PAUCĂ (1935, 1940)-PĂŞCUŢ (2012) – A COMPARATIVE ANALYSIS ON THE FLORA IN CODRU-MOMA MOUNTAINS

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Abstract

This paper is a comparative analysis of the research results obtained by Paucă (1935, 1940) and Păşcuţ between 2007-2012 on flora in Codru-Moma Mountains.

In order to show the changes that have occurred in the flora of Codru-Moma Mountains in the last 70 years, the author of this paper has carried out a comparative analysis of ecological categories concerning life forms and floristic elements, as well as the chorology of rare, endemical, endangered and vulnerable species.

Key words: flora, life forms, floristic elements, species, gender, family.

INTRODUCTION

Codru-Moma Mountains limited in the north by the Crişul Negru Valley, in the south by the Crişul Alb Valley, in the east by Beiuşului depression and in the west by the hills that end in the Crişurilor Plain, are formed of two massifs (Codru and Moma) which differ both in their landscape and in their geological structure.

The largest part of this area, with a surface of 675 km², belongs to Bihor County, and a small part in the west, south-west belongs to Arad county.

Unlike Codrului Mountains, which has a very complicated tectonic structure and where older rocks are mixed over the newer ones, Moma Mountains are formed of a thick and almost horizontal calcareous plate.

Heavy rains in the area, in the given lithological conditions, cause a quite dense hydrografic network, between 0.3-1.4 km/km², tributary of the two main arteries of the extremities of the massif: Crişul Negru and Crişul Alb. The most important rivers are: Crişul Vărateculuiı, Tărcăiţa, Finiş, Moneasa and Dezna.

MATERIAL AND METHODS

The botanical nomenclature used in this study is the one developed for the Romanian flora by Ciocârlan (2000, 2004), corroborated with the information given by "The International Code of Botanical Nomenclature" (Code de Tokyo, 1993). The systematic classification of the taxa was made according to the phylogenetic system implemented by Pop et al. (1983).

Decisions concerning life forms were made based on some synthesis papers elaborated by Sanda et al. (1983, 2003), Pop (1977), Cristea (1993), Ciocârlan (2000), Cristea et al. (2004).

Due to the fact that the nomenclature of floral elements presented by Paucă (1940) (eurosiberians, Central-South Europeans, mediterranean-Europeans, South-East Europeans, East-Europeans, eurasian-mediterraneans, South-West Europeans, East-Alpins, Euro-Siberian-mediterraneans) does not correspond to the present one, a renaming of their symbols was necessary, which was done according to the papers elaborated by Pop (1977), Sanda et al. (1983, 2003), Cristea (1993), Cristea et al. (2004).

RESULTS AND DISCUSSION

Floristic surveys conducted in Codru-Moma Mountains between 2007-2012 show the existance of 852 phytotaxa (table 1), out of which 808 species, 42 subspecies and 2 varieties, which belong to 358 genres and 94 families (Păşcuţ, 2012), compared with those performed by Paucă (1935, 1940), consisting of 890 species, assigned in 388 genres and 95 families.

Table 1

Families and number of phytotaxa indentified in Codru-Moma mountains in the studies conducted by Păşcuţ (2012) and Paucă (1935, 1940)

No.	Families	Păşcuţ (2012)		Paucă (1935, 1940)	
		Genres	Species	Genres	Species
1	*LYCOPODIACEAE*	1	2	1	2
2	*EQUISETACEAE*	1	5	1	4
3	*PTERIDACEAE*	1	1	1	1
4	*ASPIDIACEAE*	3	8	3	9
5	*THELIPTERIDACEAE*	1	1	1	1
6	*ATHYRIACEAE*	3	3	3	3
7	*ASPLENIACEAE*	2	8	2	7
8	*BLECHNACEAE*	1	1	1	1
9	*POLYPODIACEAE*	1	1	1	1
10	*CUPRESSACEAE*	1	1	1	1
11	*PINACEAE*	5	6	4	4
12	*TAXODIACEAE*	1	1	-	-
13	*ARISTOLOCHIACEAE*	2	2	2	3
14	*CERATOPHYLLACEAE*	-	-	1	2
15	*RANUNCULACEAE*	12	22	13	28
16	*BERBERIDACEAE*	1	1	1	1
17	*PAPAVERACEAE*	1	1	3	4
18	*FUMARIACEAE*	1	2	2	2
19	*ULMACEAE*	1	2	1	3
20	*CANNABACEAE*	1	1	1	1
21	*URTICACEAE*	2	3	2	3
22	*FAGACEAE*	3	7	3	7
23	*BETULACEAE*	4	4	4	4
24	*JUGLANDACEAE*	1	1	1	1

25	*CRASSULACEAE*	2	10	1	7
26	*SAXIFRAGACEAE*	2	2	3	3
27	*ROSACEAE*	19	52	16	50
28	*FABACEAE*	17	44	18	61
29	*ONAGRACEAE*	4	9	3	9
30	*LYTHRACEAE*	1	1	1	2
31	*ELAEAGNACEAE*	1	1	-	-
32	*ACERACEAE*	1	4	1	5
33	*STAPHYLAEACEAE*	1	1	1	1
34	*OXALIDACEAE*	1	1	1	2
35	*LINACEAE*	1	3	1	2
36	*GERANIACEAE*	2	6	2	9
37	*BALSAMINACEAE*	1	1	1	1
38	*POLYGALACEAE*	1	2	1	2
39	*CORNACEAE*	1	2	1	2
40	*ARALIACEAE*	1	1	1	1
41	*APIACEAE*	18	30	21	30
42	*CELASTRACEAE*	1	3	1	3
43	*AQUIFOLIACEAE*	1	1	1	1
44	*RHAMNACEAE*	2	2	1	1
45	*VITACEAE*	1	1	1	1
46	*LORANTHACEAE*	2	2	2	2
47	*EUPHORBIACEAE*	2	7	2	10
48	*THYMELAEACEAE*	1	1	2	2
49	*PAEONIACEAE*	1	1	1	1
50	*HYPERICACEAE*	1	6	1	6
51	*VIOLACEAE*	1	13	1	11
52	*CISTACEAE*	1	1	1	1
53	*BRASSICACEAE*	14	22	16	29
54	*RESEDACEAE*	-	-	1	1
55	*SALICACEAE*	2	8	2	10
56	*CUCURBITACEAE*	-	-	1	1
57	*TILIACEAE*	1	3	1	3
58	*MALVACEAE*	2	2	3	5
59	*ERICACEAE*	1	2	1	2
60	*PYROLACEAE*	2	2	2	2
61	*PRIMULACEAE*	2	6	3	8
62	*CARYOPHYLLACEAE*	14	33	21	30
63	*CHENOPODIACEAE*	1	1	1	4
64	*AMARANTHACEAE*	-	-	1	1
65	*POLYGONACEAE*	2	12	2	12
66	*GENTIANACEAE*	2	6	3	6
67	*APOCYNACEAE*	1	1	1	1
68	*ASCLEPIADACEAE*	1	1	1	1
69	*RUBIACEAE*	3	16	3	21
70	*CAPRIFOLIACEAE*	2	5	2	5
71	*ADOXACEAE*	1	1	-	-
72	*VALERIANACEAE*	1	3	2	3
73	*DIPSACACEAE*	4	8	4	10
74	*OLEACEAE*	2	2	2	3
75	*CONVOLVULACEAE*	2	2	3	4
76	*BORAGINACEAE*	6	9	12	20
77	*SOLANACEAE*	4	4	2	2
78	*SCROPHULARIACEAE*	11	32	10	43
79	*OROBANCHACEAE*	-	-	2	3
80	*PLANTAGINACEAE*	1	3	1	3
81	*VERBENACEAE*	1	1	1	1
82	*LAMIACEAE*	19	42	20	48
83	*CALLITRICHACEAE*	1	1	1	1
84	*CAMPANULACEAE*	1	7	1	7

85	*ASTERACEAE*	45	113	45	112
86	*ALISMACEAE*	1	2	1	1
87	*POTAMOGETONACEAE*	1	2	1	3
88	*NAJADACEAE*	1	1	-	-
89	*LILIACEAE*	11	15	13	18
90	*AMARYLLIDACEAE*	2	2	2	2
91	*IRIDACEAE*	3	4	3	4
92	*ORCHIDACEAE*	9	19	8	22
93	*JUNCACEAE*	2	13	2	16
94	*CYPERACEAE*	5	32	5	25
95	*POACEAE*	32	73	38	73
96	*ARACEAE*	1	1	1	1
97	*LEMNACEAE*	1	1	1	1
98	*TYPHACEAE*	1	2	1	2
99	*SPARGANIACEAE*	1	1	1	1
TOTAL		**358**	**808**	**388**	**890**

In the study made between 2007-2012 a red list was drawn up with relict plants-3 species, endemic plants-12 species, rare, protected and vulnerable plants- 57 species, according to the lists of Boşcaiu et al. (1994), Dihoru, Negrean (2009), Olteanu et al. (1994), compared to Paucă's surveys (1935, 1940), where he presents a number of 2 relict species, 4 endemic and 45 rare, protected and vulnerable species. Of the species quoted by Paucă (1935, 1940) 2 relict, 3 endemic, 26 rare, protected and vulnerable have been recently found in the area, and 1 relict, 8 endemic, 14 rare, protected and vulnerable species were mentioned for the first time in the studied area.

The species mentioned in the past by Paucă (1935, 1940) and which have not been recently found are: *Centaurea simonkaiana, Anthemis triumfetti, Cephalanthera rubra, Epipactis atrorubens, Epipactis mycrophylla, Epipactis purpurata, Euphorbia dulcis, Galium kitaibelianum, Galium parisiense, Knautia drymeia, Orchis cariophora, Orchis ustulata, Platanthera chlorantha, Rosa glauca, Rosa villosa, Rubus tereticaulis, Thymus serpyllum, Traunsteinera globosa*, but it is not excluded that further surveys should reconfirm the presence of some species mentioned.

Regarding the chorology of rare, endemic, endangered and vulnerable species identified by Paucă (1935, 1940) and confirmed in my recent study, the following changes are to be mentioned:

- *Ruscus aculeatus* (rare, endangered, protected species, natural monument) was identified by Paucă (1935) in 2 locations corresponding to the habitats of oak forests on Osoiu Peak (Bihor county) and in Megheş Valley, Piatra Mică (Arad County), in the phytocoenoses of the *Carpino-Fagetum* association. At present the species has been found in 4 locations, on Osoiu Peak (between Ormanului Valley and Şuncuiuşului Valley), Bujorului Hill (Valea Finişului), Pragului Stream (Ormanului Valley) (Bihor County) and Megheş Valley, Piatra Mică (Arad County) (Păşcuţ, 2012). It results that the geographical distribution area of the species has expanded in the last 70 years with 2 more locations (Bujorului Hill, Pragului Stream), where the

species was not found by Paucă (1935, 1940), colonizing new habitats that belong to the phytocoenoses of the following associations: *Quercetum petraeae-cerris*, *Genisto tinctoriae-Quercetum petraeae*, *Festuco drymejae-Quercetum petraeae* and *Carpino-Fagetum*. Conservation status of *Ruscus aculeatus* populations is good, the studied phytocoenoses having 3-4 specimens/m², the population being in a slight expansion.

- *Ruscus hypoglossum* (rare, protected species, natural monument) was identified by Paucă (1935) in only one locality in Megheş Valley, at Piatra Mică, close to Moneasa (Arad County) in the phytocoenoses of the *Carpino-Fagetum* association. Recently the species was found in the old location, Megheş Valley (Piatra Mică), as well as in a new locality in Luştilor Valley (Arad County). The species has widened its coverage with 2 new habitats corresponding to the *Phyllitidi-Fagetum* association (Megheş Valley) and *Festuco drymejae-Fagetum* association (Luştilor Valley). Conservation status of the species is good (the population having 4-5 specimens/m², in Megheş Valley), with a slight expansion in the neighbouring phytocoenoses of beech and hornbeam forests.

- *Paeonia officinalis* ssp. *banatica* (rare species) was mentioned by Paucă (1940) on Bujorului Peak (today it is Pacăului Hill, Bihor County), as abundant in beech forests, without coenotaxonomically classifying it. In the recently carried out study (Păşcuţ, 2012), the species was found on Pacău Hill, as well as in 2 new locations, Osoiu Peak and Ormanului Valley (Bihor County) growing in new habitats corresponding to the *Quercetum petraeae-cerris* and *Carpino-Fagetum* associations. In the studied habitats the conservation status of the *Paeonia officinalis* ssp. *banatica* populations is good, the number of individuals in this species slightly growing, occupying new habitats like the cerris and oak forests.

- *Iris graminea* (rare and protected species) was identified by Paucă (1940) on Triassic limestones on Caprei Peak (Bihor County), on meadows with the phytocoenoses of the *Festuca sulcata-Achillea collina* Br.-Bl. association. Recently this species was found in the same locality, expanding its geographic area and colonizing new habitats that belong to the phytocoenoses of the *Agrostio-Festucetum valesiacae*, *Poterio-Festucetum valesiacae* and *Carpino-Fagetum* associations. Its conservation status is good, the population of this species slightly expanding, occupying the xero-mezophyle meadows of *Agrostis capillaris* with *Festuca valesiaca*, *Sanguisorba minor* with *Festuca valesiaca* (approximately 50% of the geographic area) and the inside of the beech and hornbeam forests (approximately 50% of the geographic area).

- *Angelica archangelica* (vulnerable, protected species) was mentioned by Paucă (1940) in Brătcoaia Glade (Bihor County). In this locality this species wasn't found in the recent study. At present it has been identified in 2 new

locations, Ponoare Glade and Ponoraş Glade (Bihor County) in the phytocoenoses of the *Junco inflexi-Menthetum longifoliae, Lythro salicariae-Juncetum effusi-inflexi, Junco-Molinietum* and *Scirpetum sylvatici* associations. Its conservation status is good, it is not endangered, because in these meadows hay is not harvested and intensive grazing is not a habit either.

- *Symphytum cordatum* (Carpathian endemite) was mentioned by Paucă (1940, 1941) in 5 locations in Zugăului Valley (Izbucurile Răşchirata), Moneasa Valley (Buzovici Stream), Finişului Valley (Ursului Stream), Bălăteasa Peak, Tinoasa Glade, being classified in the *Fagetum carpaticum* cenotaxon. Today the species has a much larger spreading area, growing in the locations mentioned by Paucă, as well as in 14 new locations, on Caprei Peak, Izoiu Peak, Ronțaru Hill, Dealul Mare, Măgurii Hill, Râului Valley, Tărcăiței Valley, Băilor Valley, Şesuța Valley, Luştilor Valley, Cerbului Valley, Ponoraş Stream, Trei Holumburi, Briheni, in the phytocoenoses of the *Symphyto cordati-Fagetum, Carpino-Fagetum* and *Stellario nemori-Alnetum glutinosae* associations. It results that in the last 7 decades *Symphytum cordatum* has widened its geographic area, colonizing new habitats corresponding to beech and hornbeam forests and black alder areas in intermountain streams. Conservation status of this species is very good, black burdock populations having a great number of individuals (10-12 individuals/m²).

A number of rare, endangered, protected species have not been found in the recent study:

- *Galium parisiene* was mentioned by Paucă (1940) at the mouth of Cereşagului Valley, under Toaca Peak, on dry meadows and skeletal soils. At present (Păşcuț, 2012) the habitat of these meadows is substituted by cerris and oak forests, where this species has disappeared.
- *Sesleria rigida*, mentioned by Paucă (1940) in Brihenilor Valley, on the peak of a high limestone rock, where it was not found in the present, due to the negative influence of the zoo-anthropic factor (grazing, forest exploitation).
- *Menyanthes trifoliata*, mentioned by Paucă (1935) in a mesothropic swamp with *Sphagnum*, in Brătcoaia Glade, was not found in the present (Păşcuț, 2012) due to the warping of the surfaces covered with peat moss and reductions in groundwater levels.

Regarding the analysis of ecological categories of life forms and floristic elements, corresponding to those 890 species mentioned by Paucă (1935, 1940) and 808 species identified at present (Păşcuț, 2012), we can say that there are some minor changes concerning their number in the studied phytocoenoses.

Table 2

Comparative analysis of life forms in Codru-Moma Mountains

L.f.	Ph					H	G	Ch	Hh	T		Total species
	Mph	mPh	nPh	l-nPh	Ep					Th	TH	
L.f.. I	34	30	30	3	1	425	78	28	30	105	44	808
L.f. I (%)	4.21	3.71	3.71	0.37	0.12	52.6	9.65	3.46	3.71	13	5.46	100
L.f. II	33	30	33	3	1	413	82	21	22	188	64	890
L.f. II (%)	3.7	3.37	3.7	0.34	0.11	46.41	9.22	2.36	2.47	21.13	7.19	100

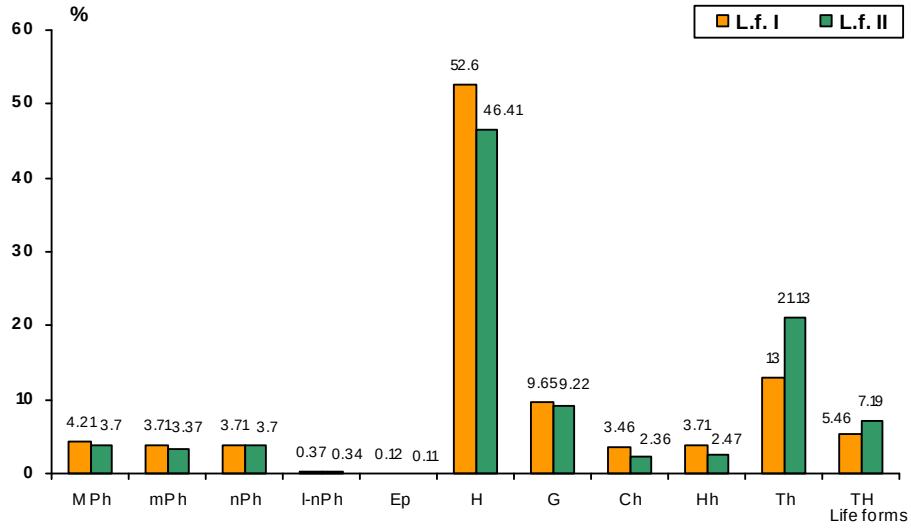

Fig. 1. Comparative spectrum of life forms in Codru-Moma Mountains

Legend: L.f.-Life forms, MPh-Megaphanerophytes, mPh-Mezophanerophytes, nPh-Nanophanerophytes, l-nPh-Climbing plants, Ep-Epiphytes, Ch-Chamaephytes, G-Geophytes, H-Hemicryptophytes, Th-Annual terophytes, TH-Biannual terophytes, Hh-Helohidatophytes, L.f. I – life forms identified at present (Păşcuţ, 2012) in Codru-Moma Mountains, L.f. II – Life forms identified by Paucă (1935, 1940) in Codru-Moma Mountains.

After analyzing life forms in Codru-Moma Mountains (table 2, figure 1), it results that there have been some changes in the structure of the ecological categories, meaning that the number of hemicryptophytes has increased from 46.41% (Paucă, 1935, 1940) to 52.16% at present and a diminution of therophytes from 28,32% (Paucă, 1935, 1940) to 18.46% at present.

In order to follow the evolution of floristic elements in time I resorted to comparing the survey results obtained at present (Păşcuţ, 2012) with the results obtained by Paucă (1935, 1940).

For analyzing the data a number of 890 species identified by Paucă (1935, 1940) and 808 species identified at present (Păşcuţ, 2012) (table 3) were taken into account.

Table 3

Comparative analysis of floristic elements in Codru-Moma Mountains

F.e.	Eua	E	Ec	Cp	Cosm	M	Mp	Atl-M	Adv
F.e. I	315	134	102	78	44	27	19	18	10
F.e. I (%)	38.99	16.58	12.62	9.65	5.45	3.34	2.35	2.23	1.24
F.e. II	352	144	102	78	73	33	21	20	17
F.e. II (%)	39.55	16.18	11.46	8.76	8.2	3.7	2.36	2.25	1.91
F.e.	**End**	**Alp**	**P**	**Ppn**	**B**	**DB**	**Carp**	**Pn**	**Total species**
F.e. I	10	9	12	6	4	4	15	1	808
F.e.I (%)	1.24	1.11	1.49	0.74	0.5	0.5	1.85	0.12	100
F.e.II	4	4	15	4	6	6	10	1	890
F.e. II (%)	0.46	0.46	1.69	0.45	0.67	0.67	1.12	0.11	100

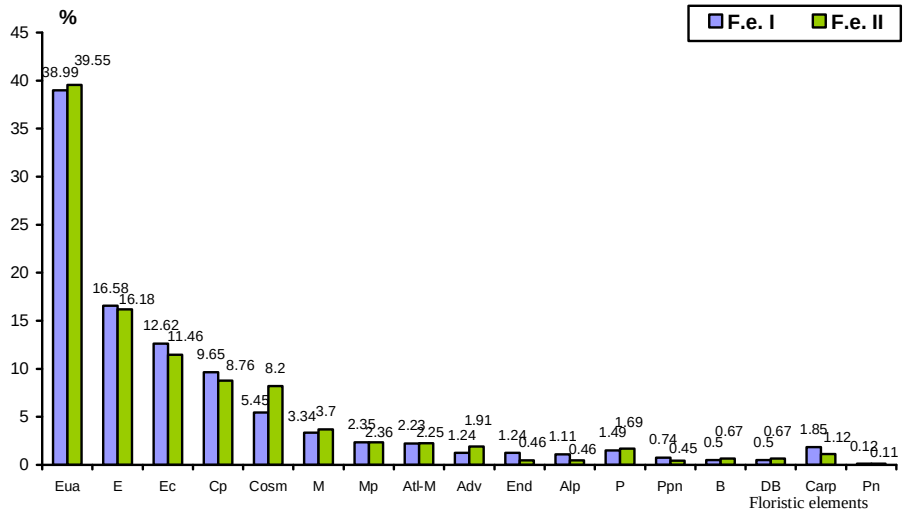

Fig. 2. Comparative spectrum of floristic elements in Codru-Moma Mountains

Legend: F.e.-Floristic elements, Cp-Circumpolar, DB-Daco-Balkan, Eua-Eurasian, Carp-Carpathian, E-European, End-Endemism, Ec-Central European, Atl-Atlantic, M-Mediterranean, Atl-M-Atlantic-Mediterranean, Mp-Mediterrano-Pontic, Alp-Alpine; P-Pontic, Cosm-Cosmopolitan, Pn-Pannonian, Adv-Adventitious, B-Balkan; F.e.I – floristic elements identified at present (Păşcuţ, 2012) in Codru-Moma Mountains; F.e.II – floristic elements identified by Paucă (1935, 1940) in Codru-Moma Mountains.

The phytogeographic analysis of the cormoflora in Codru-Moma Mountains shows that the spectrum of floristic elements has remained relatively the same (figure 2), showing a decrease in the number of cosmopolites from 8.2% (Paucă, 1935, 1940) to 5.45% at present and an increase in the number of Central-Europeans (from 11.46% to 12.62%) circumpolars (from 8.76% to 9.65%), Eurasians stay almost the same.

CONCLUSIONS

Cormoflora in Codru-Moma Mountains is rich and varied, due to the diversity of landforms found, the geological substratum and the soil types in this area.

The greater number of species identified between 1935-1940 is a result of the floristic studies carried out in crops adjacent to forests, as well as in ruderal weeds.

Of a total of 852 phytotaxons identified at present, 146 species, 14 subspecies and 1 variety are mentioned for the first time in the region of Codru-Moma Mountains, and this represents my own contribution to the floristic inventory of the studied area.

Despite the fact that most of the vegetation cover in Codru-Moma Mountains is represented by forests, based on the comparative analysis made, we can conclude that of the total number of life forms, phanerophytes are, even today, in small number, hemicryptophytes are dominant, with a tendency to increase at present. Growth in the number of hemicryptophytes is a result of some random phenomena (trees knocked down and broken off by wind and snow, wood exploitation) which, in the last 7 decades, helped some new hemicryptophytes infiltrate in the forest.

The results obtained after the comparative analysis of the flora based on phytogeographic criteria, confirms the belonging of this area to the large Eurasian region. The slight increase in the number of circumpolar elements shows the influence of a colder and more humid climate coming from Beiuşului basin.

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