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ANALYSIS OF SOME PLANT COMMUNITIES BASED ON THE BRYOPHYTE LAYER

ABSTRACT: The floristic composition of 11 plant communities was examined by cluster analysis based on the frequency and life strategies of bryophytes. The dendrograms based on floristic and life strategy data show that the bryophyte layers of grassy and woody communities are different. On the other hand, the bryophyte flora and the strategy spectrum of ecologically similar communities closely agree.

INTRODUCTION

The project "The ecological and coenological connections of the life strategies of bryophytes" is sponsored by the Hungarian Academy of Sciences. The present paper gives some coenological results of the above mentioned investigations.

It is documented by previous studies that the bryophytes are useful indicators of the environment in which they are present (Zólyomi 1931, Boros 1968, Benson-Evans 1961, Barkman 1958, Gimingham-Birse 1957, Simon 1970, Simon--Szerényi 1975, Slack 1977, Orbán 1984, 1987), and results are more exact if the investigations are made on the basis of the life strategies of bryophytes occurring in the communities (Orbán 1984 a, b). For the analysis of vegetation types a frequently used method is cluster analysis (see, e.g. Feoli--Ganis 1985, Feoli--Orlóci--Scimone 1985, Podani 1985, etc.). In the bryological research this method is employed for taxonomical investigations (e.g., Düll--Hermanns and Düll 1985, etc.), but analyses of vegetation types were also made by the author (Orbán 1984). Results of the latter investigations showed that the

communities are separable and comparable on the basis of their bryophyte layer.

METHODS

The sampling areas were chosen in the Bükk Mts. They are: Mt. Nagy-Eged, Mt. Csákpilis near Felsőtárkány and Mt. Keselyűbérc near Szarvaskő. The Ceraso-Quercetum pubescentis, Quercetum pubescentis-petraeae, Quercetum petraeae-cerris and Carpino-Fagetum communities were examined in Mt. Nagy-Eged (see Table 1, Nos 5, 7, 9 and 11). Communities Pulsatillo-Festucetum rupicolae, Potentillo-Festucetum pseudodalmaticae and Quercetum petraeae-cerris were examined near Szarvaskő (see Table 1, Nos 3, 1 and 8).

The Seslerio-Quercetum, Seslerio-Querscetum caricetosum humilis, Deschampsio-Fagetum and Grimmietum orbicularis communities were investigated in Mt. Csákpilis. The nomenclature of communities follows Soó (1964).

Fifty sample plots of 10 x 10 cm^2 area were collected randomly in each of the above mentioned communities. All bryophyte species were collected which occurred in the sample plot. The 50 randomly taken plots are enough for the collection of all bryophyte species which represent the communities.

The bryophytes were identified according to the Handbook of Hungarian Bryoflora (Orbán--Vajda 1983). After identification, the ferequency and life strategies of species were recognized. The life strategy categories are those used by During (1979) and the life strategy types of species were recognized according to Orbán (1984).

Table 1 contains the frequency data of bryophyte species which occur in the communities examined and Table 2 includes the frequency scores of life strategies.

Cluster analysis was used for the comparison of the bryophyte layer of communities. The CLAN program was developed by I. Perge based on Podani's (1980) paper and was run on a Proper 16 computer. The sorting algorithms used are furthest neighbour (complete linkage) and sum of squares agglomeration. The similarity matrices were calculated based on the correlation coefficients of frequency of species and life strategies of bryophytes.

RESULTS AND DISCUSSION

It seems from Table 1 that all communities have some very frequent species. In the Potentillo-Festucetum pseudodalmaticae community Pleurochaete squarrosa, Tortella tortuosa and Grimmia laevigata are frequent. In the Grimmietum orbicularis Ditrichum flexicaule and Grimmia pulvinata var. africana, and in the S-Q caricetosum humilis community Pleurochaete squarrosa, in the Ceraso-Quercetum pubescentis Abietinella abietina, Homalothecium lutescens and Rhytidium rugosum are the most frequent. Bryum flaccidum Pylaisia polyantha, Brachythecium velutinum Leucodon sciuroides and Hypnum cupressiforme are frequent in Quercetum petraeae-cerris. In the Deschampsio-Fagetum beechwood Leucobryum glaucum and Dicranum scoparium are frequent, and in the Carpino-Fagetum Brachythecium velutinum is the most common.

It seems that noticeable differences are between, the species composition of communities examined. The dendrogram (Fig. 1) based on the frequency of species shows very well which communities are similar according to their bryophyte composition and which are different from this point of view. The grassy (No 1, 2, 3, 4) and woody communities are well separated from each other in the dendrogram. The most similar communities are the oakwoods, e. g., Quercetum pubescentis-petraeae, Quercetum petraeare-cerris and Ceraso-Quercetum pubescentis. Among the grassy communities the Seslerio-Quercetum caricetosum humilis and the Potentillo-Festucetum pseudodalmaticae are very similar. The other communities are significantly different from the above mentioned communities. The beechwoods came to another branch in the dendrogram, and

it is very interesting that the Carpino-Fagetum and Deschampsio-Fagetum are also different from each other (No 10, 11). The Grimmietum orbicularis (No. 2) is also on a separated branch. This community occurs on the surface of dolomite rocks, where the vascular plants are very scarce or absent, so the floristical composition of bryophyte layer is very different from other communities.

The analysis was also made on the basis of life strategies of bryophytes (see Table 2 and Fig. 2.) Table 2 contains the frequency of life strategies of bryophytes. It is very interesting that the similar communities which belong together are separated well from the other communities. So it seems that there are three groups of communities: the first one contains the oakwoods, the second one contains the opened oakwoods and the beechwood communities and the third group includes the grassy communities. It is interesting that the bryophyte layer of Pulsatillo-Festucetum rupicolae is similar to the bryophyte layer of oakwoods (No. 3, 7, 8, 9). Probably the canopy closure of grass species has a similar effect on bryophytes as the canopy of oakwood communities.

The above mentioned results support our previous findings (Orbán 1984). Since the grass layer of the two opened woody communities (e.g., Ceraso-Quercetum, No. 5, and Seslerio-Quercetum, No. 6) is closed and gives strong shade for mosses, the similarity in the composition of the life strategies of bryophytes of beechwood communities is understood Nos 10, 11).

The third group is separated sharply from the above mentioned two groups because they are the opened grassy communities. The similarity of the three communities is caused by the low abundance of vascular plants, so in these communities the species of colonist strategy type are frequent. On the other hand, the perennial stayers are more frequent in the woody communities.

CONCLUSIONS

It has been found that the bryophyte flora of plant communities is determined by the composition of coenoses and the degree of canopy closure. According to this fact the opened and closed grasy communities, the opened and closed woody communities and their bryophyte layer are very different in floristic and life strategy composition. On the basis of life strategies, it seems that the bryophyte layer of closed grassy communities is closely related to the woody communities. However, the floristic composition is very different from each other. In closed grassy communities and in woody communities the perennial stayer species are very frequent, but we can found Rhytidium rugosum and Abietinella abietina in grassy communities. On the other hand, in woody communities Hypnum cupressiforme, Brachythecium velutinum and Pylaisia polyantha are very common.

It is a very interesting tendency that in opened grassy communities the proportion of the species of colonist strategy is larger than other strategy types. However, in closed grassy communities, in opened and closed woody communities the proportion of the species of perennial stayer strategy will be more and more larger (see Table 2).

Cluster analysis based on life strategies of bryophytes is suitable to the separation of plant communities, and makes the identification of the related groups of communities possible.

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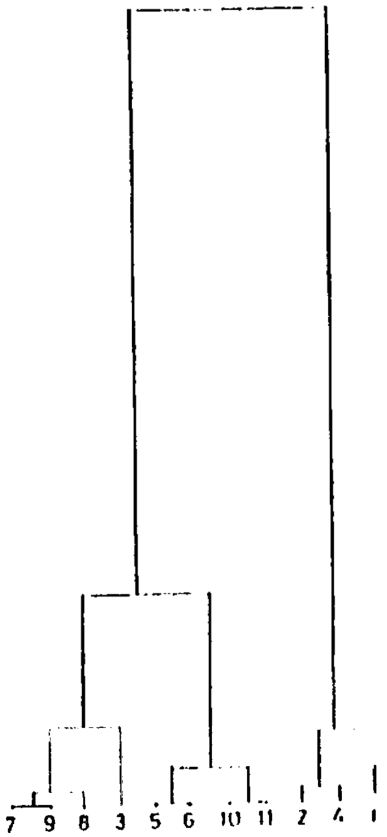
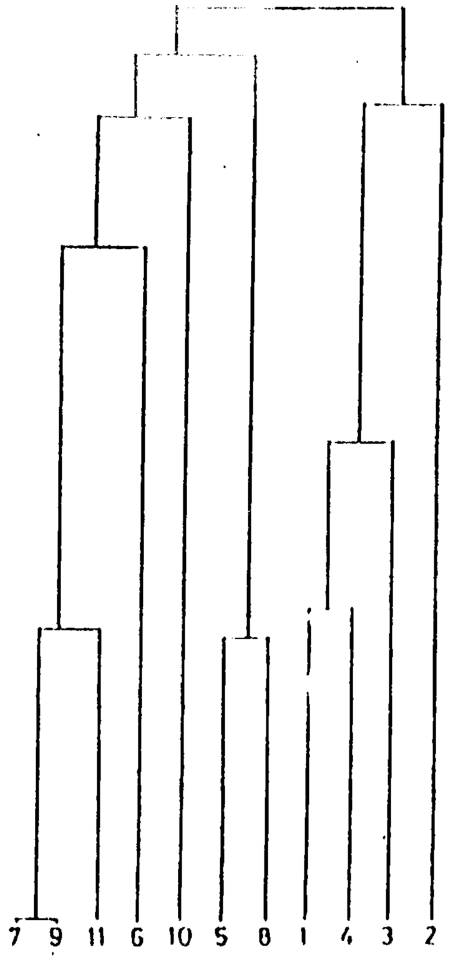
Fig. 1. Hierarchy for quadrats (based on the correlation coefficients of bryophyte species frequency).



Communities examined

1. Potentillo-Festucetum pseudodalmaticae
2. Grimmietum orbicularis
3. Pulsatillo-Festucetum rupicolae
4. Caricetum humilis
5. Ceraso-Quercetum pubescentis
6. Seslerio-Quercetum
7. Quercetum pubescenti-petraeae
8. Quercetum petraeae-cerris (Szarvaskő)
9. Quercetum petraeae-cerris (Nagyeged)
10. Deschampsio-Fagetum subcarpaticum
11. Carpino-Fagetum

Fig. 2. Hierarchy for quadrats (based on the correlation coefficients of the frequency of life strategies of bryophytes).



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11. Carpino-Fagetum

Table 1

Species	Communities										
	1	2	3	4	5	6	7	8	9	10	11
Barbula fallax	0	1	1	1	1	0	3	0	0	0	0
Barbula revoluta	6	4	0	0	0	0	0	0	0	0	0
Bryum flaccidum	0	0	0	0	1	0	31	20	44	0	4
Dicranum montanum	0	0	0	0	0	0	0	0	1	1	0
Ditrichum felxicaule	0	29	0	2	0	1	0	0	0	0	0
Encalypta streptocarpa	1	7	0	3	0	0	0	0	0	0	0
Fissidens taxifolius	0	0	0	0	0	12	0	0	0	0	1
Frullania dilatata	0	0	0	0	0	0	9	3	3	0	0
Grimmia laevigata	15	1	1	0	0	0	0	0	0	0	0
Grimmia pulvinata	8	26	0	0	1	0	0	0	0	0	0
Ortotrichum anomalum	0	5	0	0	0	0	2	0	3	0	0
Platygyrium repens	0	0	0	0	0	0	0	0	10	0	0
Pleurochaete squarrosa	23	1	18	17	9	0	0	1	0	0	0
Schistidium apocarpum	2	4	0	1	0	0	1	2	0	0	0
Tortella inclinata	2	3	4	2	0	1	0	0	0	0	0
Tortella tortuosa	18	7	15	7	9	8	1	1	0	0	0
Tortula ruralis	10	6	9	0	20	0	11	14	7	0	0
Phascum cuspidatum	1	0	0	0	1	0	0	0	0	0	0
Encalypta vulgaris	12	7	6	1	0	0	0	0	0	0	0
Hymenostomum microstom.	8	0	3	3	1	0	1	0	0	0	0
Mannia fragrans	0	0	1	0	0	0	0	0	0	0	0
Pterygoneuron ovatum	4	0	1	0	1	0	0	0	0	0	0
Leucodon sciuroides	0	4	0	0	0	0	3	16	2	0	0
Ortorichum speciosum	0	0	0	0	0	0	0	1	0	0	0
Plagiomnium cuspidatum	0	0	0	0	0	0	2	0	6	0	0
Porella platyphylla	0	0	1	0	0	0	0	0	0	0	0
Abietinella abietina	0	0	7	0	49	4	0	27	0	0	0
Brachythecium populeum	0	0	0	1	5	1	0	1	0	0	0
Brachythecium velutinum	0	0	1	3	0	3	20	19	26	0	22
Dicranum scoparium	0	0	0	0	0	0	0	0	3	27	0
Eurhynchium schleicherii	0	0	0	0	2	0	1	0	2	0	0

Eurhynchium swartzii	0	0	0	0	0	0	0	0	0	0	4
Homalothecium lutescens	0	0	0	2	21	23	0	0	0	0	0
Homalothecium sericeum	0	3	0	0	0	0	0	1	0	0	0
Hylocomium splendens	0	0	0	0	0	3	0	0	0	0	0
Hypnum cupressiforme	0	3	5	9	11	18	32	9	43	9	9
Hypnum vaucheri	0	16	0	1	0	1	0	0	0	0	0
Leskea polycarpa	0	0	0	0	0	0	9	7	7	0	0
Leskeella nervosa	0	0	0	0	0	0	2	1	2	0	0
Leucobryum glaucum	0	0	0	0	0	0	0	0	0	32	0
Lophocolea heterophylla	0	0	0	0	0	0	0	0	1	0	1
Paraleucobryum longifol.	0	0	0	0	0	0	0	0	0	6	0
Polytrichastrum formosum	0	0	0	0	0	0	0	0	0	19	0
Pseudoleskeela catenul.	0	2	0	0	0	0	0	0	0	0	0
Pylaisia polyantha	0	0	0	0	0	0	24	4	24	0	3
Rhodobryum ontariense	0	0	1	0	0	7	0	0	0	0	0
Rhytidium rugosum	7	0	39	0	21	1	0	16	0	0	0
Thuidium recognitum	0	0	0	0	0	24	0	0	0	0	0

COMMUNITIES

1. Potentillo-Festucetum pseudodalmaticae
2. Grimmietum orbicularis
3. Pulsatillo-Festucetum rupicolae
4. Seslerio-Quercetum caricetosum humilis
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Table 2.

	Communities										
Stategy	1	2	3	4	5	6	7	8	9	10	11
C	85	94	48	35	41	22	66	41	76	1	5
AS	1	0	0	0	1	0	0	0	0	0	0
SL	24	7	11	4	2	0	1	0	0	0	0
LS	0	4	1	0	0	0	5	17	8	0	0
P	7	24	54	16	111	85	103	87	118	93	44