PAUCĂ (1941)-PĂŞCUŢ (2012) – A COMPARATIVE STUDY ON THE VEGETATION IN CODRU-MOMA MOUNTAINS

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Abstract

Due to the changing of the landscape as a result of the anthropic influences and microclimatic changes I resorted to a comparativ study on the structure of vegetation, between the results obtained by Paucă (1941) and Păşcuţ (2012).

There have been comparatively analyzed the phytocoenoses of 14 vegetal associations, considering their floristic composition, life forms, floristic elements and chorology.

Key words: vegetation, Codru-Moma Mountains, association, phytocoenoses, floristic elements, life forms.

INTRODUCTION

Codru-Moma Mountains are part of the Apuseni Mountains, lying on the later´s westwern part and which appears as a well-shaped promontory, heading NV-SE. The territory of Codru-Moma Mountains is situated in Bihor and Arad County, having the coordinates set of 46º20'-46º41' N and 22º06'- 22º32' E (Buz, 1980).

Codru-Moma Mountains have a surface of about 675 km^2, having the shape of a parallelogram with length of approximately 39 km and width of 17 km. Considering their names, Codru-Moma Mountains are formed of two separate mountains groups: Codru Mountains and Moma Mountains. Codru Mountains are on the northern and southwest part of the massif, while Moma Mountains, are on the southeast part.

Codru-Moma Mountains represent the most typical horst in the Apuseni Mountains, having the greatest lithologic complexity.

MATERIAL AND METHODS

In the comparative study of the vegetation in Codru-Moma Mountains have been used some phytosociologic research methods developed by the Central-European school, developed by considering the principles and methodical approaches elaborated by Braun-Blanquet (1964), and adapted by Borza, Boşcaiu (1965), Cristea et al. (2004), to the characteristics of vegetation in our country.

The names of the associations were given according to the provisions found in the Code of Phytosociologic Nomenclature (Weber et

al., 2000). The including of the association in the cenotaxonomic system, suballiance, alliance, order and class was done according to the traditional ecologic-floristic systems elaborated by Tüxen (1955), Braun-Blanquet (1964), Borza, Boşcaiu (1965), Soó (1964-1980), as well as according to the main newly published articles written by Mucina (1997), Pott (1995), Rothmaler (1994-2000), Borhidi (1996-2003), Coldea et al. (1997), Sanda et al. (2008).

Great importance was given to the comparative analysis of life forms and floristic elements by their graphic interpretation in the form of spectrum in the histograms.

Key terms used in this paper are:

- L.f.-Life forms; Ph-Phanerophytes; Ch-Chamaephytes; G-Geophytes; H-Hemicryptophytes; T-terophytes; Hh-helohidatophytes; L.f.I-life forms identified in the present, in the studied area, L.f.II-life forms identified by Paucă (1941), in the studied area;
- F.e.-Floristic elements; Cp-Circumpolar; DB-Daco-Balkan; Eua-Eurasian; Carp-Carpathian; E-European; End-Endemism; Ec-Central European; Atl-Atlantic; M-Mediterranean; Alp-Alpine; P-Pontic; Cosm-Cosmopolite; Pn-Pannonian; Adv-Adventitious; B-Balkan; Ppn-Ponto Pannonian; F.e.I-floristic elements identified in the present, in the studied area; F.e.II-floristic elements identified by Paucă (1941), in the studied area.

RESULTS AND DISCUSSION

In his doctoral thesis on vegetation in Codru-Moma Mountains Paucă (1941), identified 19 vegetal associations (table 1), classified in 10 alliances, 10 orders and 4 classes; out of these for 14 vegetal associations she made synthetic charts; she analyzed the phytocoenoses considering the importance of the life forms and floristic elements.

The study of vegetation in Codru-Moma Mountains has been recently carried out (Păşcuţ, 2012) shows the presence of 62 vegetal associations, classified in 6 suballiances, 41 alliances, 29 orders and 18 classes. The phytocoenoses of the 62 vegetal associations were analyzed considering their floristic composition, their life form type, floristic element type, karyotype and value of ecological indices (Păşcuţ 2010, 2011; Păşcuţ, Burescu, 2009, 2010; Burescu, Păşcuţ, 2010). Using the new data, for each association, there have been made some graphics of the life form spectrums, floristic elements, karyotypes, the diagram of ecological indices and the dendogram of the phytocoenoses analyzed.

The anlysis of the vegetal associations considering the spectum of the ecological indices, the cytogenetic structure, dendograms, except for the importance of life forms and floristic elements, shows new elements in the study of vegetation in Codru-Moma Mountains.

Table 1

The comparative summary of vegetal associations identified by Paucă (1941) and Păşcuţ (2012) in Codru-Moma Mountains

Associations identified by Paucă (1941)	**Associations identified by Păşcuţ (2012)**
- *Asplenium ruta muraria-Asplenium trichomanes* (frag.) - *Asplenium septentrionale* (frag.) - *Seslerietum rigidae praebiharicum* - *Kickxia elatine* et *Scutellaria hastifolia* - *Onopordetum acanthii* - *Xanthietum strumarii* Paucă 1941 - *Senecioni sylvatici-Epilobietum angustifolii* R. Tüxen 1937 - *Cyperetum flavescentis* - *Phleum phleoides* et *Hieracium Bauhini* - *Festuca sulcata-Achillea collina* Br.-Bl. - *Vulpio-Airetum capillaris* Paucă 1941 - *Juncus effusus et Ranunculus repens* - *Molinietum* fragm. - *Nardus stricta* et *Calamagrostis arundinacea* - *Cytiso nigricantis-Quercetum petraeae* Paucă 1941 - *Fagetum carpaticum* - *Alnus glutinosa* et *Salix purpurea* - *Acereto-Fraxinetum typicum* - *Carpino-Fagetum* Paucă 1941	- *Najadetum minoris* Ubriszy 1941 - *Potametum natantis* Soó 1927 - *Callitrichetum palustris* (Dihoru 1975 n.n.) Burescu 1999 - *Typhetum latifoliae* Lang 1973 - *Sparganietum erecti* Roll 1938 - *Glycerietum fluitantis* Eggler 1933 - *Agrostetum gigantei* Sanda et al. 1994 - *Eleocharitetum palustris* Schennikov 1919 - *Carici remotae-Calthetum laetae* Coldea (1972) 1978 - *Carici flavae-Eriophoretum latifolii* Soó 1944 - *Juncetum effusi* Soó (1931) 1949 - *Junco inflexi-Menthetum longifoliae* Lohmeyer 1953 - *Lythro-Calamagrostetum epigei* Pop I. 1968 - *Lythro salicariae-Juncetum effusi-inflexi* Todor et al. 1971 - *Junco-Molinietum* Preising 1951 - *Lysimachio vulgaris-Filipenduletum ulmariae* Balátová-Tuláčková 1978 - *Scirpetum sylvatici* Ralski 1931, Maloch 1935 em. Schwick 1944 - *Festuco rubrae-Agrostetum capillaris* Horvat 1951 - *Trifolio repenti-Lolietum* Krippelová 1967, Resmeriţă et Pop 1967 - *Anthoxantho-Agrostietum capillaris* Sillinger 1933 - *Festuco rubrae-Nardetum* Csűrös et Resmeriţă 1960 - *Festuco-Genistelletum* Issler 1927 - *Festuco rubrae-Danthonietum* Csűrös et al. 1968 - *Agrostio-Festucetum valesiacae* Borisavljevič et al. 1955 - *Medicagini-Festucetum valesiacae* Wagner 1940 - *Poterio-Festucetum valesiaceae* J. Danon 1964 - *Sedo sexangulari-Syntrichietum calcicolae* Mihai et al. 1973 - *Asplenio rutae-murariae-Melicetum ciliatae* Soó 1962 - *Thymo comosi-Festucetum rupicolae* (Csűrös et Gergely 1959) Pop et Hodişan 1985 - *Asplenietum rutae-murariae-trichomanis* R. Tüxen 1937 - *Asplenio quadrivalenti-Poëtum nemoralis* Soó ex Gergely et al. 1966 - *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938 - *Asplenio trichomani-Poëtum nemoralis* Boşcaiu 1971 - *Ctenidio-Polypodietum* Jurko et Peciar 1963 - *Parietarietum officinalis* Csűrös 1958 - *Filagini-Vulpietum* Oberdorfer 1938 - *Vulpio-Airetum capillaris* Paucă 1941 - *Xanthietum strumarii* Paucă 1941 - *Sambucetum ebuli* Felföldy 1942 - *Veratretum albi* (Puşcaru et al. 1956) Buia et al. 1962 - *Telekio-Petasitetum hybridi* (Morariu 1967) Resmeriţă et Raţiu 1974 - *Clinopodio-Pteridietum aquilini* Dihoru 1975 - *Calamagrostietum epigei* Juraszek 1928

	- *Senecioni sylvatici-Epilobietum angustifolii* R. Tüxen 1937 - *Eupatorietum cannabini* R. Tüxen 1937 - *Spiraeo-Coryletum* Ujvárosi 1944 - *Coryletum avellanae* Soó 1927 - *Pruno spinosae-Crataegetum* (Soó 1927) Hueck 1931 - *Frangulo-Salicetum cinereae* Malcuit 1929 - *Stellario nemori-Alnetum glutinosae* (Kästner 1938) Lohmeyer 1957 - *Symphyto cordati-Fagetum* Vida 1963 - *Festuco drymejae-Fagetum* Morariu et al. 1968 - *Luzulo albidae-Fagetum sylvaticae* Zólyomi 1955 - *Phyllitidi-Fagetum* Vida (1959) 1963 - *Acereto-Ulmetum* Beldie 1951 - *Carpino-Fagetum* Paucă 1941 - *Genisto tinctoriae-Quercetum petraeae* Klika 1932 - *Petraeo-Fagetum* Scamoni (1956) 1959 - *Castaneo-Quercetum* Horvat I. 1938 - *Quercetum petraeae-cerris* Soó 1963 - *Cytiso nigricantis-Quercetum petraeae* Paucă 1941 - *Festuco drymejae-Quercetum petraeae* Morariu et al. 1970

In the following paragraphs, some comparative data on the study of phytocoenoses for 14 vegetal associations will be presented.

1. The ***Asplenietum rutae-murariae-trichomanis*** association R. Tüxen 1937, was described by Paucă (1941) as ***Asplenium ruta muraria-Asplenium trichomanes*** (frag.), being mentioned in two locations, Briheni (Şopotesei Valley) and Coleşti. In Coleşti this association was not to be found again. The floristic composition of the two relevées made by this botanist was formed at that time, of 25 species.

In his doctoral thesis (Păşcuţ, 2012), which was publicly presented, he analyzed the phytocoenoses of the association in 12 locations (Râposu Stream, Morilor Valley, Ormanului Valley, Briheni Valley, Şopotesei Valley, Crişului Vărateс Valley, Ponoraş Glade, Câmp Moţi, Rastetului Hill, Bănişoara Sfâraş, Ţarinii Valley, Moneasa Valley), the floristic composition having a number of 64 rockery plants, found in the 25 relevées studied.

We can conclude that the phytocoenoses of the association have spread their geographical area of distribution in the last 72 years in 10 new locations, and the biodiversity of the phytocoenoses has risen from 25 species in the past (Paucă, 1941), to 64 species in the present.

2. The ***Asplenietum septentrionali-adianti-nigri*** association Oberdorfer 1938, is mentioned by Paucă (1941) as ***Asplenium septentrionale*** (frag.), in only one relevée in one locality, on the siliceous rocks north of Briheni village. The floristic composition of the described relevée comprises a number of 17 species, which does not include the

Asplenium adiantum-nigrum, a species that is characteristic of the association.

In the present, the association has been identified in two new locations, Mic´s Valley and the confluence of Briheni Valley and Crişului Văratec Valley. The floristic composition includes a number of 28 species out of the 9 analyzed relevées which shows a slight rise of the biodiversity in the area, from 17 (Paucă, 1941) to 28 species.

3. The ***Xanthietum strumarii*** association in Codru-Moma Mountains was first described in our country by Paucă (1941). She analyzed 4 relevées in 3 locations, Borz (Hăigaşului Valley), Călugări (Dan´s Valley) and Finiş. The floristic composition of the association comprises a number of 82 species.

In the study presented as doctoral thesis (Păşcuţ, 2012), the phytocoenoses of the association were found and inventoried in 6 locations (Briheni Valley, Iugii Valley, Moneasa Valley, Ponoraş Glade, Crişului Văratec Valley, Urseşti, Bănişoara Sfăraş). The floristic composition comprises a number of 47 species, out of a total of 6 relevées.

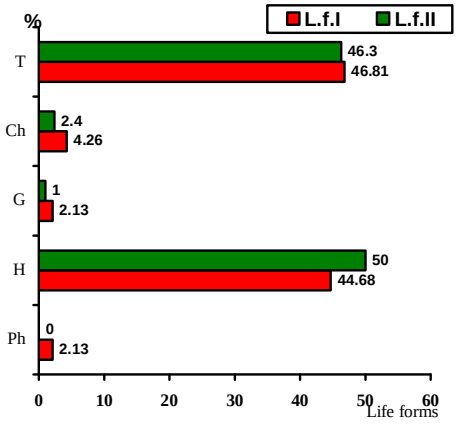

Fig. 1. Comparative spectrum of the life forms for the *Xanthietum strumarii* association

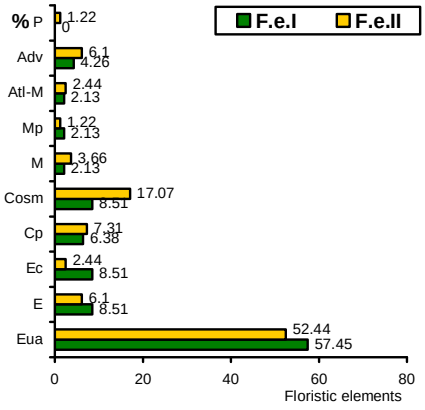

Fig. 2. Comparative spectrum of floristic elements for the *Xanthietum strumarii* association

By analyzing the spectrum of life forms (figure 1), for the *Xanthietum strumarii* association, one can notice that there are no eloquent changes, except for the growth in the number of chamaephytes (from 2.4% to 4.26%), geophytes (from 1% to 2.13%%) and a diminution of hemicryptophyte ones (from 50% to 44.68%).

The spectrum of the floristic elements (figure 2), shows a higher percentage of the Eurasian species, 57.45% compared to 52.44%, that the

Central-European ones, 8.51%, compared to 2.44% and a lower percentage of cosmopolites, 8.51% compared to 17.07%.

4. The ***Senecioni sylvatici-Epilobietum angustifolii*** association R. Tüxen 1937, was mentioned by Paucă (1941) in Codru-Moma Mountains in 7 locations (Bulalău Hill, Şasa Valley, Huta, Purcarului Valley, Cerbeasa Peak, Pietroasă Valley, Groşeni), she identified a number of 89 species.

In the recent study (Păşcuţ, 2012), the phytocoenoses of the association have been identified in 5 locations: Clitului Valley, Archişel Valley, Râului Valley, Tarnița Hill and Arinda. In the floristic composition there are 66 species.

One can notice a diminution in the biodiversity of weeds found on the edges of forests and cutting areas from 89 species to 66. This is due to the young forests (hornbeam-beech forests, beech-oaks, pure beech forests) that have grown on the areas afferent to the phytocoenoses of this association.

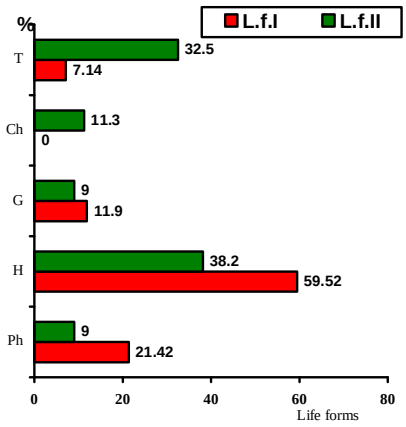

Fig. 3. Comparative spectrum of life forms for the *Senecioni sylvatici-Epilobietum angustifolii* association

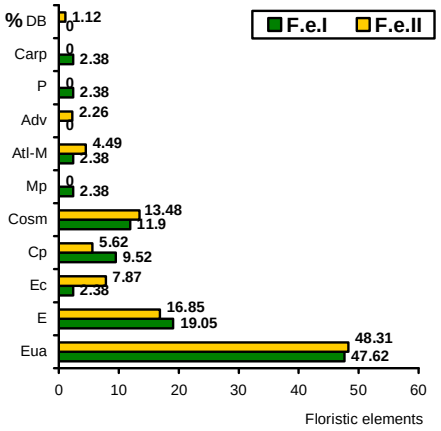

Fig. 4. Comparative spectrum of floristic elements for the *Senecioni sylvatici-Epilobietum angustifolii* association

The spectrum of life forms (figure 3), shows a growth in the number of hemicryptophytes (from 38.2% to 59.52%), due to the infiltration of some pioneer wood species (*Betula pendula*, *Populus tremula*, *Salix capraea*, *Corylus avellana*), in the floristic composition of the association. Percentages concerning terophytes and chamaephytes are lower. These have decreased from 32.5% to 7.14% with terophytes and from 11.3% to 0% with chamaephytes.

The spectrum of floristic elements (figure 4), does not show any major changes; still there is a slight growth in the number of circumpolar

species (from 5.62% to 9.52%), european species (from 16.85% to 19.05%), there is a diminution of cosmopolites (from 13.48% to 11.9%), Central-Europeans (from 7.87% to 2.38%), while the number of Eurasians is relatively constant.

5. The ***Vulpio-Airetum capillaris*** association in the Codru-Moma Mountains was first described by Paucă (1941), in the 7 locations (Groşeni, Briheni, Şoimi, Dumbrăvița, Finiş, Urvişul Belului, Urviş). In those 14 phytocenological relevées the authors enumerates 135 plant species.

Out of the 6 locations in which the associations have been recently found, 2 locations (Groşeni, Şoimi) are common and 4 locations (Crişului Vărateс Valley, Urseşti, Fiziş, Hăşmaş) recently studied are new for the phytocoenoses of this association.

There are 5 locations (Briheni, Dumbrăvița, Finiş, Urvişul Belului, Urviş) mentioned by Paucă (1941) where the phytocoenoses of this association have not been found in the recent study, and this is due to the cerris-oak forests that have grown in these areas. The existing floristic composition of the phytocoenoses comprises a number of 73 species.

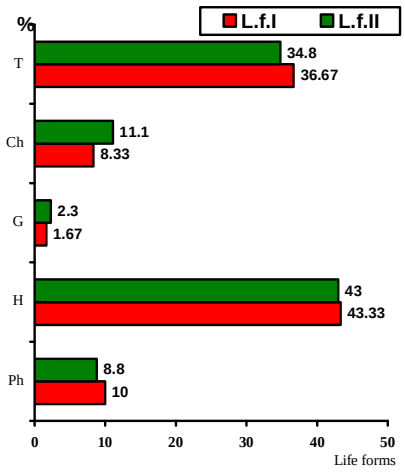

Fig. 5. Comparative spectrum of life forms for the *Vulpio-Airetum capillaris* association

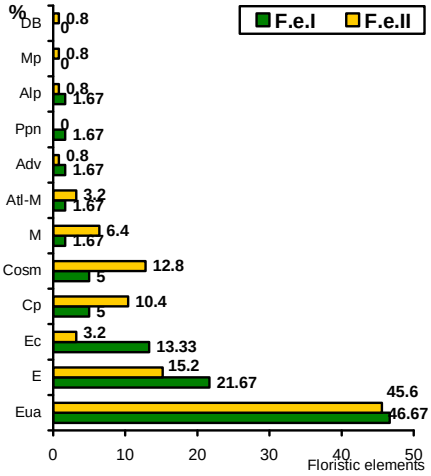

Fig. 6. Comparative spectrum of floristic elements for the *Vulpio-Airetum capillaris* association

As the spectrum of the life forms (figure 5) shows, there are no major changes, except for a slight decrease in the number of chamaephytes from 11.1% to 8.33%, a growth in the number of terophytes from 34.8% to 36.67% and phanerophytes from 8.8% to 10%.

The growth in the number of phanerophytes is due to the fact that in the last 2 decades the number of animals has decreased in the villages found in Codru-Moma Mountains, grazing has lost in importance as main activity, thus the meadows have grown old and the *Vulpia myuros* with *Aira elegantissima* areas have been invaded the bushy phanerophytes (*Crataegus monogyna, Rosa canina, Rubus sulcatus, Saronthamnus scoparius*).

In the last 70 years have been some changes in the phytogeographical composition of the association (figure 6), with a growth in the present of the Central-European elements (from 3.2% to 13.33%), European ones (from 15.2% to 21.67%), a decrease in the number of cosmopolite elements (from 12.8% to 5%) and circumpolar ones (from 10.4% to 5%), the number of Eurasian species being relatively constant.

The growth in number of European and Central-European elements in the studied area is due to the decrease of the territory occupied by the phytocoenoses in the ***Vulpio-Airetum capillaris*** association, by the infiltration in these meadows of the phanerophytes subordinated to the cerris-oak forests. The lower number of circumpolar elements is due to the fact that in the past these meadows used to lie on slopes with a colder, more humid climate, which at present are wooded.

6. The ***Juncetum effusi*** association Soó (1931) 1949, in the Codru-Moma Mountains was described by Paucă (1941), in 10 locations (Ponoare Glade, Ponoraş Glade, Finiş, Groşeni, Lespezi Valley, Tomnaticului Valley, Ormanului Valley, Dan´s Valley, Şopotesei Valley, Şoimului Valley), coenotaxonomically placing the 13 relevées made in the ***Juncus effusus et Ranunculus repens*** association. The floristic composition of the association comprises a number of 120 species.

At present the phytocoenoses of the ***Juncetum effusi*** association can be identified in 8 locations, placed as some clusters along the main valleys (Botfei Valley, Preotesei Valley, Crişului Văratec Valley) and in the swampy places found in the intramontane glades (Ponoare Glade, Brătcoaia Glade), comprising in the floristic composition a number of 59 species.

The decrease in the number of stations with *Juncus effusus* is due to the regularization of the stream flows and ditches made while constructing the forest roads.

The spectrum of the life forms for the ***Juncetum effusi*** association (figure 7) shows a growth in the number of helohidatophytes (9.09%), phanerophytes (4.54%), a decrease in the number of hemicryptophytes (from 73.3% to 70.45%), terophytes (from 11% to 9.09%), chamaephytes (from 9.1% to 2.27%), geophytes (from 6.6% to 4.55%).

As for as the composition of floristic elements is concerned (figure 8), one can notice an important growth in the number of circumpolars (from

6.9% to 25%) and a decrease in the number of Eurasians (from 62.7% to 52.27%).

The number of circumpolar elements has grown because the phytocoenoses of the ***Juncetum effusi*** association have taken refuge in time in habitats found at the bottom of cold and in time in habitats found at the bottom of cold and shady streams, swampy places, at the feet of some northern slopes, in stations with humid and cold microclimate.

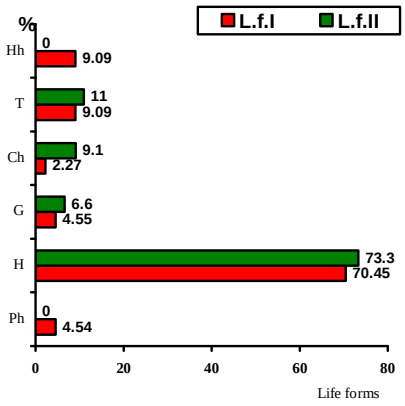

Fig. 7. Comparative spectrum of life forms for the *Juncetum effusi* association

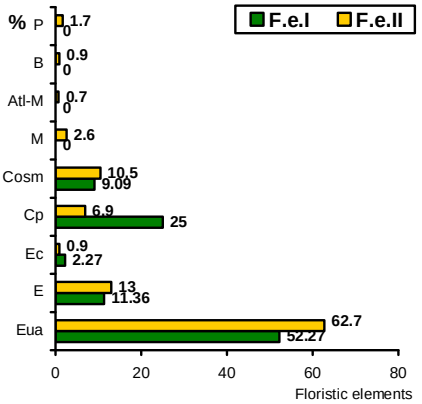

Fig. 8. Comparative spectrum of floristic elements for the *Juncetum effus* association

7. The ***Junco-Molinietum*** association Preising 1951, can be found in Paucă´s (1941) studies under the name of ***Molinietum***. The 6 relevées comprise 77 species.

In the 8 relevées made recently (Păşcuţ, 2012) there have been identified 65 species.

The decrease of biodiversity in the phytocoenoses of the ***Junco-Molinietum*** association is due to the reducing of areas with *Molinia caerulea* and *Juncus effusus*, as a result of draining of small depressions, where rain gathers up, thus habitat conditions change.

After comparatively analyzing the spectrum of life forms (figure 9), one can notice that there are no essential changes in their structure, except for the decrease of chamaephytes from 9.1% to 1.96% and a slight growth of the number of hemicryptophytes from 77.9% to 82.35%.

According to the comparative spectrum of the floristic elements (figure 10), there is a growth of circumpolars from 12.5% to 21.57% and a decrease of Europeans from 19.44% to 9.8%, Eurasian elements having close values.

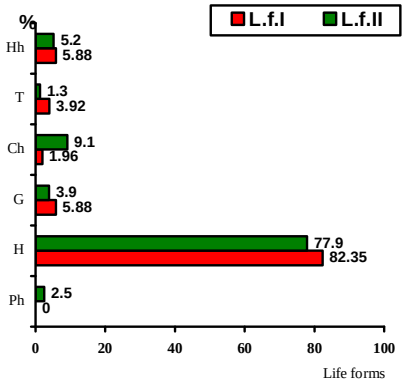

Fig. 9. Comparative spectrum of life forms for the *Junco-Molinietum* association

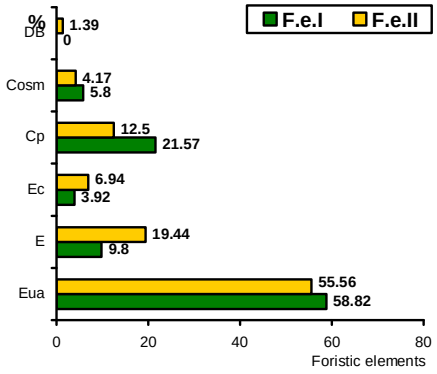

Fig. 10. Comparative spectrum of floristic elements for the *Junco-Molinietum* association

8. The ***Festuco rubrae-Nardetum*** association Csűrös et Resmeriță 1960, named by Paucă (1941), ***Nardus stricta-Calamagrostis arundinacea***, was described in Codru-Moma Mountains in 4 locations: Ponoare Glade, Ponoraş Glade, Brătcoaia Glade and Dosul Prislopului Hill, in 2 locations (Ponoraş Glade, Dosul Prislopului Hill), the phytocoenoses of the association can´t be found at present. The flora of the 7 relevées presented by Paucă (1941) in the table of association totalizes a number of 115 species.

The *Festuca rubra* and *Nardus stricta* phytocoenoses have been identified in 6 locations: Crişului Văratec Valley, Mică Valley, Ronțaru Hill, Carpeni Hill, Ponoare Glade, Brătcoaia Glade. The 25 relevées made totalize 69 species.

Although the phytocoenoses of the association have enlarged their geographical distribution area with 4 new locations (Păşcuț, 2012), at present there is a decrease of biodiversity in the phytocoenoses of this association due to less area where this can be found and due to change in habitat conditions. As a result of overgrazing the structure of the soil has changed, the acidic pH has become slightly acid and neutre, helping the development of amphitolerant species, transgressive acid-neutrophylous species belonging to the phytocoenoses of the *Festuco rubrae-Agrostetum capillaris* association.

As the analysis of the comparative spectrum of the life forms shows (figure 11), there is a higher percentage of hemicryptophytes (from 65.9% to 75.93%), phanerophytes (from 2.7% to 11.11%) and a lower percentage

of chamaephytes (from 14.8% to 7.41%), terophytes (from 10.5% to 3.7%), geophytes (from 6.1% to 1.85%).

The growth of phanerophytes is a result of the migration on these meadows of some ligneous plant species from the neighbouring forests (*Betula pendula*, *Juniperus communis*, *Sorbus aucuparia*, *Vaccinium myrtillus*, *Vaccinium vitis-idaea*). The high number of hemicryptophytes is caused by the climatic changes in the last 7 decades, with droughty, arid summers and frosty, more or less snowy winters. Decrease of chamaephytes is due to grazing (sheep, cattle, horses).

Analysis of floristic elements (figure 12) shows a slight decrease of Euroasians (from 50.91% to 44.44%), Europeans (from 20.91% to 14.81%), a growth of circumpolars (from 11.82% to 20.37%) and cosmopolites (from 3.64% to 7.41%).

The number of circumpolar elements has grown due to the quatering of phytocoenoses *Fesruca rubra* with *Nardus stricta* in stations with cold and humid microclimate.

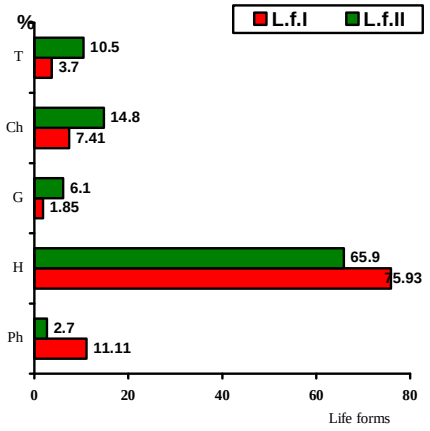

Fig. 11. Comparative spectrum of life forms for the *Festuco rubrae-Nardetum* association

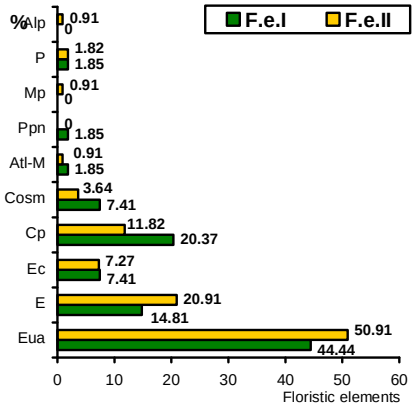

Fig. 12. Comparative spectrum of floristic elements for the *Festuco rubrae-Nardetum* association

9. In Ponoare, Brătcoaia, Ponoraş Glades, Paucă (1941) presents 4 relevées with peat moss (*Sphagnum*), totalizing 46 species in mesotrophic marshes, without subordinating these phytocoenoses to a certain association.

In the recent study (Păşcuţ, 2012) the phytocoenoses of the ***Carici flavae-Eriophoretum latifolii*** association Soó have been identified in 2 locations (Crişului Văratec Valley, Bănişoara Sfăraş); these vegetate in marshy puddles, where *Sphagnum recurvum*, *Carex flava* şi *Eriophorum*

latifolium can be found abundantly. The 6 relevées made comprise a number of 36 species.

10. The ***Cytiso nigricantis-Quercetum petraeae*** association Paucă 1941, in the Codru-Moma Mountains was first described and coenotaxonomically placed in our country by Paucă (1941). After 13 relevées, the phytocoenoses of the association were identified in 9 locations: Fața Hill, Halaş Peak, Iermaru Peak, Câmpului Peak, Căsoaia, Izoiu Peak, Râşnița Peak, Arsura Peak, Pleşului Summit. The floristic composition of these phytocoenoses is formed of 112 species.

In the recently carried out study (Păşcuț, 2012), the phytocoenoses of the association have been found in 4 locations mentioned by Paucă (1941) as well as Merişoara Peak, Izoiu Peak, Pleşului Summit, Finiş, as well as in other 13 locations, not mentioned before (Şoimului Valley, Visagului Valley, Huta Valley, Zărzagului Valley, Cusuiuş Valley, Tărcăiței Valley, Jigăului Valley, Mică Valley, Botfei Valley, Luştilor Valley, Urvişului Valley, Lungă Valley, Râului Valley). In some locations mentioned by Paucă (1941), the association was not found (Câmpului Peak, Râşnița Peak, Arsura Peak, Căsoaia, Clitului Valley due to forest exploitation in the last 20 years. The actual floristic composition of these phytocoenoses is formed of 75 species. In 3 relevées I have identified a facies with *Vaccinium myrtillus*, and in 6 relevées a facies with *Deschampsia flexuosa*, quartered in forest glades.

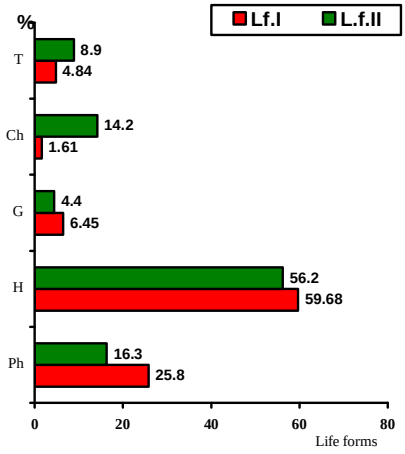

Fig. 13. Comparative spectrum of life forms for the *Cytiso nigricantis-Quercetum petraeae* association

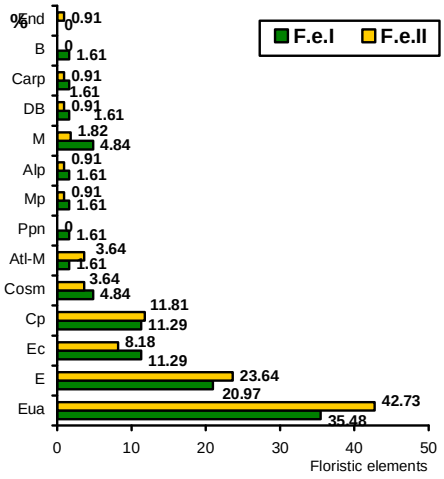

Fig. 14. Comparative spectrum of floristic elements for the *Cytiso nigricantis-Quercetum petraea* association

Analysis of life forms (figure 13), shows a slight growth in the number of hemicryptophytes (from 56.2% to 59.68%), phanerophytes (from 16.3% to 25.8%), a decrease of chamaephytes (from 14.2% to 1.61%) and terophytes (from 8.9% to 4.84%).

The decrease in the number of chamaephytes is a result of the growth of oak forests with *Cytisus nigricans*, the crowning of trees covering in some phytocoenoses up to 90% of the area. This decreases also due to the fact that Paucă (1941) placed some hemicryptophytes (*Sanicula europaea, Hieracium pilosella, Lamium galeobdolon*) as well as 2 species of bryophytes (*Leucobryum glaucum, Dicranum scoparium*) in the category of chamaephytes.

The higher number of phanerophytes is due to the fact that Paucă (1941) placed them in the category of chamaephytes (*Cytisus nigricans, Genista ovata, Vaccinium myrtillus*).

The spectrum of floristic elements (figure 14), shows a decrease in the number of Eurasian species (from 42.73% to 35.48%), European species (from 23.64% to 20.97%), a growth of Central-European ones (de la 8.18% la 11.29%) and Mediterraneans (from 1.82% to 4.84%), with less contrasting values.

11. Information about the ***Symphyto cordati-Fagetum*** association Vida (1959) 1963 is given by Paucă (1941), who places pure beech with *Symphytum cordatum* found in Codru-Moma Mountains in a group of associatons named by Moor ***Fagetum carpaticum***. Out of a total of 14 phytocoenological relevées the *Symphytum cordatum* species appears in 5 (relevées 2, 5, 7, 9, 11). The floristic inventory of these 5 relevées comprises 53 species. Beech and common black burdock phytocoenoses were identified by Paucă (1941) in 4 locations in Ursului Valley, west of Tinoasa Glade, on the N-W slope of Bălătească Peak and in Zugăului Valley.

At present, with 19 relevées made, 92 species have been identified (Păşcuţ, 2012), showing a biodiversity much richer than the phytocoenoses identified by Paucă (1941). I found the association in 3 locations mentioned by Paucă (1941) in Tinoasa Glade, Bălătească Peak and Zugăului Valley. In Ursului Valley the phytocoenoses of this association were not found any more due to forest exploitation. Nowadays, the association is spread in 6 new locations in Bihor County (Tărcăiţei Valley, Şesuţa Valley, Măgurii Hill, Mare Hill, Ronţaru Hill, Caprei Peak) and in 7 new locations in Arad County (Cerbului Valley, Luştilor Valley, Băilor Valley, Lacului Valley, Ponoraş Brook, Izoiu Summit, Trei Holumburi). To conclude, the geographical distribution area of the phytocoenoses of the association is larger with 13 new locations, compared to the area 7 decades ago.

Beside the typical association I have suggested a new subassociation *dentarietosum glandulosae* subas. nova of 7 relevées and separated a facies with *Leucojum vernum* in 7 relevées, which I subordinated to the typical association.

In the spectrum of life forms (figure 15), one can notice a percentage growth of phanerophytes (from 7.55% to 19.57%), hemicryptophytes (from 37.74% to 43.48%), as well as a decrease of geophytes (from 39.62% to 30.43%) and chamaephytes (from 9.42% to 2.17%).

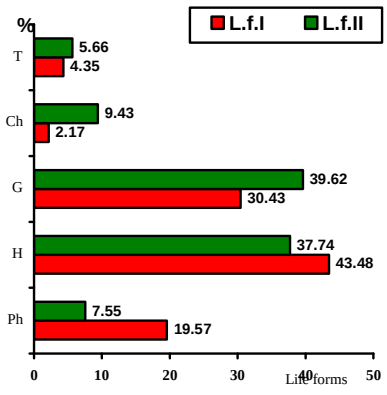

Fig. 15. Comparative spectrum of life forms for the *Symphyto cordati-Fagetum* association

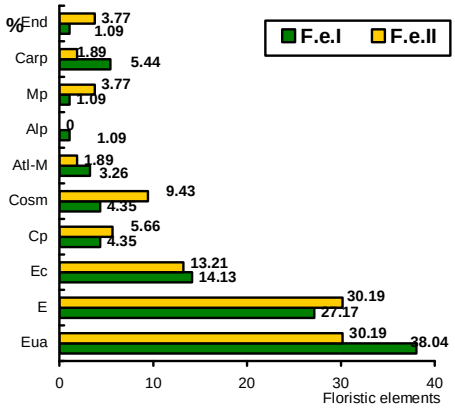

Fig. 16. Comparative spectrum of floristic elements for the *Symphyto cordati-Fagetum* association

Growth in the number of phanerophytes is the result of the infiltration in the floristic composition of 12 ligneous phanerophytes (*Acer pseudoplatanus*, *Abies alba*, *Ulmus glabra*, *Betula pendula*, *Acer platanoides*, *Fraxinus excelsior*, *Populus tremula*, *Evonymus latifolius*, *Sambucus racemosa*, *Salix capraea*, *Rubus idaeus*, *Rosa canina*), from the neighbouring associations, which can´t be found in the relevées made by Paucă (1941).

As far as floristic elements are concerned (figure 16), the most significant growth in the last 70 Years can be noticed with the Eurasians (from 30.19% to 38.04%) and the Carpathians (from 1.89% to 5.44%). Regress can be seen with European species (from 30.19% to 27.17%) and cosmopolite ones (from 9.43 to 4.35%).

12. The association described by Paucă (1941) as ***Alnus glutinosa-Salix purpurea***, includes in its floristic composition, in 2 relevées the *Stellaria nemorum* species as well, which places it in the valid ***Stellario nemori-Alnetum glutinosae*** (Kästner, 1938) Lohmeyer 1957 coenotaxon.

The phytocoenoses of the association were identified in 7 locations: Zugăului Valley, Urseştilor Valley, Susanilor Valley, Finişului Valley, Bârzeştilor Valley, Huta Valley and Deznei Valley. The 10 relevées made by Paucă (1941) comprises 155 species.

In the recently carried out studies (Păşcuţ, 2012), I have identified the phytocoenoses of this association in 10 locations: Şoimului Valley, Finişului Valley, Tărcăiţei Valley, Clitului Valley, Botfei Valley, Archişel Valley, Râului Valley, Luştilor Valley, Zugăului Valley, Urvişului Valley. In 5 locations mentioned by Paucă (1941) (Urseştilor Valley, Susanilor Valley, Bârzeştilor Valley, Huta Valley, Deznei Valley), the association was not to be found again, but in 8 locations (Şoimului Valley, Tărcăiţei Valley, Clitului Valley, Botfei Valley, Archişel Valley, Râului Valley, Luştilor Valley, Urvişului Valley), the association was found for the first time in the studied territory. One can notice that the geographical distribution area of this association has extended in the last 7 decades. After making 11 relevées, 114 species were inventoried.

It can be seen that the floristic biodiversity of the phytocoenoses of this association is in slight regress, due to the anthropic impact, to the drainage and regularization of some river flows during the construction of the forest roads.

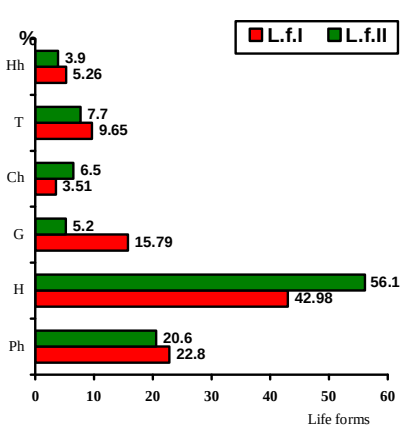

Fig. 17. Comparative spectrum of life forms for the *Stellario nemori-Alnetum glutinosae* association

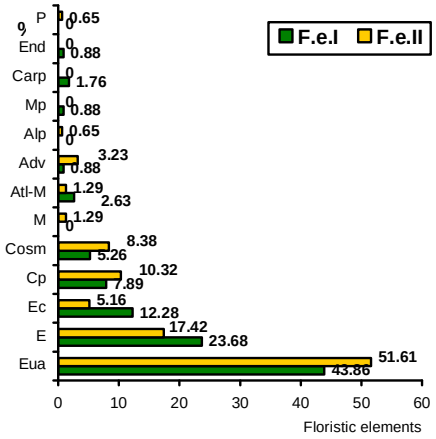

Fig. 18. Comparative spectrum of floristic elements for the *Stellario nemori-Alnetum glutinosae* association

In the spectrum of life forms (figure 17) one can notice a decrease in the number of hemicryptophytes (from 56.1% to 42.98%), a growth in the number of geophytes (from 5.2% to 15.79%), while phanerophytes, chamaephytes, terophytes and helohidatophytes are relatively constant.

The spectrum of floristic elements (figure 18) shows a decrease in the number of Eurasian species (from 51.61% to 43.86%), circumpolar species (from 10.32% to 7.89%), cosmopolite species (from 8.38% to 5.26%), a growth in number of European (from 17.42% to 23.68%) and Central- European species (from 5.16% to 12.28%).

The slightly changed proportion of the floristic elements, between the percentages given by Paucă (1941) 7 decades ago and those obtained in the present, is due to the changing of habitat conditions.

13. The ***Acereto-Ulmetum*** association Beldie 1951 was identified by de Paucă (1941) as ***Acereto-Fraxinetum typicum*** and mentioned in 3 locations: Finişului Valley, Megheş Valley and Huta (Izbucului Valley). The floristic composition of the 4 relevées described, includes a number of 63 species.

In my recent studies I have found the association on the old location (Megheş Valley), as well as in other 7 new locations situated in the studied area: Tărcăiței Valley, Morilor Valley, Clitului Valley, Boroaia Valley, Moneasa Valley, Lungă Valley, Râului Valley (Păşcuț, 2012). It results that the phytocoenoses of this association have extended in the studied area, and meanwhile they have disappeared in other 2 former locations (Finişului Valley, Huta). The floristic inventory of those 9 relevées studied cover 90 species.

By comparing the data about the number of species specified in the association chats, we can conclude that the biodiversity of the phytocoenoses has grown from 63 species in the past to 90 species in the present.

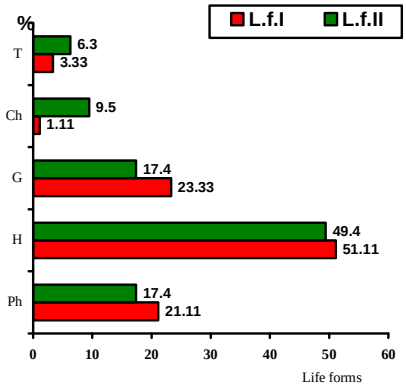

Fig. 19. Comparative spectrum of life forms for the *Acereto-Ulmetum* association

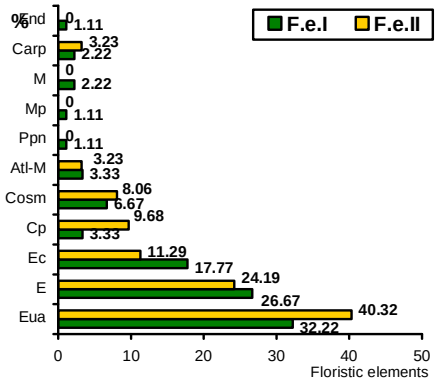

Fig. 20. Comparative spectrum of floristic elements for the *Acereto-Ulmetum* association

The spectrum of life forms (figure 19), shows in the present, a higher percentage of geophytes (from 17.4% to 23.33%), phanerophytes (from 17.4% to 21.11%) and a lower percentage of chamaephytes (from 9.5% to 1.11%). Growth in the number of geophytes in time is a result of the infiltration from the neighbouring associations of some species in the association studied by Paucă (1941). These species are: *Erythronium dens-canis, Scilla bifolia, Dentaria glandulosa, Galium odoratum, Galium schultesii, Polypodium vulgare, Corydalis solida, Corydalis cava, Galanthus nivalis, Isopyrum thalictroides, Anemone nemorosa, Polygonatum odoratum, Polygonatum latifolium, Hepatica nobilis*.

The spectrum of floristic elements (figure 20), shows a diminution in the last 70 years of Eurasians (from 40.32% to 32.22%), circumpolars (from 9.68% to 3.33%) and a growth of Central-Europeans (from 11.29% to 17.77%).

In the last 7 decades a number of 16 Eurasian species (*Polystichum aculeatum, Chrysosplenium alternifolium, Geum urbanum, Carex remota, Aegopodium podagraria, Heracleum spondylium, Chaerophyllum aromaticum, Epilobium montanum, Astragalus glycyphyllos, Aconitum vulparia, Prunella vulgaris, Ranunculus ficaria, Galium palustre, Caltha palustris, Telekia speciosa, Myosotis scorpioides*), have disappeared from the phytocoenoses made in the present, as a result of habitat changes.

Also, some circumpolar species (*Chrysosplenium alternifolium, Prunella vulgaris, Galium palustre, Caltha palustris*), have disappeared from the phytocoenoses made in the present, as a result of microclimate changes.

14. The first description and coenotaxonomic placing of the ***Carpino-Fagetum*** association in our country was made by Paucă (1941), in the Codru-Moma Mountains. The studied association covers a number of 29 relevées grouped in 2 subassociations: *aposeridetosum* (11 relevées) and *filicetosum* (18 relevées), found in 20 locations (Finişului Valley, Sohodol, Zugău-Resfirata, Roşia Peak, Briheni, Huta, Zugăului Valley, Iapa Valley, Merişoara Peak, Megheş Valley, Călugări, Ermaru Peak, Şopotesei Valley, Izbucului Valley, Iapa Peak, Moneasa, Luştilor Valley, Ravna, Ponoraş Glade, Pleşu Peak). The florisitc composition includes 213 species.

The association has been recently identified (Păşcuț, 2012), in 25 locations (Șoimului Valley, Finișului Valley, Pontului Valley, Bujorului Hill, Ursului Valley, Ursului Hill, Dracului Mill, Ormanului Valley, Tărcăiței Valley, Șerbanului Valley, Caprei Peak, Izoiu Summit, Izbuc Monastery, Pacău Hill, Ponoare Glade, Urvișului Valley, Zugău-Răşchirata, Megheș Valley, Râului Valley, Momuța Peak, Moma Peak, Zugăului hillock, Botfei Valley, Hăşmaş Valley, Clitului Valley), comprising a

number of 25 relevées. The floristic composition is poorer, totalizing 158 species. In 5 relevées, I have identified a facies with *Allium ursinum*.

Although two species, *Aposeris foetida* (Central-European element) and *Dryopteris filix-mas* (cosmopolite element), appear in all the relevées, I couldn´t find any suitable coenotaxonomic criteria or any differential species in order to separate them in those 2 subassociations mentioned by Paucă (1941).

The comparative analysis of life form (figure 21), shows a growth in the number of phanerophytes (from 19.7% to 24.69), geophytes (from 15.5% to 23.42%), a decrease in the number of terophytes (from 9.9% to 3.8%) and chamaephytes (from 8.4% to 2.53%).

Growth in the number of phanerophytes at present, is a result of the infiltration in the main association of 11 ligneous species from the neighbouring associations. These 11 species are: *Abies alba, Tilia platyphyllos, Tilia tomentosa, Ulmus minor, Quercus cerris, Evonimus latifolius, Viburnum lantana, Rhamnus cathartica, Sambucus racemosa, Rubus idaeus, Clematis vitalba*.

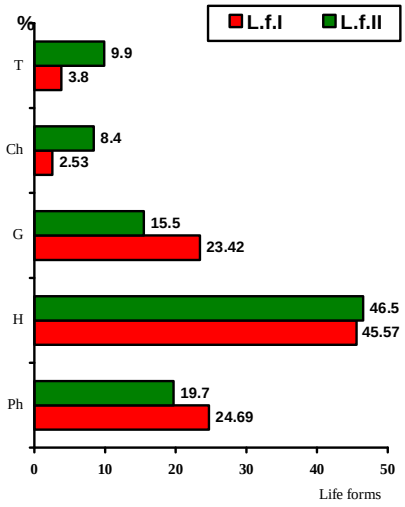

Fig. 21. Comparative spectrum of life forms for the *Carpino-Fagetum* association

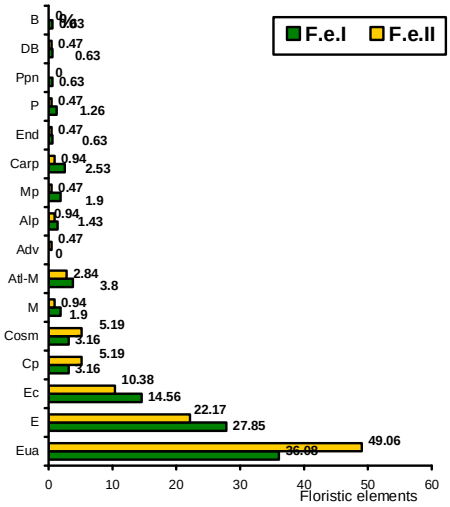

Fig. 22. Comparative spectrum of floristic elements for the *Carpino-Fagetum* association

The comparative spectrum of the floristic elements (figure 22), shows a diminution of Eurasian species (from 49.06% to 36.08%), a growth of European (from 22.17% to 27.85%) and Central-European species (from 10.38% to 14.56%).

As a result of changing habitat conditions in the last 70 years, we can notice a diminution of Eurasian elements; thus, such plant as *Carex remota, Lathyrus hallersteinii, Campanula patula, Euphorbia cyparissias, Agrimonia eupatoria, Anthoxanthum odoratum, Cynosurus cristatus, Vicia sepium, Briza media, Verbascum nigrum, Aristolochia clematitis, Poa pratensis, Veratrum album, Campanula glomerata, Gentiana cruciata, Sanguisorba minor, Silene nutans, Origanum vulgare, Telekia speciosa,* were not found in the analyzed phytocoenoses, but it is possible that further studies should reconfirm the presence of some of these plants in the association.

CONCLUSIONS

Vegetation found on rocks and extended by the phytocoenoses of these 2 associations, ***Asplenietum rutae-murariae-trichomanis*** and ***Asplenietum septentrionali-adianti-nigri,*** has enlarged its geographical distribution area in 10 new locations, and it also contributed to the growth of the floristic biodiversity with approximately 39 new taxons.

Regarding weeds found in streams and intermountainous valleys, represented by the phytocoenoses of the ***Senecioni sylvatici-Epilobietum angustifolii*** association, one can notice a diminution in the geographic distribution area and in their biodiversity, as a result of change occured their in habitat conditions, great due to the anthropic factor.

Regarding xero-mesophile grassland vegetation extended by the phytocoenoses of the ***Vulpio-Airetum capillaris*** associations, there is a considerable decrease in its geographic distribution area along with a decrease in the biodiversity of the floral composition due to the fact that cerris-oak forests have covered the station characteristic of this association.

Mezohygrophile vegetation extended by the phytocoenoses of the ***Juncetum effusi*** and ***Junco-Molinietum*** association has considerably reduced its geographic area along with a decrease in the biodiversity of phytocoenoses due to drainage of wet areas along rivers and valleys, as well as global warming.

Acidic grassland vegetation subordinated to the phytocoenoses of the ***Festuco rubrae-Nardetum*** association has considerably reduced its geographic distribution area, as a result of changing habitat conditions and overgrazing.

Evergreen vegetation found on crystalline schists extended by the phytocoenoses of the ***Cytiso nigricantis-Quercetum petraeae*** association has widened its geographic distribution area with 13 new locations along with a slight decrease in the floristic biodiversity from 112 species to 75 species.

Among the associations described for the first time in Codru-Moma Mountains, for example the ***Petraeo-Fagetum*** association, based on differential species I have identified a new subassociation: *deschampsietosum flexuosae* subas. nova, on acidic rocks, which I subordinated to the typical association.

Vegetation in pure beech forests found on limestone bedrock extended by the phytocoenoses of the ***Symphyto cordati-Fagetum*** association has spread its geographic area along with a considerable growth of the floristic biodiversity from 53 to 92 species. Based on differential species I have identified a new subassociation: *dentarietosum glandulosae* subas. nova on limy rocks.

Forest vegetation in gorges and on calcareous rocks extended by the phytocoenoses of the ***Acereto-Ulmetum*** association has considerably enlarged its distribution area from 3 to 7 locations, along with a growth of the floristic biodiversity from 63 to 90 species.

Vegetation found in beech and hornbeam forests extended by the phytocoenoses of the ***Carpino-Fagetum*** association shows a geographic distribution area slightly larger from 20 locations in the past to 25 locations in the present, as well as a diminution of the biodiversity from 213 species to 158, due to change in habitat conditions and forest exploitation.

In the last 72 years wood industry has developed a lot, due to the great need of wood for furniture production in factories like: Beiuş, Ştei and Oradea. A big quantity of raw material needed came from Codru-Moma Mountains.

An important anthropic factor is represented by the stripping of forest vegetation on the surface, which is done in order to exploit limestone and marble. The marble quarry at Moneasa, is known for black and red marble mining. The quarry was open after the removal of forest vegetation. Limestone exploitation in the Cărpinet and Câmp-Moți mines had been for long the main occupation of people in Vaşcăului Plateau.

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