here also spruce and pine forests as well as deciduous woods with the usual Hercynian vegetation with *Calluna vulgaris, Antennaria dioica, Potentilla tormentilla, Genista germanica, Anthoxanthum odoratum,* etc. Where there is more leaf humus, there appear different wood plants; also *Carex montana* is abundant.

Dracocephalum austriacum L. Only on one locality in the central part of the valley on calcareous rocks and also in an adjacent rock Seslerietum.

Dictamnus albus L. Common in our territory. It grows only on calcareous soil, especially on wood openings, on rocky slopes and in dry open woods. It avoids the sunny and very dry slopes as well as woods with a deep shadow.

Erythraea centaurium L. Very scattered, especially on non-calcareous soil, but sometimes also on limestone.

Euphorbia angulata Jacq. In woods and on clearings scattered, in places rather abundant.

Gagea bohemica Schult. Years ago it grew abundantly on a rocky ridge rising above the eastern part of Velký háj (in company with *Arabis auriculata, Stipa Joannis,* etc.). The occurrence of the species, characteristic for non-calcareous soil, on a limestone ridge is surely very noteworthy, although it seems to be only temporary, as *Gagea bohemica* was never before found there; nevertheless it was plentiful here in the period 1912—1916, but I looked for it in vain in the last ten years.

Galium vernum Scop. In places very gregarious, especially on the clearings of the plateau of the wood Kopanský les and on its slopes into the main valley. It grows besides on the southern slope near the entrance to the side-valley of Kosoř. It is a widely destributed Carpathian species that in Bohemia already is becoming very rare.

Gentiana ciliata L. Here and there on calcareous sunny slopes or in light woods, especially within the boundaries of Velký háj.

Helichrysum arenarium DC. This characteristic psammophyte grows at the foot of Velký háj on a little hillock with sandy soil by the side of the highway to Třebotov.

Hieracium canofloccosum Čelak. Here and there on limestone in different associations. On Hradiště we find it on sunny slopes with a non-closed vegetation, in other places in light woods and in one locality even in a Callunetum. On dry limestone slopes we meet here and there *Hieracium cymosum* L., *H. setigeram* Tausch., *H. echioides* Lumn., in woods with calcareous soil *H. vulgatum* Fr. in the variety *maculatum,* on rocks and rocky ridges *H. bifidum* Kit.

Hierochloe australis Roem. et Schult. Very scattered in light deciduous woods and on clearings, but often gregariously.

Koeleria pyramidata Dom. In our territory rather rare (also in Seslerietum). The quite common species of this genus is here *K. gracilis* Pees., which occurs in many forms and varieties.

Lithospermum purpureo-coeruleum L. In light subxerophilous woods and in thickets on limestone only in places.

Loranthus europaeus L. As far as known only on an oak tree near the locality *Saxifraga aizoon.*

Melica nutans L. f. *radotinensis* f. n.

Excellit culmis plus foliosis, foliis duobus supremis paniculam longe superantibus, panicula spiciformi plus ramosa et interrupta, virescenti.

On a clearing of Velký háj with *Hierochloe australis* and *Brachypodium silvaticum.* This interesting form somewhat resembles var. *paniculata* Borbás (= var. *composita* Murr) and var. *viridans* Čelak.

Myosotis suaveolens Waldst. Kit. Not rare on semi shaded steppe meadows amid xerophilous woods.

Omphalodes scorpioides Schrk. Here and there gregariously on wet places in woods, but only on a few localities.

Orobanche arenaria Borkh. On the sunny slope above Kalina's mill. The rather common species of this genus is *O. lutea* Baumg.

Peucedanum oreoselinum Moench. On a few places in dry Hercynian pine forests or woods on sandy soil.

Polypodium vulgare L. A non-calcareous type, on limestone sometimes on mossy roots and trunks of trees.

Potentilla thyrsiflora Zimm. On one place above Radotín along the tourist path from Radotín to Kosoř, on schists.

Potentilla arenaria × *opaca.* Zadní Kopanina.

Potentilla arenaria × *verna.* Here and there.

Potentilla opaca × *verna.* Velký háj, on non-calcareous soil.

Palmonaria angustifolia L. On the wooded plateau above Šubert's mill in the direction towards Kopanský les.

Ranunculus polyanthemus L. In bushy woods and on openings, sometimes also in grassy associations, but on the whole rather rare.

Rosa Jundzillii Besser. On a few localities. *R. gallica* grows in places abundantly on schists. Here and there on limestone we find thickets with predominant roses. They belong to *R. agrestis* Savi, *R. elliptica* Tausch. (a characteristic limestone species!), *R. rubiginosa* L., *R. tomentella* Lem., *R. tomentosa* Smith. *R. canina* L., *R. glauca* Vill., *R. dumetorum* Thuill.

Quercus pubescens × *sessilis.* On the plateau of Velký háj.

Saxifraga tridactylites L. Scattered throughout the territory.

Sesleria calcaria Opiz. This species, constituing the widely spread Sesleria eta, is somewhat variable, although its forms are partly only ecological morfoses. Some of them, however, seem to be fixed, but it would be necessary to prove it in culture. The chief forms are the following:

f. *ovata* Opiz (*S. calcaria α. coerulea a. ovata* Opiz). Spikes nearly ovoid, dense, short, of a clouded steel colour. — The common form.

f. *luteo-alba* Opiz. Spikes elongated, cylindrical, yellowish and often somewhat interrupted.

f. *elongata* Opiz. Spikes elongated, cylindrical, more of less of a clouded steel colour.

f. *angustifolia* Aschers. et Gr. This narrow-leaved form occurs as a subform of the preceding forms.

f. *Ratzeburgii* Aschers. et Gr. An analogical form to f. *elongata*, but with very elongated leaves.

F. *mutica* Aschers. et Gr. et f. *aristata* Podp. occur only in approximate forms.

Stachys germanica L. On dry places, especially in secondary communities, not rare.

Stipa tirsa Stev. On the very steep calcareous slope above the brook behind the mill „u Šarbochů".

Thalictrum minus L. On the border of a meadow in the beginning of the main valley.

Thesium montanum Ehrh. Very scattered. Plentiful along the long cut through the xerophilous woods of Velký háj above the side valley of Kosoř.

Thymus Löwyanus Opiz and its variety *stenophyllus* (Opiz) Dom. only in places. Abundantly on the diabase hill in the main valley.

Trifolium rubens L. On the plateau above the little pond towards the Kopanský les.

Vicia pisiformis L. Very scattered in deciduous woods and thickets.

Vicia cassubica L. On the plateau of Velký háj on non-calcareous soil.

Viola arenaria DC. Here and there on drier slopes. Of hybrids of this genus *V. arenaria* × *hirta*, *V. collina* × *hirta*, *V. hirta* × *odorata*, *V. Riviniana* × *silvatica* are to be found.

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