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EPIPHYTIC LICHEN VEGETATION IN THE LUMIEI - VALLEY (CARNIAN ALPS)

VEGETAZIONE LICHENICA EPIFITA NELLA VALLE DEL LUMIEI (ALPI CARNICHE)

Abstract — The epiphytic lichen vegetation of the Lumiei-Valley (Carnian Alps) has been studied on the basis of the phytosociological approach. 11 main lichen synusiae have been recognized. Their floristic composition, ecology and distribution are briefly discussed. The results characterize the study area as transitional between the oceanic outer ridges and the more continental inner portion of the Carnian Alps.

Key words: Lichens, Epiphytes, Carnian Alps.

Riassunto breve — *La vegetazione lichenica epifita della Valle del Lumiei (Alpi Carniche) è stata studiata sulla base dell'approccio fitosociologico. 11 tipi vegetazionali principali sono stati riconosciuti. Nel lavoro vengono discusse la loro composizione floristica, ecologia e distribuzione. I risultati portano a caratterizzare l'area studiata come transizionale tra la zona prealpina esterna a clima suboceanico e quella alpina interna maggiormente continentale.*

Parole chiave: *Licheni, Epifite, Alpi Carniche.*

Introduction

During the last five years I was working on the floristical and vegetational investigation of the Friuli-Venezia Giulia Region (North Eastern Italy), as far as lichens are concerned. The papers that have been published until now were mainly dealing with the Province of Trieste, that is now relatively well known (at least in comparison with most of Italy) both from the floristical (NIMIS & LOI, 1981, 1982) and the vegetational points of view (NIMIS, 1982). The only available data concerning the Region of Friuli are limited to an overview of *Xanthorion*-communities in North

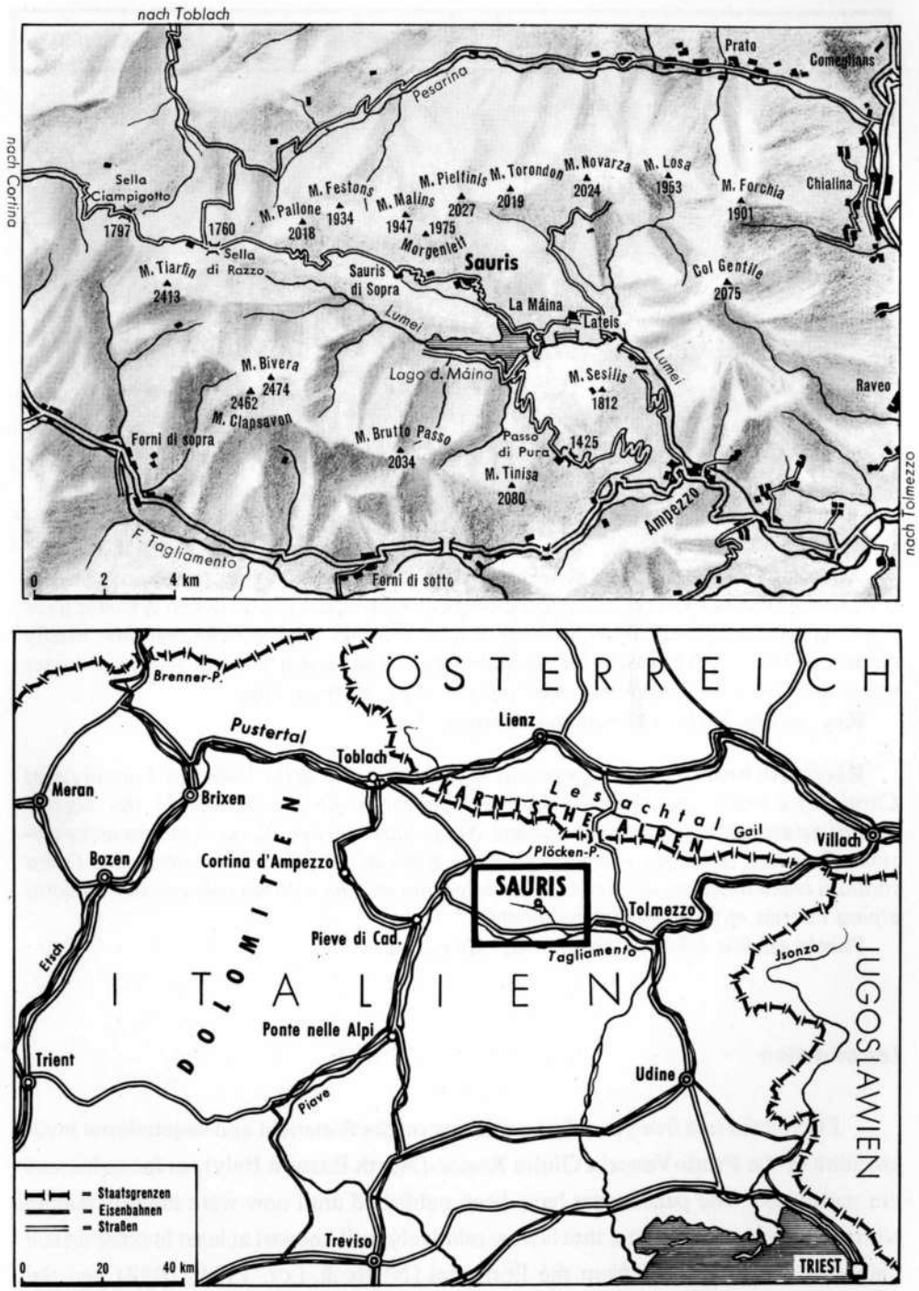

Fig. 1 - Location of study area.
- *Localizzazione della zona di studio.*

Eastern Italy (NIMIS & DE FAVERI, 1981), in which also part of Friuli is taken into consideration.

In the present paper I present the first results relative to the phytosociological investigation of epiphytic lichen communities in the Valley of Sauris (Carnian Alps).

Two points should be made clear at the beginning: the term "epiphytic" is here used in a somewhat narrow sense, including only lichen communities growing on phanerophytes. Consequently, the epiphytic lichen vegetation of alpine grasslands has not been taken into consideration. The second point concerns the communities dominated by species of the genus *Usnea*: they are an important part of the vegetational landscape in the study area, but they have not been considered in the present paper for a different reason. The present knowledge of the genus *Usnea,* even with the detailed monography of MOTYKA (1936) is so unsatisfactory, that in most cases a correct identification is impossible (see also WIRTH, 1980). Consequently, I preferred to avoid the treatment of such communities in the present work, since I believe that this could be undertaken in a correct and fruitful way only after the solution of the many taxonomical problems concerning the genus *Usnea.*

Study area

The study area is located in the central portion of the Carnian Alps: it includes the upper portion of the hydrographic basin of the Lumiei-creek, and its center corresponds with the village of Sauris (Province of Udine). The area is limited at the northern and eastern sides by a mountain ridge, known as "Monti di Sauris" that separates the Lumiei-valley from the Pesarina valley (M. Pieltinis, 2027 m; M. Tarondon, 2022 m; M. Novarza 2023 m); the geological substrate is mostly composed by weakly acid, violet-reddish sandstones (Werfen-sandstones). At the Southwestern side, the area is limited by a chain of calcareous mountains (M. Tiarfin, 2079 m; M. Bivera, 2473 m; M. Clapsavon, 2462 m; M. Tinisa, 2115 m) with prevailing limestone and dolomite. As far as precipitation is concerned, the only available data are limited to the village of Sauris (1200 m): mean yearly precipitation is 1580 mm (1911-1925) with 114 rainy days in a year and with precipitation maxima in May (178 mm), September (137 mm) and November (178 mm). Mean yearly temperature is 6.53°. As far as it can be judged by indirect observations concerning flora and vegetation, and by direct experience, precipitation should be higher in the

southeastern portion of the area (Passo Pura, 1450 m) and lower in the northwestern portion (Casera Razzo, 1700 m). The outer southeastern ridges are still under maritime influence, that progressively decreases northwestwards (GENTILLI, 1964).

The vascular flora of the study area has been studied by PIGNATTI E. & S. (1968) and by PIGNATTI & POLDINI (1969): 664 species have been reported in the latter work. As far as the vegetation is concerned, three principal associations dominated by trees are present: the *Abieti-Fagetum* is widespread in the montane zone, chiefly preferring a North (NW-NE) exposure. Pure *Fagus*-stands are also present but less frequent. The *Piceetum subalpinum* is very rare and localized (one station near Casera Razzo, at 1500 m). The *Rhodoreto-Vaccinietum laricetosum* occurs near treeline and it is best developed on not-calcareous substrate.

The studied portion of the area is comprised between 1000 m (La Maina) and 1850 m, including the montane and subalpine vegetation belts.

Methods

Phytosociological releves have been performed with the usual Braun-Blanquet method (BRAUN-BLANQUET, 1964), the cover scale is the Braun-Blanquet scale as modified by PIGNATTI (1953). The data were sufficiently well-structured to be handled without the use of numerical methods. Numerical classification has been anyway performed just to rapidly obtain an ordered table. Complete linkage clustering on Van der Maarel's coefficient has been adopted (WESTHOFF & VAN DER MAAREL, 1978). This strategy has been used in order to obtain compact groups from a clearly discontinuous data structure. The classification was performed with the package of programs of WILDI & ORLOCI (1980). The sequence of the releves in tab. I follows the results of the numerical classification.

The pH of the bark was measured by pulverizing bark samples in distilled water. The measures have been taken in laboratory with a standard digital pH-meter.

Results

As a result of the numerical classification, 11 principal releve groups have been obtained. In the following discussion each group is discussed from the phytosociological and ecological points of view, with some additional remarks on its distribution within the Carnian and Julian Alps.

LETHARIETUM VULPINAE GAMS 1927 (Releve group Nr. 1)

The union was first described by GAMS (1927), on the basis of two releves. Ten years later FREY (1937) rediscribed it as new with the same name. The correct name is thus *Letharietum vulpinae* GAMS.

Among the characteristic species *Letharia vulpina* and *Usnea hirta* subsp. *laricicola* are constant. *Hypogymnia austerodes* seems to be lacking in the study area. *Hypogymnia bitteri* was considered as characteristic species for the union by FREY (1937); in the study area it also occurs within the *Pseudevernietum furfuraceae,* with high frequency and cover degree. This fact was already observed by KALB (1970), so that the species is here considered as faithful to the Foederatio. Among *Usneion*-species the most frequent are *Pseudevernia furfuracea, Hypogymnia bitteri, Cetraria chlorophylla* and *Evernia mesomorpha. Bryoria fuscescens, Parmeliopsis ambigua, Parmeliopsis aleurites, Hypocoenomyce scalaris* and *Cyphelium tigillare* are differential in respect with other *Usneion*-unions.

In the study area the community is limited to the area near Casera Razzo, from 1600 to 1800 metres, always occurring on Larix, from (0.5) 1 m to 4 (5) m on the boles, being absent or scarcely developed on the branches. According to KALB (1970), in the Ötztaler Alpen the *Letharietum vulpinae* prefers a West to North exposure. In the study area it is mostly South exposed. The reason is probably to be found in the different climatic conditions of the two areas: the Ötztaler Alpen have a strongly continental, aeroxeric climate, whereas in our area oceanic influences are stronger; *Letharia vulpina* is a strongly continental species (GAMS, 1955): its preferrence for the South side of the boles in the study area is probably due to higher evaporation rates in respect with the northern part of the boles. The average pH of the bark is 4.3 (5 measures).

The community is photophylous (hence limited to *Larix,* a deciduous conifer), acidophylous and chionophobous. According to FREY (1952) it is preceded by a *Parmelia exasperatula*-stage; in the study area it seems to develop directly, without previous pioneer associations, a fact already observed by KALB (1970) (see also DEGELIUS, 1946).

The presently known distribution of the *Letharietum vulpinae* includes the Central Swiss Alps, the Northern Alps of Ötztal and the study area. I observed well developed stands of the community also in the Taurian Alps (Austria). In general, considering the ecology of *Letharia vulpina,* the union is expected to be widespread, within the *Rhodoro-Vaccinietum laricetosum* or *cembretosum,* along the whole internal portion of the alpine ridge, where the climate is more continental. In this sense, this union seems to be one of the most characteristic elements of the endalpic system (POLDINI, 1974). In the study area, Casera Razzo is the only locality in which the community has been found: this is well in accordance with the fact that precipitations tend to decrease from Southwest to Northeast, and Casera Razzo is located just at the Northeastern limit of the area. The relative continentality of the Casera Razzo area is further indirectly confirmed by the fact that well developed stands of the *Piceetum subalpinum* are confined to it, with the only known station of *Listera cordata* for the study area (PIGNATTI & POLDINI, 1969). I have never found the *Letharietum vulpinae* in the Carnian and Julian Pre-alps and in the Julian Alps, where I suspect that it should be completely absent owing to the lack of a sufficiently continental climate.

PSEUDEVERNIETUM FURFURACEAE HILITZER 1925 (Releve group Nr. 2)

In the study area the union is negatively characterized by the absence of differential species in respect with other *Usneion*-unions. *Usnea hirta* and *Hypogymnia tubulosa* are considered as characteristic for the union by KALB (1970). In the study area both species are present, but do not seem to be confined to the *Pseudevernietum,* the former commonly occurring also within *Xanthorion*-unions, the latter being very frequent in the *Evernietum divaricatae.* Constant species are *Pseudevernia furfuracea, Parmelia sulcata* (both with high cover degree), *Hypogymnia bitteri,* frequent species are *Cetraria chlorophylla, Evernia prunastri, Lecanora coilocarpa* and *Hypogymnia physodes.*

The union is montane-subalpine, occurring from 1000 m to 1700 on a variety of trees, mostly conifers. The upper distributional limit is consistently higher than the one reported by KALB (1970) for the Ötztaler Alpen, where the union is present from 500 to 1300 m. I suspect that this difference is due to climatic differences, chiefly the oceanicity of the climate in the study area. The *Pseudevernietum furfuraceae* is one of

the most common epiphytic lichen synusiae in the study area: it mainly grows on branches of *Larix, Abies* and *Picea,* being less frequent on the boles and in dense tree stands. Its preferrence for relatively exposed habitats is well in accordance with the ecological requirements of the union as given by BARKMAN (1958): according to this author, the *Pseudevernietum furfuraceae* is less aerohygrophytic than *Usnea*-communities and the *Lobarietum pulmonariae,* being also relatively photophilous. In the study area it is most frequent on the outer branches of the trees, being replaced by the *Evernietum divaricatae* or by *Usnea*-communities on the inner branches or in dense tree stands. Average pH is 5.7 (6 measures) the community being subacidiphytic. On the syndinamical relationships of the *Pseudevernietum* with other community-types there are different opinions: according to KLEMENT (1964), the colonization directly occurs by means of the isidia of *Pseudevernia,* whereas HILITZER (1925), KLEMENT (1955) and KALB (1970) reported a successional trend from the *Lecanoretum subfuscae* to the *Pseudevernietum furfuraceae.* This latter case seems to prevail in the study area, where the community is quite always preceded by crustaceous species, chiefly *Caloplaca herbidella, Lecanora coilocarpa* and *Lecanora symmicta.* The *Pseudevernietum furfuraceae* is widely distributed in central Europe. Several subassociations, variants and facies have been hiterto distinguished. The two regions that are nearest to the study area, for which phytosociological releves of the *Pseudevernietum* are available, are the Ötztaler Alpen (KALB, 1970) and South Tyrol (TOMASELLI & DE MICHELI, 1952). TOMASELLI & DE MICHELI (1952) described four subassociations for a narrow area, but a comparison with their data is almost impossible since their identifications are at least doubtful (see also BARKMAN, 1958). Of the two subassociations described by KALB (1980), the subassociation *typicum* is the one that better fits our releves.

In the Carnian and Julian Alps the *Pseudevernietum furfuraceae* is extremely common from the montane to the subalpine zone. Near treeline, on *Larix,* it often substitutes the more continental *Letharietum vulpinae.* I have also observed the community in the colline zone (Tarcento, 300 metres; Karst near Trieste, 350 metres), where it is azonal and scattered in small enclaves with colder microclimates.

EVERNIETUM DIVARICATAE FREY 1952 (Releve group Nr. 3)

The union is very well characterized by a large set of faithful species, such as

Evernia divaricata, Alectoria sarmentosa, Ramalina thrausta, Ramalina farinacea, Bryoria subcana and probably also *Usnea pendulina.* It is further negatively characterized in respect with the *Letharietum vulpinae* and the *Pseudevernietum furfuraceae* by the lack or low frequency of such species as *Hypogymnia bitteri, Cetraria chlorophylla, Cetraria laureri* and *Usnea hirta.* The characteristic appearance of the community is given by the long, pendulous thalli of *Evernia divaricata* and of *Bryoria*-species. In well developed- stands these can reach more than 1 m in lenght.

The *Evernietum divaricatae* is a strongly aerohygrophylous and skiophytic community: in the study area it is particularly well developed because of the high frequency of fog, always within the *Abieti-Fagetum,* between 1200 and 1500 metres. It is most common on the lower branches of *Picea* and *Abies,* being substituted by *Usnea*-communities higher up on the bole and on the upper and outer branches, where light intensity is higher. The lack of the community within the *Abieti-Fagetum,* or its scarce development, are a good indication of human disturbance, chiefly through the falling of trees with the consequent opening of the tree canopy.

The *Evernietum divaricatae,* despite its high aerohygrophytism, has a continental subarctic-subalpine distribution, from Northern Siberia through North Eastern Europe up to the mountains of Central Europe. According to BARKMAN (1958) such a distribution pattern cannot be explained in terms of xerophytism, and should be related to historical factors. The community seems to be present also in Eastern North America (AHLNER, 1948). In the Carnian Alps the community is rare, and localized in well-developed, undisturbed *Abieti-Fagetum* stands, almost exclusively in the outer southern mountain ridges with suboceanic climate. I never observed it in the Julian Alps, where it should be still rarer or even absent, above all in the northern part of the region where the maritime influence is very weak.

LECANORETUM SUBFUSCAE (HILITZER 1925) OCHSNER 1928 (Releve group Nr. 5)

Differential species within our data set are: *Lecanora carpinea, Pertusaria alpina, Lecanora intumescens, Buellia disciformis, Buellia griseovirens, Pertusaria pertusa.* Other species commonly occurring within the union in the study area, and not present in our releves are: *Pertusaria flavida, Pertusaria coronata* and *Candelariella xanthostigma.* Constant species are *Phlychtis argena, Lecanora chlarotera, Lecidella elaeochroma.*

History, nomenclature and phytosociological delimitation of the *Lecanorion subfuscae* sensu OCHSNER (1928) are quite confuse. BARKMAN (1958) even changed the name of the union in *Lecanoretum carpineae* on the basis of the fact that *Lecanora subfusca* s.l. is to be considered a very large aggregate of species. He recognized three unions partially corresponding to the *Lecanoretum subfuscae* sensu OCHSNER (1928): the *Lecanoretum carpineae atlanticum,* the *Lecanoretum carpineae continentale* and the *Lecanoretum carpineae montanum.* The first two unions are, according to this author, geographical vicariants. Such a subdivision has been later criticized by KALB (1970), above all as far as the differential species proposed by BARKMAN (1958) for the three unions are concerned. The reason for such a confused situation are to be found in first line to the poor knowledge of the *Lecanora subfusca* group. In my opinion, a better articulation than the one proposed by BARKMAN (1958) will be surely possible on the basis of new data taking into consideration the recent subdivisions within the *Lecanora subfusca*-group (for a recent key see POELT & VEZDA, 1981). For the moment, I prefer to follow KALB (1970) in mantaining the old name *Lecanoretum subfuscae* for the union s.l. In any case, for the presence of *Lecanora coilocarpa, Candelariella xanthostigma* and *Lecanora intumescens,* the releves of our table are nearest to the *Lecanoretum carpineae montanum* sensu BARKMAN (1958).

The community is common in the montane zone, chiefly occurring on the smooth bark of *Fagus,* both in dense tree stands (mainly *Abieti-Fagetum*) and on more or less isolated trees. It is a pioneer community, being followed by unions included in the *Hypogymnietalia*-Order, or, more rarely, by the *Lobarietum pulmonariae.* Its previously known distribution is quite broad in Central Europe if the community is defined sensu lato; on the contrary, if we consider it in a narrower sense (as *Lecanoretum carpineae montanum*), the distribution is limited to the lower montane zone (400-800 m) of Switzerland (Mittelland and Southern Germany) (BARKMAN, 1958). In North Eastern Italy, as far as I could judge till now, at least two different unions partially corresponding to the *Lecanoretum subfuscae* might be distinguished: the first seems to be nearest to the *Lecanoretum carpineae montanum,* and is the one present in our table: its distribution is mainly centered in beech woods of the montane zone. The second occurs on isolated trees in the lowlands, and does not seem to correspond well with any of the three unions proposed by BARKMAN (1958). Further

differences between the two communities are to be found in the fact that the former is quite always followed by *Hypogymnietalia*-unions, the latter by *Xanthorion*-unions.

LOBARIETUM PULMONARIAE HILITZER 1925 (Releve group Nr. 4)

This community is fairly well characterized by a large set of differential species. They are: *Menegazzia terebrata, Lobaria pulmonaria. Nephroma resupinatum, Peltigera collina, Parmotrema arnoldii, Sticta fuliginosa, Cetrelia cetrarioides, Radula complanata, Peltigera horizontalis* and *Peltigera polydactyla.* The first six species are considered as characteristic for the union by KALB (1970), most of the other species are characteristic of the *Lobarion. Peltigera neckeri* and *Peltigera horizontalis* are among the differential species of the subunion *peltigeretosum horizontalis* as defined by KALB (1970), to which at least a part of our releves belongs. Other frequent species are *Phlychtis argena, Parmelia elegantula* and *Ramalina fraxinea*; the latter, although frequent has been never found with apothecia, and does not seem to thrive well in this community. Other *Lobarion* - species present in the area, although less frequent, are *Parmotrema crinitum* and *Parmelia sinuata. Normandina pulchella,* considered by BARKMAN (1958) as characteristic for the *Lobarion,* is absent from our releves. I doubt that its synsistematic value can be further mantained: in North Eastern Italy the species frequently occurs outside *Lobarion*-vegetation. Mosses and hepatics are quite frequent in the *Lobarietum pulmonariae*; not all of the species are reported in the table. Among the most frequent are *Radula complanata, Neckera pennata, Frullania dilatata* and *Hypnum cupressiforme.*

In the study area the community is very localized: it mostly occurs in a narrow belt of 100-200 m immediately above the Lake of Sauris, chiefly at the basis of *Fagus,* more rarely of *Abies* and *Picea,* within the *Abieti-Fagetum.* This fact is probably due to the particularly humid microclimate due to the presence of the lake. Immediately above the lake, che community is present also on naked bark, whereas 100-200 metres above the lake it exclusively occurs on a thick carpet of mosses, that provides a sufficient degree of humidity in the substrate. According to KALB (1970) the community should be considered in this case as epibryophytic, and mosses should not be considered in its synsistematical evaluation. The pH was 5.2 on naked *Fagus*-bark, 6.3 on a thick moss-carpet.

As far as the distribution of the union is concerned, according to BARKMAN

(1958) the *Lobarion*-Foederatio has an atlantic-montane distribution type in Europe, with two centres of development, namely the hyperatlantic province and the Carpathians Mountains. KALB (1970) states that the centre for the *Lobarietum pulmonariae* lies in the mountains of the Western Mediterranean Basin. In the fog-belt of the mountains of Southern Italy (M. Pollino, Gargano Peninsula, Madonie) I observed extremely rich and well developed stands of the *Lobarietum pulmonariae*; in comparison with such situations, the stands of North Eastern Italy appear as strongly impoverished and fragmentary, so that I tend to agree with KALB (1970) on the mediterrane-montane character of this union. In North Eastern Italy, the *Lobarietum pulmonariae* is restricted to the outer prealpine ridges with clearly oceanic climate, mostly in associations of the *Fagion* being completely absent in the more continental internal chains. In this sense, che behaviour of the *Lobarietum pulmonariae* is completely opposite to the one of the *Letharietum vulpinae.* The presence of both unions in the study area underlines its transitional character from the climatic and phytogeographical points of view.

PHYSCIETUM ADSCENDENTIS FREY and OCHSNER 1926 (Releve Group Nr. 6)

Differential species within our data set are: *Physcia adscendens, Xanthoria parietina, Caloplaca cerina, Parmelia exasperata, Physcia aipolia, Physconia pulverulacea. Lecidella elaeochroma* is constant.

The community occurs on isolated trees, mostly *Acer, Sorbus, Pyrus,* but sometimes also conifers, if growing along the roads, near the villages of Sauris, Lateis and La Maina from 1000 to 1400 metres. Its presence is clearly linked with human action, chiefly through the accumulation of dust and nitrates on the bark. Average pH is 7.3 (3 measures).

For an overview on *Xanthorion*-communities in North-Eastern Italy and distribution of the various variants of the *Physcietum adscendentis* in the region, see NIMIS & DE FAVERI (1981).

CLADONIETUM CENOTEAE FREY 1927 (Releve Group Nr. 7)

Among the characteristic species of the union *Cladonia digitata, Cladonia*

cenotea and *Cladonia coniocraea* are present in our table. Moss species are also present, the most frequent are *Dicranum scoparium, Tetraphis pellucida* and *Polytrichum formosum.*

The community is widespread and common in the whole of the study area, from 1000 to 1800 metres, on decaying wood, mainly on fallen trees or stumps in closed or more rarely open tree stands. The pH of the wood is very low: the average of six measures is 3.4, the community clearly being strongly acidiphytic.

The evolution of the *Cladonietum cenoteae* is characterized by a progressive increase of mosses: in the more mature stages species like *Tetraphis pellucida* and *Polytrichum formosum* are replaced by the common species of the understory of coniferous stands as *Pleurozium schreberi* and *Hylocomium splendens.* On the horizontal portion of the stumps, it is not infrequent to find also *Cladonia arbuscula* and even *Cetraria islandica,* though always with reduced vitality.

The *Cladonietum cenoteae* has a very broad distribution all over the northern hemisphere. In boreal North America I observed very similar communities growing in comparable ecological conditions, differing only for the presence of some north american endemics, like *Cladonia cristatella* in the East, and *Cladonia multiformis* chiefly in the Northwestern portion of the continent (NIMIS, 1981). In North Eastern Italy the *Cladonietum cenoteae* is widespread from the montane zone to the lowlands. The lowland stands are however charachterized by the absence of *Cladonia digitata* and by the high frequency and cover degree of *Cladonia coniocraea* and *Cladonia fimbriata,* so that two subassociations might probably be distinguished.

PARMELIOPSIDETUM AMBIGUAE HILITZER 1925 (Releve group Nr. 8)

The union is characterized by a very constant characteristic species combination, including the following species: *Parmeliopsis ambigua, Parmeliopsis hyperopta* and *Cetraria pinastri. Parmeliopsis aleurites* is differential of the subassociation *parmeliopsidetosum aleuritis*; *Parmeliopsis hyperopta* is preferentially linked with the typical subunion. Both subunions are represented in our table. The typical one is a very common community throughout the montane zone of the study area, where it occurs at the basis of conifers, chiefly *Picea* and *Larix,* sometimes also on wood (recently cut stumps). The subunion *parmeliopsidetosum aleuritis* is found in the subalpine vegetation belt, and is restricted to *Larix.* As already noted, this subunion

constitutes most of the crustaceous layer in the *Letharietum vulpinae.* A further ecological difference between the two subunions is given by the fact that the typical one is most frequent in woody stands, and is limited to the basis of the boles, whereas the other mostly occurs on isolated trees, and is present on the boles up to an height of 3 m. The pH did not show any remarkable difference between the two subunions: the average of 5 measures was 4.5.

As far as the dynamics is concerned, the *Parmeliopsidetum ambiguae typicum* is a clearly chionophilous Dauergesellschaft; on stumps it is generally followed by the *Cladonietum cenoteae,* following the decomposition of the wood. The subunion *parmeliopsidetosum aleuritis* is followed, in the higher parts of the bole, by the *Letharietum vulpinae.* Both subunions are to be considered as pioneer communities.

The *Parmeliopsidetum ambiguae* is widely distributed in the boreal-subarctic vegetation belts throughout Europe. According to BARKMAN (1958) it should be further present in the Ural Mountains, Caucasus and the Balkans. In boreal North America I observed it frequently both in Alaska-Yukon (where it grows at the basis of *Picea glauca, Pinus contorta* and *Picea mariana*) and in Northern Ontario, Quebec and the Magdalena Islands (on *Picea mariana, Picea glauca, Abies balsamea, Larix laricina* and other conifers). The total distribution of the union seems also to be circumboreal-montane. In the Carnian and Julian Alps the community is very common throughout the montane and subalpine vegetation belts.

XYLOGRAPHETUM VITILIGIS KALB 1970 (Releve group Nr. 9)

Differential species are *Xylographa vitiligo, Xylographa abietina* and *Lecidea tornoensis.* A *Lecidea*-species was further present, that I could not identify with certainty, being the apothecia always strongly damaged by Gasteropoda. *Xylographa vitiligo,* in the study area is also present in the *Parmeliopsidetum ambiguae typicum,* above all in the stands where humidity and shade are higher, but has a clear optimum in this community.

The *Xylographetum vitiligis* is a pioneer association on wood. Stumps of conifers are the main habitat for the community, that is mostly present at the sides of the stumps, a fact already noticed by KALB (1970), and absent or scarcely developed on their upper, horizontal surface. The community was hiterto known only for the Northern Alps of Ötztal (KALB, 1970), but has most probably quite a broader distribu-

tion. In the Carnian and Julian Alps it is fairly common from the submontane to the montane zone.

XYLOGRAPHETUM ABIETINAE SMARDA 1940 (Releve group Nr. 10)

As already noted, *Xylographa abietina* has its optimum in the *Xylographetum vitiligis.* In our releves of the *Xylographetum abietinae* the species is completely lacking. The two characteristic species, *Cyphelium tigillare* and *Lecidea elabens,* are the only species that constitute the community in the study area.

Also this community is restricted to wood. The differences with the previous one chiefly consist in the fact that this community grows on the parts of *Larix*-boles that have lost the bark, in the subalpine zone, from 1600 to 1900 metres. I never saw stands of the *Xylographetum vitiligis* at an height of more than 3 metres on the boles of *Larix*; the community is further absent near the basis of the boles. The community often forms mosaics with the *Letharietum vulpinae.* The main ecological difference with the latter union is due to the fact that the *Letharietum vulpinae* always occurs on bark, whereas the *Xylographetum vitiligis* is always restricted to wood.

In the study area the distribution of the community is restricted to Casera Razzo, just like the *Letharietum vulpinae.* In the Carnian and Julian Alps the community is rare: till now I observed it only three times on M. Coglians, M. Canin and M. Paularo, always on *Larix* near treeline, and always in very fragmentary stands.

PSORETUM OSTREATAE HILITZER 1925 (Releve group Nr. 11)

This "community" is characterized by the absolute dominance of *Hypocoenomyce scalaris* (= *Psora ostreata, Lecidea scalaris*), that is the only species present in our releves. *Parmeliopsis aleurites* and *Cetraria pinastri* are also sometimes present.

Hypocoenomyce scalaris is a rare species in the study area and in general in the Carnian and Julian Alps. Relatively well-developed stands have been found only near Casera Razzo, where the species is frequent on *Larix,* mostly on wood, within the *Rhodoro-Vaccinietum laricetosum* between 1600 and 1800 m. The species is also present on bark, and in this case is also found in the *Letharietum vulpinae.* Considering the aeroxerophytism of the community (KALB, 1970), it is probable that its

restrict distribution in the study area is due to the same reasons as the ones discussed for the *Letharietum vulpinae.*

Other *Calicion*- fragments

The *Calicion viridis* (= *Calicion hyperelli* CERN & HADAC) includes a number of tipically ombrophobous and aerohygrophilous unions, preferentially occurring on strongly acid wood, more rarely on acid bark of conifers. The greatest number of the hiterto described unions is composed by a very small number of species, often reduced to one or two species only. The separation of the described "communities" is often difficult, and great care should be taken to evaluate, while taking a releve, the fundamental ecological parameters, such as inclination of the surface, degree of decomposition of the wood etc, that may vary within very small surfaces. I am presently working to a detailed ecological study of *Calicion*-communities in the Carnian and Julian Alps: here I shall limit my considerations to some notes on the occurrence of *Calicion*-species in the study area.

The following *Calicion*-species have been found in the study area:

Calicium viride: it is the most common *Calicion*-species in the area; it occurs both on acid bark (*Picea, Abies*) and on dead wood, between 1200 and 1400 m, often together with *Lepraria candelaris.*

Chaenotheca chrysocephala: the species is not rare in the study area; it has a broad altitudinal range from 1000 to 1800 metres, where it commonly occurs in more or less pure stands on the bark or wood of *Larix.*

Chaenotheca brunneola: it has been found three times, always on rotten wood within the *Abieti-Fagetum,* growing together with *Calicium viride* and *Lepraria candelaris,* or in pure stands, between 1100 and 1250 metres.

Chaenotheca ferruginea: most abundant in the Northwestern portion of the area, on acid bark of trees in open stands (*Picea, Larix, Pinus*), from 1300 to 1750 metres, often with *Chaenotheca chrysocephala.*

Chaenotheca trichialis: the species has been found only once, together with *Lepraria candelaris,* on strongly rotten stumps of *Abies* in a dense *Abieti-Fagetum* - stand (1250 m).

Coniocybe furfuracea: also this species has been found only once, in a pure stand on strongly rotten *Abies*-stumps in a close *Abieti-Fagetum.*

Lepraria candelaris: very common but never abundant throughout the study area, from 1000 to 1800 metres, both on wood and on bark (mostly *Larix* but also *Abies* in the *Abieti-Fagetum*).

Conclusions

Lichen species, for their dependance from athmospheric humidity, are among the best indicators of a variety of climatical factors, such as amount of precipitation, frequency of fog, air pollution etc. The utilizatiqn of lichens for the phytogeographical characterization of an area, despite the lack of interest for such an approach in the South European phytosociological literature, seems to provide quite useful informations (NIMIS, 1981b; NIMIS & LOI, 1981, 1982).

As far as the study area is concerned, one of the most striking facts regarding lichen vegetation, is the compresence in such a narrow area of lichen synusiae characteristic of aeroxeric, continental climate, together with other synusiae that are strongly aerohygrophytic and linked to a suboceanic climate type. Among the first we cite the *Letharietum vulpinae* and the *Psoretum ostreatae,* among the latter the *Lobarietum pulmónariae,* the *Evernietum divaricatae,* and most of the other *Calicion*-fragments. There is a clear geographical differentiation in the distribution of these two groups of communities within the study area: the "continental" group is limited to the northwestern portion of the area, whereas the "oceanic" group has its clear optimum in the southeastern part. The first is mainly present within the *Rhodoro-Vaccinietum laricetosum,* the second within the *Abieti-Fagetum.* As already mentioned, such a distribution pattern fairly well corresponds with the gradient in precipitation from the outer southeastern mountain ridges, still under maritime influence, to the inner northeastern ridges, where precipitation is lower. This is further confirmed by other data concerning vascular vegetation, such as the presence in the northwestern portion of the area of a *Piceetum subalpinum.* (PIGNATTI S. & E., 1968).

An attempt of phytogeographical subdivision of the Carnian Alps has been published by POLDINI (1974) on the basis of the analysis of the distribution of vascular plants. He subdivides the Carnian Alps into three main districts: the endocarnic, characterized by the prevalence of arctic-alpine species, *Pinus cembra*-stands and the *Piceetum subalpinum,* the esocarnic, with high incidence of endemics and the

prevalence of Beech-woods, and the mesocarnic, with characteristics that are intermediate between the endocarnic and the esocarnic. The Lumiei-valley and the mountains surrounding it, are placed by POLDINI (1968) in the mesocarnic district. A further characterization of the various districts proposed by POLDINI (1974) could be based on the distribution of lichen species and synusiae: the endocarnic system is characterized by the scarcity of the oceanic element in the lichen flora, and by the prevalence of aeroxerophytic species, whereas in the esocarnic system the oceanic element is very well rapresented, and aeroxerophytic species are less frequent. *Letharia vulpina* and *Lobaria pulmonaria* could be respectively taken as good indicator species for the two situations. In this sense, from what has been said above, the transitional character of the study area from the ecological (chiefly climatical) and phytogeographical points of view, as proposed by POLDINI (1974), is fully confirmed by the study of its epiphytic lichen vegetation.

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RIASSUNTO — La vegetazione epifita della Valle del Lumiei (Alpi Carniche) è stata studiata sulla base dell'approccio fitosociologico. 11 tipi vegetazionali principali sono stati descritti. Essi sono:

— *Letharietum vulpinae*: su *Larix* nel *Rhodoro-Vaccinietum laricetosum* tra 1600 e 1800 metri (limitatamente alla porzione nord-occidentale della zona studiata).
— *Pseudevernietum furfuraceae*: diffuso nelle fascie montana e subalpina, per lo più su conifere.
— *Evernietum divaricatae*: limitato all'*Abieti-Fagetum* nella fascia montana, in corrispondenza con la fascia delle nebbie.
— *Lobarietum pulmonariae*: anche limitato all'*Abieti-Fagetum,* e ristretto agli immediati dintorni del Lago di Sauris.
— *Lecanoretum subfuscae*: sinusia pioniera sulla corteccia liscia di *Fagus.*

— *Physcietum adscendentis*: su alberi isolati in zone antropizzate.
— *Cladonietum cenoteae*: su ceppi tagliati nelle fascie montana e subalpina.
— *Parmeliopsidetum ambiguae*: alla base di conifere nella fascia montana (subunione *typicum*) o su *Larix* nella fascia subalpina (subunione *parmeliopsidetosum aleuritis*).
— *Xylographetum vitiligis*: su legno morto nella fascia montana.
— *Xylographetum abietinae*: su legno nella fascia subalpina.
— *Psoretum ostreatae*: su legno di *Larix* nella fascia subalpina, limitatamente alla parte nord-occidentale della zona studiata.

I risultati confermano il carattere transizionale dell'area studiata tra la zona prealpina esterna a clima suboceanico e quella alpina interna a clima più continentale.

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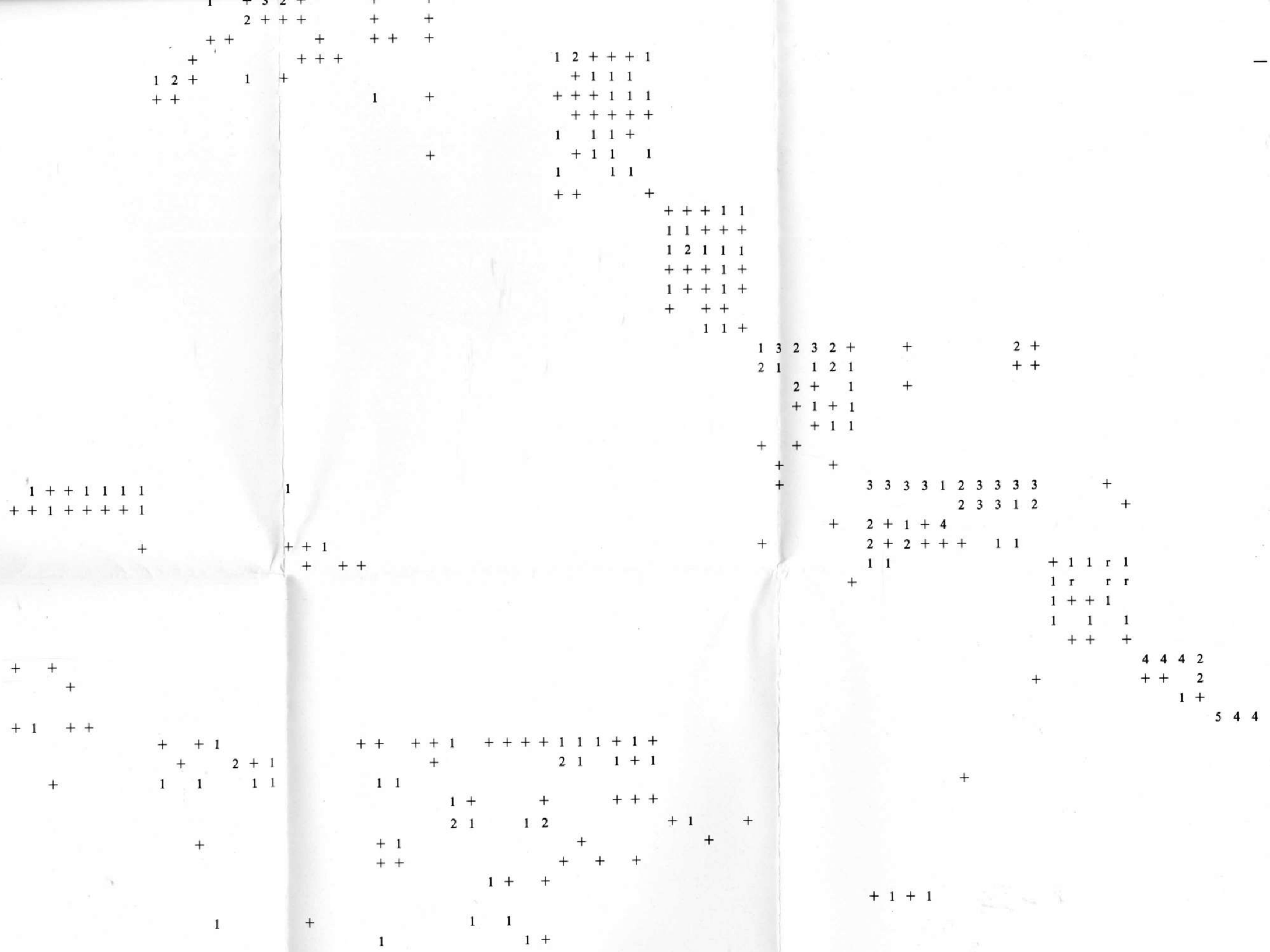
| Releve Nr. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |



Sporadic species:

Rel. 5: *Ochrolechia androgyna.* Rel. 13: *Ochrolechia androgyna.* Rell. 14, 15: *Arthonia dispersa.* Rel. 19: *Trentepholia umbrina.* Rel. 20: *Candelariella xanthostygma, Anaptychia crinalis.* Rel. 21: *Anaptychia crinalis, Radula complanata.* Rel. 23: *Bryoria nadvornikiana.* Rel. 24: *Usnea ceratina, Bryoria nadvornikiana.* Rel. 27: *Lobaria amplissima.* Rel. 28: *Nephroma parile.* Rel. 30: *Peltigera praetextata.* Rell. 31, 32: *Pertusaria coronata, Rinodina corticola.* Rel. 33: *Parmelia subaurifera.* Rel. 36: *Opegrapha rufescens, Graphis scripta.* Rel. 38: *Physcia ciliata, Physcia hirsuta.* Rel. 39: *Collema nigrescens.* Rel. 40: *Ramalina pollinaria, Ramalina fraxinea.* Rel. 42: *Lepraria aeruginosa.* Rel. 53: *Cetraria sepincola.* Rell. 59, 60: *Calicium viride.* Rell. 67, 68: *Chaenotheca chrysocephala.*

Appendice al contributo «Epiphytic lichen vegetation in the Lumiei-Valley» by P.L. Nimis; GORTANIA, vol. 3 (1981).