Contribuţii Botanice - 2010, *XLV*: 25-33
Grădina Botanică "Alexandru Borza"
Cluj-Napoca

THE VEGETATION OF THE BIHARIA MASSIF (APUSENI MOUNTAINS) – GENERAL CHARACTERISATION

***Tudor-Mihai URSU*[1], *Crăciun OLARU*[2]**
[1] Institutul de Cercetări Biologice, str. Republicii, nr. 48, **RO-400015 Cluj-Napoca, România**
[2] 2., Chemin des Coquelicots, **F-50300, Avranches, France**
e-mail: utudor@yahoo.com

Abstract: The Biharia Massif, situated in the south-western part of the Apuseni Mountains, with its highest peaks, Bihor-Cucurbăta Mare (1849 m) and Cucurbăta Mică (1769 m), provides a wide range of ecological conditions and allows the development of diverse vegetation. It comprises forests ranging from beech to spruce, small patches of riparian forest, scrub (including alpine juniper over a wide area and mountain pine in a small area), meadows used as pastures or hay-fields, many types of hygrophilous vegetation and, over small areas, saxicolous vegetation. Our research in this region, previously scarcely studied, resulted in the identification of 39 plant associations that are briefly presented here, included in 22 alliances, 13 orders and 11 vegetation classes. As regards nature protection, the most important and diverse area, the source of the Cepelor Valley, has already been declared a SCI but other important areas also need protection.

Keywords: Romania, Apuseni Mountains, Biharia Massif, Montane-subalpine vegetation, plant communities

Introduction

The Biharia Massif, part of the Bihor Mountains, is situated in the south-western part of the Apuseni Mountains. The Cucurbăta Mare peak (also called Bihor peak) with an altitude of 1849 m, represents the highest peak from the area of the Apuseni Mountains. On its north-eastern slope, at 1750m altitude are the remnants of a glacial cirque.

Concerning the geological structure, the massif is dominated by acidic rocks, in its highest part being constituted almost exclusively of andesites and crystalline schists from the Biharia series [14].

The large altitudinal range of the territory (760–1849 m) allows for the differentiation of two topoclimates: mountain and subalpine. The mean annual temperature is +1,25 °C for the high peaks and +6,25 °C for the village of Arieşeni. Precipitation ranges from *c*. 900 mm/m^2/year for Arieşeni to 1380 mm/m^2/year for the high peaks, with maximum values during summer [22]. The high peaks Cucurbăta Mare, Cucurbăta Mică, and the glacial cirque under the Cucurbăta Mare Peak (unique in the Apuseni Mountains), have particular environmental conditions, often retaining snow until June.

Most of the soils in the region are formed over igneous and metamorphic acidic rocks and belong to the following categories: Dystric Cambisols, Entic Podzols, Rustic Podzols, Rhodi-eutric Cambisols and Haplic Luvisols [4, 13]

From a floristic and phyto-sociological perspective the region is scarcely known, as publications from the area are relatively few and fragmentary [2, 7, 8, 9, 15, 16, 17, 23].

Material and Methods

The territory selected covers an area of about 100 km^2 between the Arieşul Mare and Arieşul Mic rivers, comprising most of the Biharia Massif. It was studied between the years 2005–2010 as part of the first author's PhD thesis. Studies of the cormophyte flora and vegetation had also been carried out by the second author in 1972–1975 over an area of about 50

km^2, mostly with unpublished results [16, 17] The present paper makes use of both the recently collected data and the older (but only recently available) data for the extensive characterization of the cormophyte vegetation.

For species determination we have used both older and modern works [5, 21], while species nomenclature follows Ciocârlan (2009) [5]. Fieldwork and data processing methodologies are those elaborated by J. Braun-Blanquet [3], adapted for regional conditions by Borza [1] and revised by his Transylvanian school [6, 10, 11]. The assignment of relevés to specific plant associations has been carried out according to several literature sources [6, 7, 8, 9, 18, 20].

Results and Discussion

Based on the 250 relevés recorded, we consider that the region studied has a diverse vegetation (taking into account the acid substrate that acts as a diversity-limiting factor), the plant communities belonging to 39 associations, 22 alliances, 13 orders and 11 vegetation classes, presented in the following coeno-taxonomic conspectus. Of the 39 associations presented here, 24 have not been previously published from the Biharia Massif.

ASPLENIETEA RUPESTRIS Br.-Bl. 1934
POTENTILLETALIA CAULESCENTIS Br.-Bl. 1926
Cystopteridion (Nordh.1936) J.L.Rich 1972
1. Asplenio-Cystopteridetum fragilis Oberd. (1939) 1949
JUNCETEA TRIFIDI Klika et Hadač 1944
CARICETALIA CURVULAE Br.-BI. 1926
Caricion curvulae Br.-BI. 1925
2. Potentillo ternatae-Festucetum supinae Boşcaiu 1971
Loiseleurio-Vaccinion Br.-Bl. 1926
3. Empetro-Vaccinietum gaultherioidis Br.-Bl. 1926
-Vaccinietosum vitis-idaeae Coldea 1991
CALLUNO-ULICETEA Br.-Bl. Tx. ex Klika et Hadač 1944 (Syn.: Nardo-Callunetea Preis.49)
NARDETALIA Oberd. ex Preis. 1949
Potentillo-Nardion Simon 1957
4. Scorzonero roseae-Festucetum nigrescentis (Puşcaru et al. 1956) Coldea 1987
5. Violo declinatae-Nardetum Simon 1966
Genistion Böch. 1943
6. Vaccinio-Callunetum vulgaris Bük 1942
Violion caninae Schwickerath1944
7. Polygalo-Nardetum strictae Oberd. 1957
VACCINIO – GENISTETALIA Schubert 1960
Genistion pilosae Duv. 1942 em. Schubert 1960
8. Bruckenthalio-Vaccinietum Coldea 2008
MONTIO-CARDAMINETEA Br.-Bl et Tx. 1943
MONTIO-CARDAMINETALIA Pawl. 1928
Cardamino-Montion Br.-Bl. 1925
9. Chrysosplenio-Cardaminetum amarae Mass. 1959
10. Philonotido-Calthetum laetae (Krajina 1933) Coldea 1991
11. Swertio punctatae-Saxifragetum stellaris Coldea (1995-1996)1997
SCHEUCHZERIO-CARICETEA NIGRAE (Nordh. 1937) Tx. 1937
CARICETALIA NIGRAE Koch 1926 em. Nordh. 1937
Caricion nigrae Koch 1926 em. Klika 1934
12. Junco-Caricetum fuscae Tx. (1937) 1952
13. Sphagno-Caricetum rostratae Steffen 1931

14. Carici echinatae-Sphagnetum Soó (1934) 1954

BETULO-ADENOSTYLETEA Br.-Bl. et Tx. 1943

ADENOSTYLETALIA Br.-Bl. 1931

Adenostylion alliariae Br.-Bl. 1925

15. Adenostylo-Doronicetum austriaci Horv. 1956

16. Salici-Alnetum viridis Colič et al. 1962

Calamagrostion villosae Pawl. 1928

17. Phleo alpini-Deschampsietum caespitosae (Krajina 1933) Coldea 1983

PHRAGMITETEA Tx. et Prsg. 1942

PHRAGMITETALIA W. Koch 1926

Phragmition W. Koch 1926

18. Glycerio-Sparganietum neglecti Koch 1926 em. Phillippi 1973

MOLINIO-ARRHENATHERETEA R. Tx. 1937

ARRHENATHERETALIA Pawlowski 1928

Cynosurion cristati R. Tx. 1947

19. Anthoxantho-Agrostietum tenuis Sillinger 1933 em. Jurkó 1969

20. Festuco rubrae-Agrostietum capillaris Horvat 1951

MOLINIETALIA W. Koch 1926

Deschampsion caespitosae (Horvatić 1930) Soó 1971

21. Agrostio stoloniferae-Deschampsietum caespitosae Ujvárosi 1947

Calthion palustris Tx. 1937

22. Scirpetum sylvatici Maloch 1935 em. Schwick. 1944

23. Epilobio-Juncetum effusi Oberd. 1957

Filipendulion ulmariae Segal 1966

24. Telekio-Filipenduletum ulmariae Coldea 1996

EPILOBIETEA ANGUSTIFOLII Tx. et Prsg. in Tx. 1950

ATROPETALIA Vlieg. 1937

Epilobion angustifolii (Rübel 1933) Soó 1933

25. Senecio sylvatici-Epilobietum angustifolii (Heck 1931) Tx. 1950

Sambuco-Salicion Tx. 1950

26. Sambucetum racemosae (Noirf. 1949) Oberd. 1973

27. Rubetum idaei Pfeiff. 1936 em. Oberd. 1973

28. Sorbo-Betuletum pendulae Dihoru 1975

QUERCO-FAGETEA Br.-Bl. et Vlieger 1937 em. Soó 1964

FAGETALIA SILVATICAE Pawl. 1928

Symphyto-Fagion Vida 1959

Symphyto-Fagenion (Vida 1959) Soó 1964

29. Symphyto cordato-Fagetum silvaticae Vida 1959,

30. Leucanthemo waldsteinii-Fagetum (Soó 1964) Täuber 1987

Alno-Ulmion Br.-Bl. et Tx. 1943 em. Müll. et Görs 1958

31.Telekio speciosae-Alnetum incanae Coldea (1986) 1990

VACCINIO-PICEETEA Br.-Bl. 1939

VACCINIO-PICEETALIA Br.-Bl. 1939

Piceion abietis Pawl. in Pawl. et al. 1928

Soldanello majori-Picenion Coldea 1991

32. Hieracio rotundati-Piceetum Pawl. et Br.-Bl. 1939

33. Hieracio rotundati-Abietetum (Borhidi 1971) Coldea 1991

34. Soldanello majori-Piceetum Coldea et Wagner 1998

35. Leucanthemo waldsteinii-Piceetum Krajina 1933

36. Sphagno-Piceetum (Tx. 1937) Hartman 1942

Pinion mugo Pawl. 1928

37. Vaccinio myrtilli - Pinetum mugo Hadač 1956

38. Campanulo abietinae-Juniperetum Simon 1966

39. Campanulo abietinae-Vaccinietum (Buia et al. 1962) Boşcaiu 1971

State of the present vegetation

Currently about half of the massif's area is covered by forests, which represent the potential vegetation for about 90% of the whole area. Wood exploitation (often unsustainable) has led to the disappearance of forests, replaced by secondary meadows and agricultural land, while most of the remaining forests have lost their natural, compact structure.

Anthropogenic activities were also intensive in the higher mountain area, where the widespread juniper communities were burned over significant areas in the last decades, to make room for pastures, mostly of mat-grass.

The small glacial cirques situated on the north-eastern slope of the Biharia Massif shelter, through their microthermal conditions, some relict plant species [15, 17, 23].

I. Woody vegetation

Forests

In the lower part of the Iarba Rea valley, in the Bucura valley and on the banks of the Arieşul Mic River, remain, in relatively small areas, beech forests belonging to the association *Symphyto cordato-Fagetum*, which were largely cleared for agricultural land. The tree layer is dominated by beech, the crown cover being high (80–90%). The shrub layer of these forests is poorly represented, as well as the beech seedlings and saplings. The compact litter and low light intensity also limits the grass layer, both as regards cover and number of species. Besides *Symphytum cordatum*, the characteristic species, most species from the lower herb layers are characteristic of the order *Fagetalia* and alliance *Symphyto-Fagion.* In the more humid sites, the ground cover is higher, as more species characteristic of spruce forests and pastures can be found.

The mixed forests belonging to *Leucanthemo waldsteinii-Fagetum* can be found at the base of the slopes bordering the valley of the Arieşul Mare River, on a 50–100 m altitude band, sometimes situated above spruce forests because of vegetation inversions. Among the trees, their structure is dominated by beech and spruce, while besides the characteristic herbaceous species *Leucanthemum waldsteinii*, the shrub and grass layers are represented mostly by mesophyllous species, with a higher ground cover.

Both on the eastern slope of the Biharia Massif and on its southern slope, above the mixed forest can be found spruce forests belonging to the association *Hieracio rotundati-Piceetum*, dominated by spruce. Under optimal conditions crown cover is high (70–80%) while the shrub and grass layers are poorly developed, with relatively few species. In parts where the forest is less dense because of cutting, or towards the upper limit of spruce forests, the shrub and grass layers are well represented, mostly by species characteristic of the alliance *Piceion abietis* and class *Vaccinio-Piceetea.*

In the north-eastern side of the massif (Sub Piatră, Gălişoaia, etc.), where the acid character of the substrate is moderated by the presence of small amounts of limestone, fir is more abundant, being co-dominant with spruce. These communities, covering smaller areas and with *Hieracium transsylvanicum* (*H. rotundatum*) as a characteristic species (as well as the spruce forests mentioned above), belong to the association *Hieracio rotundati-Abietetum.*

In the whole territory, in valleys and along the brooks, at higher altitudes, the more humid conditions allow the development of coenoses belonging to the association *Leucanthemo waldsteinii-Piceetum*, dominated by spruce and having *Leucanthemum waldsteinii* as

characteristic species. These communities include more meso-hygrophyllous species characteristic of the order *Adenostyletalia*.

On small areas, where the landscape structure determines the accumulation of stagnant water (the area above Ștei village, Jompului creek), spruce forests have a low crown cover and there appears an abundant development of *Sphagnum* species. These boggy spruce forests belong to the association *Sphagno-Piceetum*.

Above spruce forests and mixed forests, at 1300–1600 m altitude, is the band of high altitude spruce forests, close to the forest limit. These forests, belonging to association *Soldanello majori-Piceetum,* are dominated exclusively by spruce, the crown cover being lower. The shrub and grass layers are well developed, including many acidophyllous species characteristic of spruce forests, and meadow species that favour high light intensity.

Riparian forests

In the lower part of the valley of the Arieșul Mic River (the lowest altitude within the study area) the banks are colonized, in small areas, by communities of grey alder belonging to *Telekio-Alnetum incanae*, specific to the mountain valleys with colder microclimate conditions and shallower soils. The herb layer of these forests is well developed, comprising both hygrophilous species and species originating in the beech forests.

Shrubs

Above the upper forest limit (*c*. 1600-1650m) lies the band of subalpine shrubs that belong to the association *Campanulo abietinae-Juniperetum*. These are dominated by alpine juniper (*Juniperus sibirica*) scrub, which covers about 75% of the summit area of the massif. The shrubs have a variable height, from 30 cm (in the areas on the Cucurbăta Mică peak exposed to intense winds) and up to 1.5 m in the sheltered areas. The undergrowth is represented mainly by small blueberry shrubs and a few herbaceous species. These communities represent the climax vegetation for the summit area of Biharia Massif (>1700 m altitude). There are just a few small areas (on the highest peaks: Cucurbăta Mică and Cucurbăta Mare) where the conditions of microclimate prevent the growth of juniper, its place being taken by patches dominated by *Vaccinium uliginosum* ssp. *microphyllum (V. gaultherioides)* and *Festuca airoides.*

Only in the Cepelor Valley, above the upper forest limit can be found, in microthermal stations, the coenoses of mountain pine belonging to the association *Vaccinio myrtilli-Pinetum mugo*. In the structure of these coenoses, there also appear other woody species such as alpine juniper, green alder and *Salix silesiaca* and some small shrubs, including the characteristic species, *Vaccinium myrtillus.* The grass layer includes a mixture of species characteristic of spruce forests, mountain meadows and moist forb communities. These communities have a relict character, representing small surviving ‘islands’ of vegetation, an important observation being the rare occurrence of young *Pinus mugo* plants, so that in the next few hundred years we expect a reduction in their extent or even their disappearance.

On the steep rock outcrops above the source of the Cepelor Valley (and on small areas under the Piatra Grăitoare peak), can be found communities dominated by green alder *(Alnus viridis)* and *Salix silesiaca* belonging to the association *Salici-Alnetum viridis*. The herb layer consists mostly of moisture-loving mountain forbs. In sunny and wind-sheltered locations, mostly at the base of the cliffs, can be found, in small numbers, the vulnerable lily *Lilium carniolicum* subsp. *jankae* [12, 23].

Mainly on the eastern slope of the Biharia Massif, in areas less affected by horse grazing, the mat-grass pastures developed after the clearing of juniper bushes are replaced by small shrubs, more or less compact, belonging to the association *Campanulo abietinae-Vaccinietum*. The secondary character of these communities is proven by their structure, comprising species that are characteristic of both spruce forests and mountain meadows.

On some slopes of southern aspect, in more xerophyllous and acidophyllous conditions, the species *Calluna vulgaris* is more abundant and develops, in a few points (under peaks Cucurbăta Mică, Piatra Grăitoare, Dimerii), plant communities of heather and blueberry belonging to the association *Vaccinio-Callunetum vulgaris*.

In the area of the Cucurbăta Mică peak, on small areas, in sunny stations, can be found communities that belong to the association *Bruckenthalio-Vaccinietum*, comprising a large number of acidophyllous species characteristic of the order *Nardetalia*.

On the peaks Cucurbăta Mare and Cucurbăta Mică in areas exposed to winds, with conditions similar to the subalpine climate, small communities of bog bilberry have developed that belong to the syntaxon *Empetro-Vaccinietum gaultherioidis*, subass. *vaccinietosum vitis-idaeae*, characterized by the absence of *Empetrum hermaphroditum*, more demanding of environment conditions, and by the increased abundance of *Vaccinium myrtillus* and *V. vitis-idaea*, more resistant to the harsh conditions in these locations. The alpine juniper plants from these communities are dwarf (20–30 cm in height), as an adaptation to this microclimate.

Over the whole area of the massif the intensive forest clearances have caused wide gaps that are colonized over variably periods of time, according to local conditions, by shrubs belonging to the alliance *Sambuco-Salicion* [19].

At lower altitudes, communities of the association *Senecio sylvatici-Epilobietum angustifolii*, specific to deeper and less acid soils, take the place of the cleared beech forests. In a subsequent succession stage, they are replaced by the communities belonging to *Sambucetum racemosae*.

In the case of clearings in the spruce and mixed forests, in the first stage the empty space is colonized by communities of raspberry, belonging to *Rubetum idaei*, dominated by *Rubus idaeus*, along with *Senecio ovatus* and *Fragaria vesca*. On the more abrupt slopes with shallow soils, the succession does not lead directly to the initial forest but passes through a stage where *Sorbus aucuparia* and *Betula pendula* have a high dominance, communities that are included within the association *Sorbo-Betuletum pendulae*.

II. Meadow vegetation

Pastures and hay-fields

In the entire study area, between 800 and 1300m altitude, the gentler slopes are used for agriculture, especially potato cultivation. In the agricultural practice of this area, after potato crops the land is cultivated with rye and oats. After 3–4 years, the land is left fallow and the cycle is restarted on another piece of land.

The fallow land, retaining a significant quantity of nutrients from the fertilization of the potato by manure, is rapidly colonized by communities (temporary in character and connected to agricultural practices) of the associations *Anthoxantho-Agrostietum tenuis* and *Festuco rubrae-Agrostietum capillaris*. In the first years cover is reduced and the ground is dominated by *Rumex acetosella, Campanula patula, Leucanthemum vulgare* and segetal species persisting from the previous crops. In the next 2–3 years, the structure of these communities becomes typical as the segetal species disappear. In this stage the communities are used as hay-fields. As the reserves of nutrients from the soil are depleted, the size and vigour of the plants diminishes along with their cover. After more years, both these types of community are replaced either by low altitude mat-grass communities from the association *Polygalo-Nardetum strictae*, or by communities dominated by blueberry, mostly in the area of spruce forests.

At higher altitudes, the secondary meadows resulting after the clearing of spruce forests or alpine juniper are dominated by mat-grass. These communities, belonging to the association *Violo declinatae-Nardetum*, have lower species diversity both because of intensive grazing (reduced at present) and because of the acid soil with very compact structure.

In the areas with better edaphic conditions (less acid soils, with deeper and aerated structure), on very small surfaces can be found communities of the association *Scorzonero roseae-Festucetum nigrescentis*, with a larger number of mesophyllous species characteristic of the order *Arrhenatheretalia.*

On small patches, especially under the rock outcrops from the source of the Cepelor Valley, and the Piatra Grăitoare peak, coenoses of the association *Phleo alpini-Deschampsietum caespitosae* can be found, which have increased demands for light and humidity but are tolerant of temperature and soil reaction [6].

The highest peaks of the massif, Cucurbăta Mare (1849 m) and Cucurbăta Mică (1770 m) have particular soil and climate conditions, of a subalpine type. In these areas have developed communities belonging to the association *Potentillo ternatae-Festucetum supinae* (in patches only a few meters wide), which are well adapted to the microthermal conditions and soils that are rocky, acid and of low humidity.

III. Hygrophillous vegetation

Although the hydrographic network of the watershed of the Arieşul Mare and Arieşul Mic rivers is well developed, the gulleys in most of the territory lack a specific vegetation. The cause of this phenomenon is probably the steep slope and the fast flow through these gulleys, which does not allow the deposition of sediments, necessary for the growth of plant communities. Also, their variable flow causes the yearly washing of their banks which are, therefore, rocky and almost barren.

At the source of the Arieşul Mare River, where the gentle slope causes the flow of the river to meander, on a very small area can be found communities of the association *Glycerio-Sparganietum neglecti*, at their highest altitude limit in this area (1130 m).

At higher altitudes in Şaua Vârtop, on small areas there are plant communities dominated by soft rush that belong to the association *Epilobio-Juncetum effusi*.

In the Galbena Valley, in its lower part, on relatively flat or slightly sloping ground, with high humidity there have developed communities of the association *Agrostio stoloniferae-Deschampsietum caespitosae*. In their structure are well represented the species characteristic to the order *Molinietalia* and class *Molinio-Arrhenatheretea*.

In the same area, on terrain that is richer in nutrients but where stagnant water prevents the development of meso-hygrophyllous species, on very small surfaces are fragments of communities belonging to the association *Scirpetum sylvatici*.

On the Scoarța brook, at 1050–1170 m altitude, but also in the springs situated at lower altitude from the Iarba Rea valley and under Piatra Grăitoare, small mesotrophic swamps of low acidity develop, allowing the growth of plant communities belonging to the association *Junco-Caricetum fuscae*. Within these communities species of the class *Scheuchzerio-Caricetea nigrae* are frequent, as well as those belonging to orders *Molinietalia* and *Arrhenatheretalia.*

The springs in the spruce forests are colonized by shade-loving plant communities dominated by *Cardamine amara*, belonging to the association *Chrysosplenio-Cardaminetum amarae*. Besides the species characteristic of the alliance *Cardamino-Montion* and the order *Montio-Cardaminetalia*, in these communities species characteristic of the order *Adenostyletalia* are also frequent.

In the upper part of the Cepelor Valley, at *c.*1560 m altitude, on an area of a few tens of square metres, typical peat bogs have formed, supporting plant communities that belong to the association *Carici echinatae-Sphagnetum*, which have a reduced floristic diversity compared to the large peat bogs described from other parts of the Apuseni Mountains. Also we have identified here a community that covers a small area, which belongs to the association *Sphagno-Caricetum rostratae* Steffen 1931.

At the source of the Cepelor Valley, in the area of nivo-glacial landscape, can be found relict microthermal coenoses belonging to the associations *Philonotido-Calthetum laetae* and *Swertio punctatae-Saxifragetum stellaris*, which had attracted the attention of botanists since the last century and were better studied and appeared in more publications. [2, 7, 15, 23]

On a few steep and moist parts of the rock outcrops that could not be covered by green alder, have developed communities belonging to the association *Adenostylo-Doronicetum austriaci*, that benefit from high humidity, soils rich in organic matter and intense light.

IV. Saxicolous vegetation

On the drier rock outcrops, mostly under the Piatra Grăitoare peak, where in the geological structure there are some limestone inclusions, can be found coenoses of the association *Asplenio-Cystopteridetum fragilis*. These coenoses have small cover, being installed usually in the cracks and crevices of rocks. In the parts where the soil layer is more abundant, some species characteristic of meadows can also be found, joined sometimes by shrub species.

Conclusion

The territory studied has relatively high vegetation diversity (39 plant associations) although the geological structure of the massif is mostly constituted of acid rocks.

From a conservation point of view, the massif is important since it preserves the vulnerable species *Lilium carniolicum* subsp. *jankae* and certain priority habitats included in both national and European legislation [12, 23, 24].

The source of Cepelor Valley harbors certain relict coenoses and has been declared a Site of Community Importance (ROSCI0260).

Sheep grazing, practiced in the past in this area has ceased in recent years. Currently the horses from neighboring villages roam free in the higher part of the massif, sometimes in large numbers, especially in July and August.

Certain protection measures should be necessary for the subalpine communities on the Cucurbăta Mare and Cucurbăta Mică peaks that have adapted for centuries to the harsh climatic conditions of this area but risk being destroyed in a few years by insensitive tourists.

REFERENCES

1. Borza, Al., Boşcaiu, N., 1965, *Introducere în studiul covorului vegetal,* Ed. Acad. Rom., Bucureşti.
2. Boşcaiu, N., Marossy, A., 1979, Aspecte de vegetaţie de pe Valea Cepelor (Masivul Biharia), *Nymphaea, Muzeul Ţării Crişurilor*, **VII:** 301-321.
3. Braun-Blanquet, J., 1964, *Pflanzensoziologie, Grundzuge der Vegetationskunde,* (3rd ed.), Springer, Wien.
4. Bunescu, V., Bunescu, H., Dîrja, M., Păcurar, I., 2000, *Solurile Munţilor Apuseni*, Ed.Cartimpex, Cluj-Napoca.
5. Ciocârlan, V., 2009, *Flora Ilustrată a României. Pteridophyta et Spermatophyta*, Ed. Ceres, Bucureşti.
6. Coldea, G., 1991, Prodrome des associations végétales des Carpates du Sud-Est (Carpates roumaines), *Docum. Phytocen. (Camerino)*, **13**: 317-539.
7. Coldea, G., 1995-1996, Contribuţii la studiul vegetaţiei României (I), *Contrib. Bot., Cluj-Napoca*: 1-8.
8. Coldea, G., Filipaş, L., Stoica I.-A., 2008, Contributions to Romanian vegetation studies (IV), *Contrib. Bot., Cluj-Napoca*: 45-52.
9. Coldea, G., Wagner, I., 1998, Contribuţii la studiul vegetaţiei României (III), *Contrib. Bot., Cluj-Napoca*: 81-87.
10. Cristea, V., 1991, *Fitocenologie şi vegetaţia României, îndrumător de lucrări practice*, Univ. „Babeş-Bolyai", Cluj-Napoca.
11. Cristea, V., Gafta, D., Pedrotti, F., 2004, *Fitosociologie*, Ed. Presa Universitară Clujeană, Cluj-Napoca.
12. Dihoru, G., Negrean, G., 2009, *Cartea Roşie a plantelor vasculare din Romania*, Romanian Academy Publishing House, Bucureşti.
13. Florea, N., Munteanu, I., 2002, *Sistemul Român de Taxonomie a Solurilor (SRTS)*, Estfalia, Bucureşti.

14. Ianovici, V., Borcoş, M., Bleahu, M., Patrulius, D., Lupu, M., Dimitrescu, R., Savu, H., 1976, *Geologia Munţilor Apuseni*, Ed. Acad. R.S.R., Bucureşti.
15. Marossy, A., 1973, Contribuţii la cunoaşterea florei masivului Biharia (etajul subalpin), *Nymphaea, Muzeul Ţării Crişurilor, Oradea*, **I**: 1-5.
16. Olaru, C., 1979, Studii asupra vegetaţiei lemnoase din regiunea superioară a Văii Arieşului. In: *Mediul ecologic şi educaţia contemporană, Zalău*: 116-121.
17. Olaru, C., 1980, Aspecte floristice din cursul superior al văii Arieşului, *Acta Musei Porolissensis, Muzeul de istorie şi artă Zalău*, **IV**: 807-811.
18. Sanda, V., 2002, *Vademecum ceno-structural privind covorul vegetal din România*, Ed. Vergiliu, Bucureşti.
19. Sanda, V., Alexiu, V., Ştefănuţ, S., 2007, Instalarea şi succesiunea vegetaţiei naturale în tăieturile de pădure, *ECOS*, **19**: 15-19.
20. Sanda, V., Popescu, A., Barabaş, N., 1997, Cenotaxonomia şi caracterizarea grupărilor vegetale din România, *Studii şi Comunicări, Biologie Vegetală*, **14**: 5-366.
21. Săvulescu, T. (Red.), 1952 -1976, *Flora R.P.R. (R.S.R.)*, 1-13, Ed. Acad. R. P. - R. S. România, Bucureşti.
22. Stoenescu, Ş.M., Şchiop, A., Dică, I., Popescu, E., Patrichi, E., Ţepeş, E., 1966, *Atlasul climatologic al R.S.R.*, Ed. Academică. Bucureşti.
23. Ursu, T., Coldea, G., 2007, Contributions to the flora of the Biharia Massif (Romania), *Contrib. Bot., Cluj-Napoca*: 19-26.
24. *** Annex I to "Interpretation Manual of European Union Habitats", version EUR 15/2" adopted by the Habitats Committee on 4 October 1999 and "Amendments to the "Interpretation Manual of European Union Habitats" with a view to EU enlargement" (Hab. 01/11b-rev. 1) adopted by the Habitats Committee on 24 April 2002 after written consultation, European Commission, DG ENV. *http://www.internationalwildlifelaw.org/EUCD92AnnexI.html*

CARACTERIZAREA GENERALĂ A VEGETAŢIEI MASIVULUI BIHARIA (ROMÂNIA)

(Rezumat)

Masivul Biharia, situat în partea sud-vestică a Munţilor Apuseni, cu vârfurile sale cele mai înalte, Cucurbăta Mare (1849 m) şi Cucurbăta Mică (1769 m) prezintă condiţii ecologice variate ce au permis instalarea unei vegetaţii diverse, în ciuda absenţei aproape complete a calcarului din substrat, în care predomină şisturile cristaline. Prezenţa unor urme de relief nivo-glacial (unice în Munţii Apuseni) în partea nord-estică a masivului contribuie în mod semnificativ la această diversitate.

Teritoriul studiat are o suprafaţă de aproximativ 100 km^2 şi cuprinde o mare parte a Masivului Biharia, flora şi vegetaţia sa fiind puţin şi fragmentar cunoscute. A fost cercetat între anii 2005-2010 în cadrul tezei de doctorat a primului autor. Studii asupra florei cormofitice şi vegetaţiei au mai fost realizate în această zonă între anii 1972-1975 pe o suprafaţă de aproximativ 50 km^2, o mare parte a rezultatelor nefiind însă publicată. Acest articol utilizează atât datele recente, cât şi pe cele colectate în anii 70 (însă doar de curând disponibile) pentru caracterizarea extensivă a vegetaţiei cormofitice din zona de interes. Metoda de lucru utilizată a fost cea a Şcolii Fitosociologice Central Europene, adaptată la condiţiile regionale de către Al. Borza şi revăzută de către continuatorii acestuia din Transilvania.

Pe baza celor 250 relevee realizate şi analizate, comunităţile de plante din regiune au fost încadrate în 39 asociaţii, aparţinând la 22 alianţe, 13 ordine şi 11 clase de vegetaţie, 24 dintre cele 39 de asociaţii prezentate nefiind publicate anterior din această zonă. Vegetaţia lemnoasă este reprezentată prin păduri (7 asociaţii vegetale), zăvoaie (o asociaţie) şi tufărişuri (11 asociaţii). Vegetaţia praticolă cuprinde comunităţi de păşuni şi fâneţe (8 asociaţii). Bine reprezentată este şi vegetaţia higrofilă (11 asociaţii), îndeosebi în zona de relief nivo-glacial. Comunităţile saxicole sunt slab reprezentate, printr-o singură asociaţie.

Zona studiată adăposteşte specia vulnerabilă *Lilium carniolicum* ssp. *jankae* şi habitate prioritare, dintre care unele sunt incluse într-o arie protejată (ROSCI0260), altele însă necesitând măsuri de protecţie suplimentare.

Received: 16.10.2010; Accepted: 5.11.2010