GORTANIA - Atti Museo Friul. Storia Nat.	2	91-110	Udine, 1.VI.1981	ISSN: 0391-5859

P. L. NIMIS, R. DE FAVERI

NUMERICAL CLASSIFICATION OF *XANTHORION* COMMUNITIES IN NORTH EASTERN ITALY

*CLASSIFICAZIONE NUMERICA DI SINUSIE LICHENICHE EPIFITE (*XANTHORION*) DELL'ITALIA NORD ORIENTALE*

Abstract - A numerical classification of 250 releves of epiphytic vegetation belonging to the *Xanthorion parietinae* in North-eastern Italy led to the distinction of 9 community-types. Distribution and ecology of each type are briefly discussed.

Key words: *Xanthorion parietinae,* Lichens, Epiphytes, North-eastern Italy, Numerical classification.

Riassunto breve - *Una classificazione numerica di 250 rilievi di vegetazione epifitica appartenente allo* Xanthorion parietinae *nell'Italia Nord-orientale ha portato alla distinzione di 9 tipi di vegetazione. Viene brevemente discussa la distribuzione e l'ecologia di ciascun tipo.*

Parole chiave: Xanthorion parietinae, *Licheni, Epifite, Italia Nord-orientale, Classificazione numerica.*

Introduction

The *Xanthorion parietinae* is among the most thoroughly studied alliances of epiphytic synusiae: no less than 585 phytosociological records are available in the literature for the european region (BARKMAN, 1958). However, with the exception of two narrow areas in South Tyrol (STEINER, 1952; TOMASELLI & DE MICHELI, 1952), Italy rapresents a black hole as far as the knowledge of this alliance is concerned. In the present paper we give a first synthesis of *Xanthorion* -vegetation in North-eastern Italy. The results are based on 250 phytosociological

releves taken on isolated wayside trees. The location of the sample plots (see maps) was chosen in such a way as to allow a maximum of geographical and ecological variation to be recorded.

Methods

The releves were taken with the classical Braun-Blanquet method. The cover scale is the Braun-Blanquet scale as modified by PIGNATTI (1954). Mean plot size is 0.4 m². Only North and South exposures were taken into consideration.

The releves have been subjected to cluster analysis with Complete Linkage Clustering (ANDERBERG, 1973) based on Van der Maarel's coefficient as similarity function. 9 main clusters have been obtained. A phytosociological table has been constructed by ordering the releves according to their sequence in the dendrogram. From this table a synthetic table has been obtained (tab. I) by calculating the frequencies of each species within each group. The complete phytosociological table and the dendrogram of the releves are not presented in this paper for reasons of space.

For each group life form, growth form and dissemination spectra have been calculated (respectively LFS, GFS, DS in the text). Life forms and growth forms are according to BARKMAN (1958). The dissemination spectrum takes into consideration only the main way of reproduction of the single species in the study area.

In order to give a synthetic view of the relations among the 9 groups, the contingency table was submitted to Cluster Analysis, with Complete Linkage Clustering on Similarity Ratio (WESTHOFF & VAN DER MAAREL, 1973) and to Principal Component Analysis, with program SIPLO (FEOLI CHIAPELLA & FEOLI, 1977) on Similarity Ratio.

The pH of the bark was measured in the laboratory on the basis of pulverized samples of bark (gr 3) in distilled water with a digital pH-meter. Nomenclature follows POELT (1969, 1977).

In the following pages a brief description of the single types is given.

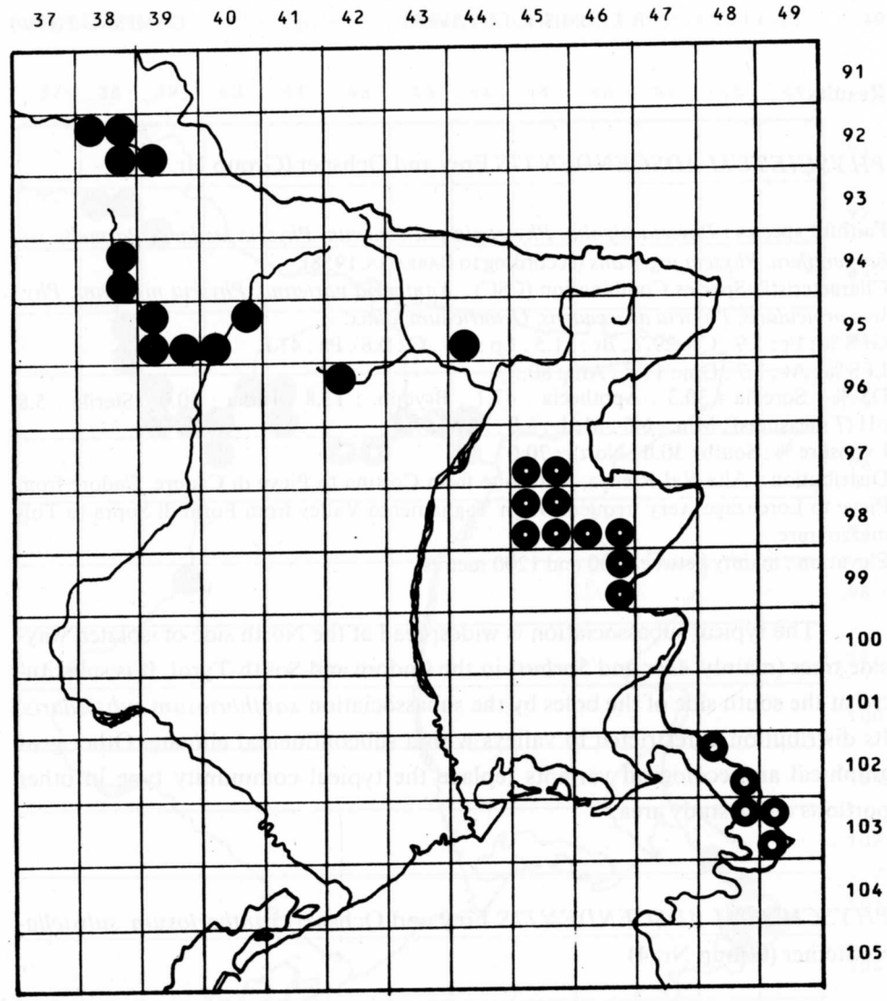

Fig. 1 – Distribution of
– *Distribuzione di*

- *Physcietum adscendentis* typicum
- *Physcietum elaeinae* var. *candelariosum concoloris* facies with *Physcia clementii*
- *Parmelietum acetabulae* var. *glabrosum*

Results

PHYSCIETUM ADSCENDENTIS Frey and Ochsner (Group Nr. 3)

Faithful species : *Physcia aipolia, Physconia pulverulenta, Physcia stellaris, Parmelia subargentifera, Physcia nigricans* (according to BARKMAN, 1958).
Characteristic Species Combination (CSC) : *Xanthoria parietina, Physcia nigricans, Physcia orbicularis, Physcia adscendens, Ortotrichum fallax.*
GFS % : Fr : 1.9 , Cr : 29.7 , Br : 11.5 , Lp : 6.6 , G : 0.6 , Pa : 41.6
LFS % : At : 7.7 , Om : 11.8 , Am : 80.5
DS % : Soredia : 30.3 , Apothecia : 47.1 , Bryoph. : 11.8 , Isidia : 50.0 , Sterile : 5.8
pH (7 measures) : Min. : 6.5 , Med. : 6.8 , Max. : 7.4
Exposure % : South : 30.0 , North : 70.0
Distribution : Alta Val Rienza, Val Boite from Cortina to Pieve di Cadore, Cadore from Pieve to Lorenzago, very frequent. High Tagliamento Valley from Forni di Sopra to Tolmezzo, rare.
Elevation : mainly between 800 and 1200 metres.

The typical subassociation is widespread at the North side of isolated wayside trees (mainly *Acer* and *Sorbus*) in the Cadore and South Tyrol. It is substituted at the south side of the boles by the subassociation *xanthoriosum substellaris.* Its distribution is restricted to valleys with a subcontinental climate. Other geographical and ecological variants replace the typical community type in other portions of the study area.

PHYSCIETUM ADSCENDENTIS Frey and Ochsner *xanthoriosum substellaris* Steiner (Group Nr. 4)

Differential species : *xanthoria fallax* (= *X. substellaris*).
CSC : *Xanthoria fallax, Physcia orbicularis, Ortotrichum fallax.*
GFS % : Fr : 0.8 , Cr : 27.4 , Br : 14.9 , Lp : 2.8 , G : 1.1 , Pa : 56.0
LFS % : At : 4.6 , Om : 15.5 , Am : 79.9
DS % : Soredia : 40.5 , Apothecia : 37.5 , Bryoph. : 14.9 , Isidia : 4.2 , Sterile : 2.9
pH (8 measures) : Min. : 6.8 , Med. : 7.2 , Max. : 7.7
Exposure % : South : 70.4 , North : 29.6
Distribution : as the typical subassociation.
Elevation : mainly between 800 and 1200 metres.

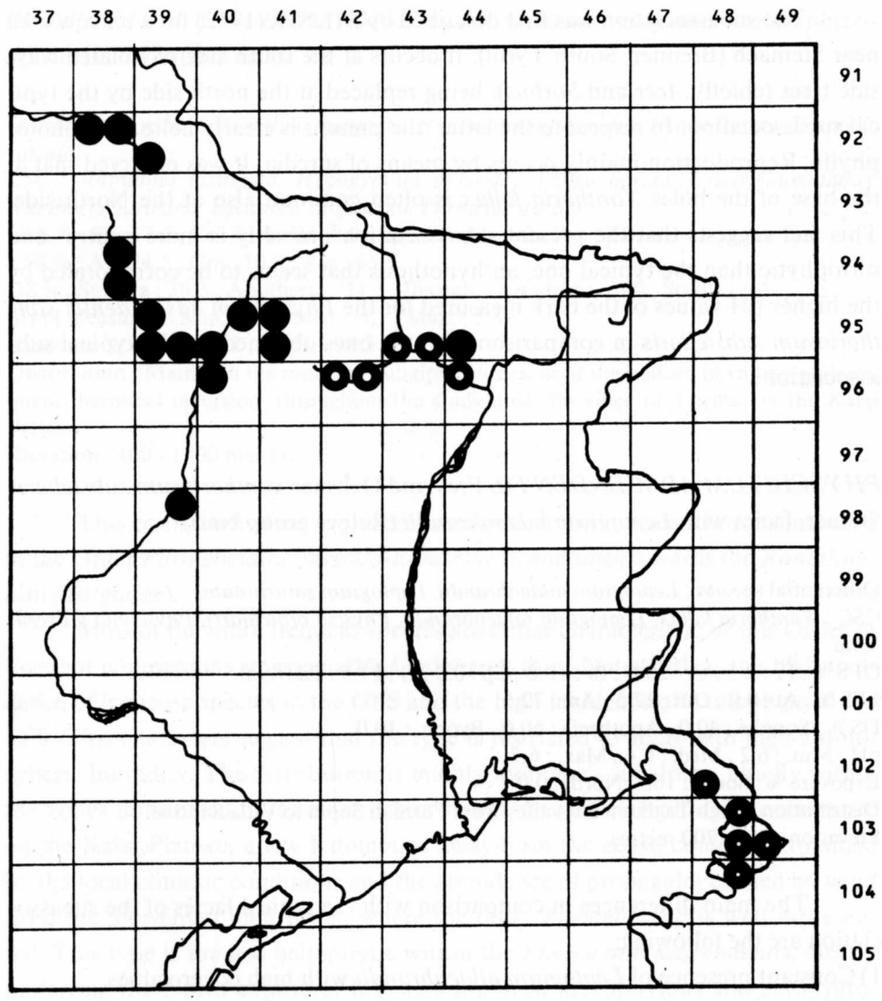

Fig. 2 – Distribution of
– *Distribuzione di*

- *Physcietum adscendentis* subass. *xanthoriosum substellaris*
- *Physcio-Leptogietum hildenbrandii*
- *Physcietum adscendentis* var. *physciosum bizianae*

The subassociation was first described by STEINER (1952) for a narrow area near Steinach (Brenner, South Tyrol). It occurs at the south side of isolated wayside trees (chiefly *Acer* and *Sorbus*), being replaced at the north side by the typical subassociation. In respect to the latter, the present is clearly helio- and photophytic. Reproduction mainly occurs by means of soredia. It was observed that at the base of the boles *Xanthoria fallax* is often common also at the North side. This fact suggests that the present subassociation probably is more neutro- and nitrophytic than the typical one, an hypothesis that seems to be corroborated by the higher pH values of the bark measured for the *Physcietum adscendentis xanthoriosum substellaris* in comparison with the ones obtained for the typical subassociation.

PHYSCIETUM ADSCENDENTIS Frey and Ochsner *xanthoriosum substellaris* Steiner, facies with *Leptogium hildenbrandii* (Releve group Nr.5)

Differential species : *Leptogium hildenbrandii, Leptogium saturninum.*
CSC : *Xanthoria fallax, Leptogium hildenbrandii, Physcia orbicularis, Physconia pulverulenta.*
GFS % : Fr : 2.5 , Cr : 25.0 , Br : 10.0 , Lp : 0.0 , G : 17.5 , Pa : 49.0
LFS % : At : 0.0 , Om : 27.5 , Am : 72.5
DS % : Soredia : 40.0 , Apothecia : 50.0 , Byoph. : 10.0
pH : Min. : 6.2 , Med. : 6.4 , Max. : 6.7
Exposure % : South : 100 , North : 0.0
Distribution : High Tagliamento valley from Forni di Sopra to Villa Santina.
Elevation : 450 - 700 metres.

The main differences in comparison with the typical facies of the subassociation are the following:
1) Constant presence of *Leptogium hildenbrandii* with high cover values.
2) Higher incidence of Ombrophyta in the LFS.
3) Higher incidence of Apothecia - bearing species in the DS.

All of these characters are in common with the *Physcio-Leptogietum hildenbrandii,* and could be considered as ecological indicators of higher precipitations. The distribution is very similar to the one of the *Physcio-Leptogietum,* that is replaced by the present community type at the South side of the boles.

PHYSCIETUM ADSCENDENTIS Frey and Ochsner *hypogymnietosum physodis* subass. *nova* (Group Nr. 1)

Differential species : *Ramalina fastigiata, Hypogymnia physodes, Usnea florida, Parmelia sulcata.*
CSC : *Ramalina fastigiata, Hypogymnia physodes, Usnea florida, Ortotrichum fallax, Xanthoria parietina, Lecanora subfuscata, Parmelia sulcata.*
GFS % : Fr : 17.0 , Cr : 33.4 , Br : 8.9 , Lp : 6.0 , G : 1.0 , Pa : 32.0
LFS % : At : 24.5 , Om : 10.0 , Am : 65.5
DS % : Soredia : 36.3 , Apothecia : 34.3 , Bryoph. : 8.9 , Isidia : 5.0 , Sterile : 5.5
pH (4 measures) : Min. : 4.2 , Med. : 5.1 , Max. : 5.8
Exposure % : South : 5.7 , North : 94.3
Distribution : Mainly in the montane-subalpine zones, or at the bottom of valleys with frequent thermical inversion, throughout the study area. Province of Trieste, on the Karst Plateau.
Elevation : 400 - 1400 metres.

This community type represents a transition towards associations included in the Order *Parmelietalia physodo-tubulosae* (sometimes towards the *Ramalinetum fastigiatae*).

Most of the more frequent species are either characteristic of this Order or frequent companions in associations belonging to it. Noteworth is the high incidence of fruticose species in the GFS and the high incidence of Atmophyta in the LFS. This characters suggest that the type is restricted to areas with high athmospheric humidity. The distribution is mainly montane - subalpine, chiefly within the zones dominated by associations of *Piceetalia* and *Fagetalia.* Its occurrence on the Karst Plateau, a few Kilometres away from the coast, could be explained by the local climatic conditions and the abundance of propagules carried by wind from the Slowenian high Karst, where the order *Parmelietalia* is well rapresented. This type is the less heliophytic within the *Physcietum adscendentis,* clearly preferring the North exposure. It is also the most acidophylous and aerohygrophytic.

PHYSCIETUM ADSCENDENTIS Frey and Ochsner *physciosum bizianae* nov. var. (Releve group Nr. 9)

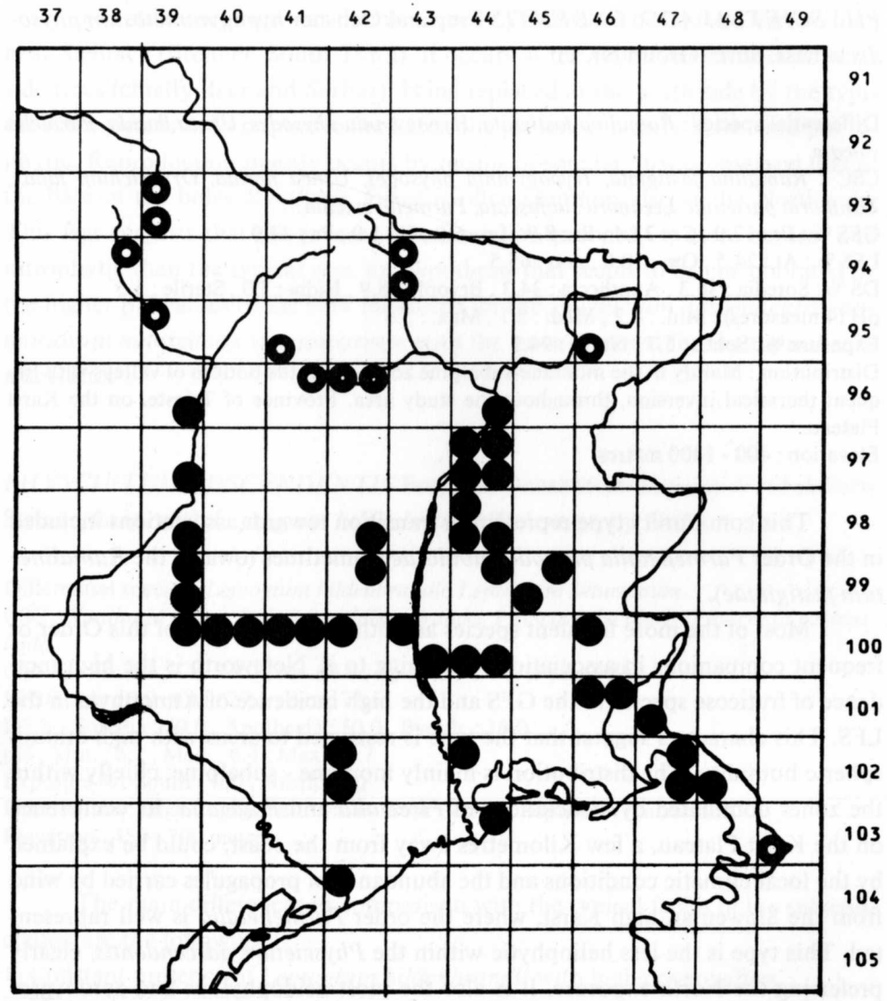

Fig. 3 – Distribution of
– *Distribuzione di*

● *Physcietum elaeinae* var. *candelariosum concolaris*

◎ *Physcietum adscendentis* subas. *hypogymnietosum physodis*

● *Physcietum adscendentis* subas. *xanthoriosum substellaris*, facies with *Leptogium hildenbrandii*

Differential species : *Physcia biziana.*
CSC : *Physcia biziana, Xanthoria parietina, Physcia orbicularis, Physcia adscendens, Physconia pulverulenta, Tortula laevipila.*
GFS % : Fr : 0.0 , Cr : 20.0 , Br : 10.0 , Lp : 8.3 , G : 0.0 , Pa : 61.7
LFS % : At : 3.3 , Om : 10.0 , At : 86.7
DS % : Soredia : 13.4 , Apothecia : 65.2 , Bryoph. : 11.3 , Isidia : 6.1 , Sterile : 3.0
pH (11 measures) : Min. : 6.8 , Med. : 7.4 , Max. : 7.8
Exposure % : South : 100.0 , North : 0.0
Distribution : Province of Trieste, near the coast.
Elevation : 0 - 200 metres.

Physcia biziana was first described for the Dalmatian coast (ZAHLBRUCKNER, 1901). It is a clearly mediterranean species that reaches its northern distributional limit within the study area in the Province of Trieste, where it is very common and often dominant on South-exposed boles (mainly of *Ulmus*). The variant is best developed at the margin of the Karst plateau towards the coast. In the interior, *Physcia biziana* is substituted by *Physcia aipolia.*

Noteworth is the high incidence of Apothecia-bearing species, a character recalling the mediterranean affinities of the variant.

PHYSCIO - LEPTOGIETUM HILDENBRANDII ass. nova (Releve group Nr. 2)

CSC : *Leptogium hildenbrandii, Collema ligerinum, Xanthoria parietina, Physcia adscendens, Physcia hirsuta, Radula complanata, Ortotrichum fallax, Collema nigrescens, Frullania dilatata.*
GFS % : Fr : 0.9 , Cr : 23.0 , Br : 21.9 , Lp : 1.9 , G : 21.9 , Pa : 30.4
LFS % : At : 7.6 , Om : 38.1 , Am : 54.3
DS % : Soredia : 22.8 , Apothecia : 53.3 , Bryoph. : 21.9 , Sterile : 2.1
pH (5 measures) : Min. : 4,5 , Med. : 5.2 , Max. : 6.1
Exposure % : South : 0.0 , North : 100.0
Distribution : High Tagliamento Valley from Ampezzo to Tolmezzo.
Elevation : 350 - 600 metres.

On the basis of two releves from the Swiss Mittelland that could be included in the present union, OCHSNER (1928) proposed the variant *Collemosum nigrescentis* of the *Physcietum adscendentis.* Other records that could be included in this type are a releve from Auvergne (FREY, 1926) and two from the headland

of the Alps (KLEMENT, 1948). Since the present community type is very well characterized both from the floristical and ecological points of view, we propose to consider it as a union.

Noteworth is the high incidence of gelatinous lichens and bryophytes in the GFS and the high incidence (the highest among the studied types) of Ombrophyta in the LFS. The distribution is restricted to the High Tagliamento Valley near Ampezzo, that is climatically characterized by very high precipitations, the union being clearly ombrophytic. This is well in accordance with the observations of BARKMAN (1958). The synusia occurs at the North side of the boles, being replaced at the South side by the *Physcietum adscendentis xanthoriosum substellaris,* facies with *Leptogium hildenbrandii.*

PHYSCIETUM ELAEINAE Barkm. *Candelariosum concoloris* nov. var. (Releve group Nr. 6)

CSC : *Physciopsis adglutinata* (= *Physcia elaeina*), *Xanthoria parietina, Physcia orbicularis, Physcia adscendens, Candelaria concolor.*
GFS % : Fr : 0.0 , Cr : 38.9 , Br : 9.5 , Lp : 1.2 , G : 1.2 , Pa : 60.3
LFS % : At : 1.6 , Om : 10.1 , Am : 88.3
DS % : Soredia : 45.7 , Apothecia : 43.3 , Bryoph. : 9.5 , Isidia : 0.5 , Sterile : 1.0
pH (8 measures) : Min. : 7.5 , Med. : 8.1 , Max. : 8.6
Exposure: South : 53.3 , North : 46.7
Distribution : Venetian and Friulian plains, extending northwards into the prealpine valleys. Province of Trieste, along the coast.
Elevation : mainly between O and 300 metres.

In his description of the *Physcietum elaeinae,* BARKMAN (1958) subdivided it into two variants: the typical one and the variant *Buelliosum canescentis.* Considering the floristical and ecological affinities, our releves show a maximal affinity with the latter. Principal differences are:

1) Absence of the differential species *Buellia canescens* and *Xanthoria candelaria.*
2) Low frequency of the differential species *Physconia grisea, Candelariella vitellina* and *Physcia hirsuta.*
3) Constancy and high cover degree of *Candelaria concolor.*

On this basis a new variant is proposed here, characterized by the latter species as differential. This community type is the most common *Xanthorion*-union in the plains of Veneto and Friuli. It is clearly nitrophytic and moderately photophytic. It occurs both at the North and South sides of the boles. Dissemination mainly occurs by means of soredia.

PHYSCIETUM ELAEINAE Barkm. *Candelariosum concoloris* Nimis & de Faveri, facies with *Physcia clementii* (Releve group Nr. 7)

Differential species : *Physcia clementii* (= *Physcia astroidea*).
CSC : *Physciopsis adglutinata, Physcia clementii, Candelaria concolor, Xanthoria parietina, Physcia orbicularis, Physcia adscendens.*
GFS % : Fr : 0.5 , Cr : 25.5 , Br : 4.5 , Lp : 1.7 , G : 1.7 , Pa : 65.9
LFS % : At : 4.0 , Om : 4.5 , Am : 91.5
DS % : Soredia : 42.6 , Apothecia : 43.3 , Bryoph. : 4.5 , Isidia : 14.3 , Sterile : 1.7
pH (5 measures) : Min. : 7.2 , Med. : 7.9 , Max. : 8.2
Exposure % : South : 54.5 , North : 45.5
Distribution : Eocenic and morenic hills in eastern Friuli, from Gemona to the Collio (GO).
Elevation : 150 - 250 metres.

Physcia clementii is a mediterranean - atlantic species that was proposed by BARKMAN (1958) as one of the faithful species of the *Physcietum elaeinae.* In the study area its occurrence is restricted to the colline zone of eastern Friuli, climatically characterized by higher precipitations than the rest of the plains. The constancy and high cover degree of *Physcia clementii* in this area characterize the present facies. For the rest, this community type does not show other remarkable differences in respect to the variant *Candelariosum concoloris.*

PARMELIETUM ACETABULAE Ochsner var. *glabrosum* Barkm. (Releve group Nr. 8)

Faithful species : *Parmelia acetabulum, Parmelia exasperata, Anaptychia ciliaris.*
Diff. sp. of the var. : *Parmelia glabra, Parmelina quercina, Physcia adscendens, Candelaria concolor, Xanthoria parietina.*
CSC : *Parmelia acetabulum, Parmelia glabra, Frullania dilatata, Parmelina quercina,*

Anaptychia ciliaris, Xanthoria parietina, Physconia pulverulenta, Pseudoparmelia caperata.
GFS % : Fr : 7.6 , Cr : 25.0 , Br : 10.5 , Lp : 3.8 , G : 0.0 , Pa : 52.8
LFS % : At : 4.8 , PM : 10.6 , Am : 84.6
DS % : Soredia : 23.3 , Apothecia : 63.4 , Bryoph. : 10.5 , Sterile : 2.8
pH (4 measures) : Min. : 5.8 , Med. : 6.3 , Max. : 6.7
Exposure % : South : 75.0 , North : 25.0
Distribution : Karst plateau in the Province of Trieste.
Elevation : 300 - 500 metres.

Our releves correspond fairly well the variant *glabrosum* of the *Parmelietum acetabulae* as described by BARKMAN (1958): all of the differential species cited by Barkman are present in our table. The variant is known for Romania, Switzerland, S - France (RONDON, 1951) and Central Atlas (WERNER, 1937). It is subacidophylous and photophytic, mostly occurring at the south side of old isolated trees (chiefly *Quercus pubescens* and *Fraxinus,* med. diameter = cm 125). It seems to be less toxitolerant than the *Physcietum adscendentis,* being completely lacking on wayside trees in roads with high traffic. Dispersal mainly occurs by means of apothecia, a character in common with the *Physcietum adscendentis physciosum bizianae*: the occurrence of both of them seems to be restricted to the Province of Trieste. The distribution of the *Parmelietum acetabulae,* however, extends much more towards the interior, in Jugoslawian territory.

General discussion

In the dendrogram of fig. 4 two principal clusters may be detected, joining at a similarity level of 15:
I cluster : Releve groups Nrs. 1, 2, 3, 4, 5.
II cluster : Releve groups Nrs. 6, 7, 8, 9.

The subdivision into the two clusters fairly well corresponds to a subdivision based on elevation taken as discriminant ecological factor:
I cluster : montane and montane-subalpine unions. (400) 600 - 1400 metres.
II cluster : lower colline and lowland - unions. 0 - 400 metres.

As a result of the ordination method (fig. 5) the releve groups are disposed along a half-circle. The two clusters obtained with the dendogram are still reco-

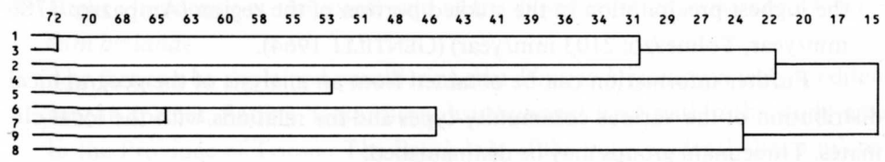

Fig. 4 – Dendrogram of the releve groups.
– *Dendrogramma dei gruppi di rilievi.*

gnizable. At the extremes of the half-circle are respectively:
1) Left : Releve groups Nrs. 8, 9.
2) Right : Releve groups Nrs. 2, 5.

Such a disposition can be interpreted taking into consideration the yearly amount of precipitations as a discriminant ecological parameter:
1) At the left side are community-types with distribution limited to the province of Trieste, with relatively low precipitation in comparison with the whole of the study area and strong dry winds during Winter and Spring.
2) At the right side are associations limited to the High Tagliamento Valley, with

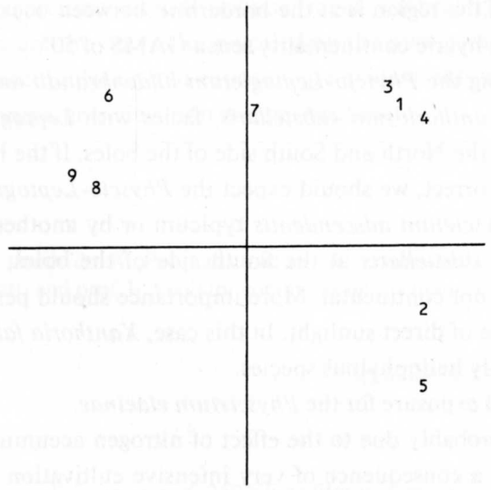

Fig. 5 – Ordination of the releve groups.
– *Ordinamento dei gruppi di rilievi.*

the highest precipitation in the studied portion of the region (Ampezzo: 1786 mm/year, Tolmezzo: 2103 mm/year) (GENTILLI, 1964).

Further information can be obtained from an analysis of the geographical distribution of the various community-types and the relations with the local climates. Three main groups may be distinguished:

1) Subcontinental communities, mainly occurring in valleys with a subcontinental climate: Releve groups Nrs. 3, 4.
2) Suboceanic communities, with distribution centred around valleys with high precipitation and high athmospheric umidity: releve groups Nrs. 2, 5 (I).
3) Submediterranean communities. Releve groups Nrs. 6, 7, 8.

At last, further information is supplied by the preferential exposure of the different community types. The following facts are relevant in this sense:

1) Vicarism between the *Physcietum adscendentis* typicum and the subassociation *Xanthoriosum substellaris,* respectively at the North and South sides of the boles. This problem has already been discussed by STEINER (1952): he came to the conclusion that illumination, dust impregnation and competition cannot explain the observed difference, and ascribed it to the general microclimate, being of a more continental nature on the South-West side of the boles. The climate of the region is at the borderline between oceanic and continental type, with a hygric continentality sensu GAMS of 50°.
2) Vicarism among the *Physcio-Leptogietum hildenbrandii* and the *Physcietum adscendentis xanthoriosum substellaris,* facies with *Leptogium hildebrandii,* respectively at the North and South side of the boles. If the hypothesis of Steiner would be correct, we should expect the *Physcio-Leptogietum* to be replaced by the *Physcietum adscendentis* typicum or by another variant than the *Xanthoriosum substellaris* at the South side of the boles, the local climate being decidely not continental. More importance should perhaps be accorded to the influence of direct sunlight. In this case, *Xanthoria fallax* could be considered as a truly heliophylous species.
3) No preferential exposure for the *Physcietum elaeinae.*
   This is most probably due to the effect of nitrogen accumulation around the whole bole, as a consequence of very intensive cultivation in the plains. No difference in pH has been observed between North and South side of the boles occupied by the *Physcietum elaeinae.*

4) Higher frequency at the south side of the *Physcietum adscendentis physciosum bizianae.*
   The fact can be explained considering that *Physcia biziana* is a truly mediterranean species, finding its northern distributional limit within the study area in the Province of Trieste. The South side of the boles evidently has a microclimate that allows the occurrence of the species in a zone in which the macroclimatical conditions are still near the critical point. It is interesting to note that *Physcia biziana* becomes extremely rare on the Karst Plateau.
5) Higher frequency of the *Physcietum adscendentis hypogymnietosum physodis* at the North side of the boles.
   The fact is easy to explain taking into consideration the sociological behaviour of the differential species, that are more or less bound to associations of the order *Parmelietalia physodi-tubulosae.*
   The order includes acidiphytic and skiophytic community types; from that it derives the preference for the North side of this subunion.

Summarizing, in order of importance the main ecological factors affecting the distribution of the described epiphytic communities in the study area seem to be: 1) Elevation (montane-subalpine versus colline-lowland communities), 2) Mean yearly precipitation (aeroxerophytic versus ombrophytic communities). These two factors are the only ones revealed by the numerical analyses. The effects of nitrogen accumulation and exposure are evident only at a local level, within areas with comparable elevation and macroclimate.

Acknowledgements

We wish to thank dr. A. Pasqualis and dr. A. Pilotto for assistance during field work, prof. S. Pignatti and prof. E. Feoli for comments on the manuscript.

Manoscritto pervenuto il 30.XI.1980.

RIASSUNTO – Un'analisi numerica di 250 rilievi fitosociologici di vegetazione epifita appartenente allo *Xanthorion parietinae* nell'Italia Nord-Orientale, ha portato all'individuazione di 9 differenti tipi vegetazionali:

A) *Physcietum adscendentis* Frey and Ochsner typicum.
B) *Physcietum adscendentis* Frey and Ochsner subass. *xanthoriosum substellaris* Steiner.
C) *Physcietum adscendentis* Frey and Ochsner subass. *xanthoriosum substellaris* Steiner facies with *Leptogium hildenbrandii.*
D) *Physcietum adscendentis* Frey and Ochsner subass. *hypogymnietosum physodis* nova.
E) *Physcietum adscendentis* Frey and Ochsner var. *physciosum bizianae* nova.
F) *Physcio-Leptogietum hildenbrandii* nova.
G) *Physcietum elaeinae* Barkm. var. *candelariosum concoloris* nova.
E) *Physcietum elaeinae* Barkm. var. *candelariosum concoloris,* facies with *Physcia clementii.*
F) *Parmelietum acetabulae* Ochsner var. *glabrosum* Barkm.

I principali fattori che determinano la distribuzione dei tipi vegetazionali descritti nell'ambito della regione studiata sembrano essere:

1) Altitudine sul livello del mare (Associazioni montano-subalpine, associazioni collino-planiziali).
2) Precipitazioni (Associazioni ombrofitiche, associazioni anombrofitiche o aeroxerofitiche).

Questi due fattori sono solo i soli a venir messi in evidenza dall'analisi multivariata condotta sulla tabella sintetica. Gli effetti dell'accumulo di sostanze azotate e dell'esposizione si rendono evidenti a livello locale, nell'ambito di zone con simili condizioni macroclimatiche e simile altitudine, determinando fenomeni di vicarianza ecologica tra le varie associazioni.

Literature cited

ANDERBERG M.R., 1973 - Cluster Analysis for Applications. *Academic Press,* New York.

BARKMAN J.J., 1958 - Phytosociology and Ecology of cryptogamic Epiphytes. Including a taxonomic Survey and Description of their vegetation Units in Europe. Pp. 625, Assen.

FEOLI CHIAPELLA L. & FEOLI E., 1977 - A numerical phytosociological analysis of the summits of the Majella Massive. *Vegetatio,* 34(1): 21-39.

FREY E., 1926 - Contribution à la connaissance de la végétation lichénique et muscinale. 2. La végétation epíphytique. Études phytosociologiques en Auvergne. *Arvenia,* 2: 74-84.

GENTILLI J., 1964 - Il Friuli. I climi. Pp.591, Udine.

KLEMENT O., 1948 - Das *Physcietum adscendentis* in Schwaben. *Ber. Naturf. Ges.,* Augsburg: 26-39.

OCHSNER F., 1928 - Studien über die Epiphytenvegetation der Schweiz. *Jahrb. St. Gall. Naturwiss. Ges.,* 63(2): 1-106.

PIGNATTI S., 1954 - Introduzione allo studio fitosociologico della pianura veneta orientale. Pp.170, Forlì.

POELT J., 1969 - Bestimmungschlüssel der europäischen Flechten. Pp.757, Lehre.

POELT J., 1977 - Bestimmungschlüssel der europäischen Flechten. Ergänzungsheft 1, pp. 258, Vaduz.

RONDON Y., 1951 - Premieres observations sur les lichens corticoles du Chêne blanc (*Quercus pubescens* WILLD.) au Mont Ventoux (Vaucluse). *Monde des Plantes,* 46(10): 274-275

STEINER M., 1952 - Zur Expositionsabhängigkeit epixiler Flechtengesellschaften. Das *Physcietum adscendentis xanthorietosum substellaris. Ber. Deutsch. Bot. Ges.,* 65(8): 255-262.

TOMASELLI R. & DE MICHELI N., 1952 - Su alcune associazioni di licheni epifiti di conifere nei dintorni del Passo della Mendola (Trentino). *Arch. Bot.,* 28: 1-42.

WERNER R.G., 1937 - Essai d'une synthèse phytogeographique des cryptogames en montagne marocaine d'apres nos connaissances actuelles. *Bull. Soc. Sc. Nat. maroc.,* 17(2): 99-126.

WESTHOFF V.E. & VAN DER MAAREL E., 1973 - The Braun-Blanquet Approach. In: *R.H. Whitthaker (ed.) Handbook of Vegetation Science,* Part V : 278-321, Le Hague.

ZAHLBRUCKNER A., 1901 - Vorarbeiten zu einer Flechtenflora Dalmatiens. I, 26. *Österr. Botan. Zeitschr.,* 51: 26.

Releve Group No.	1	2	3	4	5	6	7	8	9
Hypogymnia physodes	V		I	I		I			
Usnea florida	IV	I							
Evernia prunastri	III		I	I					
Pertusaria amara	I	III	I	I	II				
Ramalina fastigiata	IV		I	I					
Leucodon sciuroides	I	III		I	I				
Pertusaria albescens	I	III	I	I			I		
Collema nigrescens		IV		I		I	I		
Leptogium hildenbrandii		V	I	I	V		I		
Leptogium saturninum	I	III			II		I		
Radula complanata		V		I					
Opegrapha sp.		III		I		I			
Collema ligerinum		V							
Parmelia subargentifera			III	I					
Xanthoria fallax	I		I	V	V		I		I
Physcia clementi						V			
Physciopsis adglutinata				I		V	IV		
Parmelia acetabulum								V	
Parmelia glabra								V	
Parmelina quercina								IV	
Parmelia exasperata	I		I	I				III	
Anaptychia ciliaris	I		I		I			IV	
Caloplaca ferruginea	I		I			I		III	
Physcia biziana									V
Xanthoria parietina	V	V	V	II		IV	V	IV	V
Physcia orbicularis	II	II	IV	IV	V	IV	V	II	IV
Physcia adscendens	III	V	IV	III	I	IV	V	I	IV
Candelaria concolor	II	III	II	III	II	V	IV	III	IV
Lecanora subfuscata	IV	III	III	II	I	II	II		
Lecidella elaeochroma	III	III	III	I	I	III	II		II
Lecanora chlarotera	II	IV	II	II	III		I	II	
Candelariella xanthostigma	III	I	III	II		I	I	II	II
Parmelia sulcata	IV		III	I	I	I			
Frullania dilatata	II	V	II	I	I	I	I	V	
Physcia nigricans	II	II	IV	III			I		
Ortotrichum fallax	IV	V	IV	IV	III		I		
Caloplaca cerina	II		III	I		I	I		I
Physconia pulverulenta	I	II	III	II	IV		I	IV	IV
Parmelia exasperatula	III		II	II		I			
Tortula laevipila	I		I	I		II	III	II	IV
Physcia aipolia	II	II	II	I			I		
Physcia tenella	I		I	I		I	I		I
Physcia stellaris	II	I	II	I	I				
Lecanora carpinea	III		II	I		I	I	II	I
Physcia hirsuta		V		I		II	I		
Parmelia subaurifera	II		II	I	II		I		
Caloplaca pyracea	II		I			I	I	III	II
Caloplaca aurantiaca	I		I						
Physconia grisea						I	II		I
Protococcus viridis	I	I	I				I	I	
Pseudoparmelia caperata	I	II	I			II		IV	
Parmelia borreri	I					II	I	I	
Xanthoria candelaria	I		I	I					
Anaptychia crinalis	I		I						
Phlychtys argena	I		I						

Releve Group No.	1	2	3	4	5	6	7	8	9
Physcia ciliata	I						I		
Lecanora symmictera	I								
Pertusaria pertusa			I			I			
Lecanora allophana			I						
Pseudevernia furfuracea	I								
Alectoria jubata	I								
Candelariella vitellina			I				I	I	II
Lecanora atra	I		I						
Lecanora intumescens	I								
Rinodina pyrina			I				I	II	
Lecanora varia							I		
Normandina pulchella	I			I					
Parmelia elegantula	I		I						
Graphis scripta		I							
Lecanora chlarona								II	
Pertusaria hemisphaerica								II	
Parmelina tiliacea							I	II	

Authors' address - Indirizzo degli Autori:
- Dr. Pier Luigi NIMIS
- Dr. Rudy DE FAVERI
Istituto ed Orto Botanico
dell'Università degli Studi
Sal. Monte Valerio 14, I-34127 TRIESTE