

STRUCTURAL AND FLORISTIC DIVERSITY OF THE SHRUBLANDS VEGETATION IN THE CĂPĂȚÂNII MOUNTAINS, ROMANIAN CARPATHIANS

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Abstract

*The surveys have been carried out in the Căpățâni Mountains, part of the Southern Carpathians, in Romania. In the last 3 decades, the issues of species diversity in shrub vegetation in relation to the evolution, stability and maturity of natural ecosystems have been a priority from an ecological, phytocoenotic and conservation point of view. These shrublands plant communities have some of the greatest plant diversity, characterized by their floristic richness, but which has recently been significantly reduced as a result of a relatively rapid evolution, being under stress from drought, fire, grazing and cutting. In the lower mountain sub-zone, some shrublands plant communities occur, such as: *Spiraeo chamaedrifolii-Coryletum avellanae* Ujv. 1944. *Pinus mugo* develops here scrubs between 1,700 and 2,100 m. We found such types of shrublands in the subalpine area, the upper limit of spruces on gentle slopes but also on steep slopes. Alongside these, other shrubby plant communities are also found, which settle on rocky substrates, at the edge of forests or meadows, all of which have an ecological, pedological and conservative role.*

Key words: Căpățâni Mountains, structural diversity, plant communities, habitats, scrublands.

INTRODUCTION

The establishment and maintenance of shrub vegetation in the mountainous region is of particular importance from an eco-pedogenetic and conservation point of view, especially since these habitats and ecosystems they build are characterized by less favorable environmental conditions.

In the recent years, the shrub vegetation in the mountainous region of the European Mountains has undergone a significant process in terms of physiognomy and floristic structure as well as syndynamics, either due to anthropogenic factors or due to current global climate changes. Among the anthropogenic factors that have had a negative effect on shrub vegetation, we can mention the extensive grazing of animals in close correlation with the fires made in order to increase the grazing area in the mountainous region, waste resulting from tourism or construction, mining and material extraction. This paper presents studies on the structure and dynamics of shrub vegetation in the Căpățâni Mountains, an integral part of the Romanian Carpathians. The shrub vegetation in the Romanian Carpathians is very diverse, having a complex structure and often creating natural

habitats of community interest or priority within protected natural areas.

MATERIALS AND METHODS

Study area

The territory under study refers to the the mountainous level pertains to the central-European province, the Carpathian sub-province, the land of the Meridional Carpathians, the Western District (Godeanu-Parâng). From an orographic point of view, the Căpățâni Mountains present a high, main, bare ridge (crest) oriented in the east-west direction, from which there are numerous ramifications, to the north, as well as to the south, which have the shape of edges and crests and which locals call "plaiuri".

These mountains stand out by their deeply fragmented and well developed massive relief (Popescu, 1968; Niculescu, 2006). The most important crests and ridges of these mountains, belonging to the, are the following: Ursu Peak (2124 m), Nedeia (2130 m), Negovanu (2064 m), Beleoia (2109 m), Căpățâna Peak (2113 m), Govora Peak (1958 m), Zmeuretu Mountain (1979 m), Balota Peak (2094 m), Coșana Peak (2080 m), Corșor Peak (2001 m),

Ionaşcu Peak (1979 m), Turcinu Peak (1963 m), Priota Peak (1954 m), Bogdanu Peak (1881 m), Gera Peak (1856 m), Târnovu Mare Peak (1846 m), Văleanu Peak (1847 m), Funicelul (1820 m) Mountain, Piatra Roşie Mountain (1820 m), Roman's Peak (1810 m), Dârjalea Mountain (1900 m), Vioreanu Peak (1866 m), Vânturariţa Peak (1885 m), Buila Peak (1847), Petriceaua Mountain (1650 m), Căşăriei Mountain (1721 m). In the highest part of Căpăţâna Mountains there is still some evidence of glacial activity.

Therefore, a well defined cove which has the shape of a circle can be noticed on the Eastern side of Ursu Peak (Popescu, 1968; Niculescu, 2006). The Capatanii Mountains have three secondary ridges: Buila-Vânturariţa, Piatra Târnovului and Foarfeca Năraţului. In the Căpăţâni Mountains there are important hydrographic basins, Olteţ, Cerna, Luncavăţ, Bistiţa, Horezu, Repedea, Govora, Cheia, Olăneşti. We can also mention important gorges that are found in the Căpăţâni Mountains: Olteţ, Bistriţei, Costeşti, Cheia, Albeştenilor Gorges. Several protected areas are found in the studied territory: ROSAC0128 Nordul Gorjului de Est, Buila-Vânturariţa National Park, Cozia National Park (eastern part of the Căpăţâni Mountains, called Năraţu) and ROSAC0239 Tarnovu Mare-Latoriţa.

The climate of the studied territory is the result of complex interactions between solar radiation, the particularities of the relief and of the atmospheric circulation, characteristic to this area.

The relief acts upon the meteorological elements by its altitudinal development, by the orientation and the inclination of the slopes, by the configuration of the main relief units, determining the climatic disposal of the territory in floors and a multitude of topo-climates. On the investigated territory, one can notice the following climatic floors: mountainous and subalpine (Niculescu, 2006).

Methods

To identify the species and the inter-taxa, we looked into: *Romanian Flora*, vol. I-XII (Săvulescu coord., 1952-1976); *Flora Europaea*, vol. I-V (Tutin et al., 1964-1980); *Flora Italica*, vol. I-II, by P. Zangheri (1976); *The Romania illustrated Flora - Pteridophyta et*

Spermatophyta, by V. Ciocârlan (2000, 2009); *Spontaneous and cultivated wooden flora in Romania*, vol. I-II, by V. Zanoschi, I. Sârbu et Angela Toniuc (1996, 2000); *Alpin Flora*, Vol. I, II, III by D. Aeschimann et al. (2004). For the study of the vegetal carpet in the Căpăţâni Mountains, we have used methods of phytosociologic research characteristic to the Central European phytosociologic School, which was based on the principles and methods elaborated by J. Braun-Blanquet (1928) adapted by A. Borza (1934) Borza and Boşcaiu (1965) to the particularities of our country's vegetation (Niculescu, 2006).

The size of the sample areas was: 25-100 m², characteristic of shrub vegetation. The synthetic tables of the described vegetal associations contain information referring to: number of surveys, altitude (m.s.m), exposure, inclination (in grades), the completion of the crowning (where it is the case), vegetation level of covering (%) and the analyzed surface (m²). The vertical arrangement of the phytosociological tables was done according to the coenotaxonomic criterion. The quantitative assessment of the participation of every species to the vegetal association was performed with the help of the abundance-dominance index, according to the Braun-Blanquet scale. We have noted the constancy of the species (K) in the case of the plant communities. As for the classification of the plant communities, we have used synthesis papers on the Romanian vegetation, elaborated by G. Coldea (1986, 1991, 1997, 2015), V. Sanda et al. (1997) as well as other recent belonging to the authors: E. Oberdorfer (1992, 1994), Mucina et al. (1993, 1997, 2016), Rodwell et al. (2002).

RESULTS AND DISCUSSIONS

The shrub vegetation in the Căpăţâni Mountains is extremely rich and diverse due to the very varied ecological, geomorphological and climatic conditions in this territory. The coenotaxonomic overview was carried out based on our own research carried out between 1997-2024, as well as data from specialized literature regarding this area.

The shrubby vegetation in this territory is found both in the mountain and in the subalpine levels, either on rocky substrate, on crystalline schists

or limestone, either at the edge of forests, or on the banks of streams, in humid and cool or shady valleys, or interrupting the continuity of mountain or subalpine meadows.

The structure of phytocoenoses of plant communities varies depending on eco-pedoclimatic conditions in close correlation with the intensity and types of anthropogenic pressures as well as the implementation of appropriate management for each type of vegetation. Following the studies carried out, but also based on the specialized literature, a fairly large number of shrubby plant communities were identified in the Căpățânii Mountains.

These are classified into many categories:

1. Shrubby plant communities established in forest clearings

These plant communities have a high intensity of synanamics, they are also established on mobile debris on sloping slopes, but also on flat terrain, in the forest floor of beech, spruce, or mixtures of beech with fir or beech with fir and spruce. The following plant communities fall into this category:

1. The plant community *Rubetum idaei*

Gams 1927 (Syntax. Syn.: *Fragario vesca-Rubetum idaei* (Pfeiffer 1936) Siss. 1936) has a wide distribution in the Căpățânii Mountains, occurring in all the hydrographic basins: Olteț, Luncavăț (Niculescu, 2006), Olănești, Cheia, Bistrița-Vilcii (Popescu, 1974), Horezu, Govora, Cerna de Olteț (Răduțoiu, 2008), Stan Valley, Suhăioasa, Cîrstoiu, Sașa, Cioroiu, Plescioara, Mesteacanul, Niculii, Sturșori, Grotului, Izvorul Mare. It is frequently spread from the mountain to the subalpine level, forming a serial vegetation on the lands where forestry exploitations have been made, but also at the edge of the forests, in forest clearings, where there are favorable ecological conditions, based on a well-individualized coenotic nucleus in which the edificator species is *Rubus idaeus* which has a high abundance-dominance (3-5) and a high constancy.

This plant community presents pedogenetic, alimentary, phytopharmaceutical, but also conservative importance.

2. *Spiraeo-Coryletum* Ujv. 1944

(Syntax. Syn.: *Calamagrostio arundinaceae - Spiraeetum ulmifoliae* Resmeriță et Csűrös 1966) is a plant community of succession to

acidophilous beech forests. The germander meadowsweet and common hazel phytocoenoses are spread in the mountain floor, at altitudes between 750-1550 m on rocky slopes, with different exposures, whose inclination is between 20° and 70°. In the Căpățânii Mountains this plant community is found in the Valleys: Luncavăț, Curpenilor, Polovrăgeni, Suhăioasa, Olănești, Otăsău, Govora, Cheia, Bistrița-Vilcii, Olteț, Costești, Stan's Valley and also on the Culmea Tribunalului. It is a succession plant community towards acidophilic beech trees in southern Romania.

The phytocoenoses of this plant community are characterized by a well-established shrub layer, in which, alongside the edifying species, one also encounters: *Rosa pendulina*, *Lonicera nigra*, *Rubus idaeus*, *Sambucus racemosa*. In the grassy layer, some species have a high dominance abundance (3-4) and high constancy: *Calamagrostis arundinacea*, *Luzula luzuloides*, *Veronica urticifolia*, *Poa nemoralis*, *Valeriana tripteris*, *Saxifraga cuneifolia*, *Aplenium trichomanes*, *Polypodium vulgare*, *Selaginella helvetica*.

3. *Calamagrostio arundinaceae-*

Sambucetum racemosae Resmeriță (1970) 1986 (Syntax. Syn.: *Sambucetum racemosae* (Noirf. 1940) Oberd. 1973; *Sambuco-Calamagrostietum arundinaceae* Resmeriță (1970) plant community edifying by red elderberry and bunch grass, is found in the forest clearings in the beech and fir-beech areas. This plant community is found sporadically on soils rich in organic substances, on semi-shady slopes, with an inclination between 15-35°.

In the researched territory, phytocoenoses of this association were identified in the upper basin of the Luncavăț river, in the valleys of the streams Râmești, Blajului, Costești, Stan, Văleanu, Suhăioasa, Culmea cu Larice and also in the upper basin of the Govora and Olănești rivers, at altitudes between 900-1400 m.

In the coenotic structure of this plant community, species characteristic of the *Sambuco-Salicion* alliance of the *Querco-Fagetea* class, of the *Fagetalia* order, participate with high constancy.

In the floristic composition, tree shoots from the initial plant community are also found (Niculescu, 2006). The vegetation coverage is between 80-100%.

II. *Shrubby plant communities established on the banks of streams, mountain springs or on moist and shady valleys in the mountain floor*

This type of shrubby vegetation is also well represented in the Căpățâanii Mountains. Thus, the following plant communities are very widespread in the researched territory:

1. The plant community *Salicetum*

purpureae (Soó 1934 n.n.) Wendelbg-Zelinky 1952 is frequently found in the form of small strips or clumps on the banks of the ravines in the lower montane undergrowth of the Căpățâanii Mountains.

The phytocoenoses of this plant community develop on moist soils, and have a shrubby state dominated by the edifying species *Salix purpurea*, alongside which *Salix fragilis* and *Salix alba* are also found with high constancy. Such phytocoenoses are found in the Luncavățului Valley, in Vaideeni and Horezu, in the Bistriței-Vâlcii Valley, in Costești, Bărbătești and Pietrari de Sus, in the Cernei de Olteț Valley, in Marița, in the Oltețului Valley in Polovragi, in the Govorei Valley, in Stoienesti and in the valleys of the Cheia and Olanești streams. This plant community is characterized by a heterogeneous floristic composition of the grassy layer, in which some species belonging to the *Salicion* and *Alno - Ulmion* alliances, the *Salicetalia purpureae* order and the *Molinio-Arrhenatheretea* class have a high abundance-dominance and a high constancy.

From a syndynamically point of view, the phytocoenoses of the described plant community evolve towards mountain alder forests, but under the pressure of the anthropogenic factor they undergo a process of weeding and ruderalization, which may lead to the development of vegetation characteristic of grasslands from the *Agropyro-Rumicion* alliance.

2. *Salicetum cinereae* Zólyomi 1931

(Syntax. Syn.: *Salici cinereae-Sphagnetum recurvi* (Zóly 1934) Soó 1955); *Calamagrostids lanceolata* Dihoru 1965) plant community edifying by *Salix cinerea* and *Calamagrostis canescens* which settles on alluvial, humid soils with an acidic pH. It is a less widespread woody plant community in the Căpățâanii Mountains, occurring in the middle and upper mountain undergrowth, in the stream basins: Luncavăț, Curpenilor, Sașa, Cioroiu, Niculii, Sturișori,

Izvorul Mare, Cheia, Olteț, Stan Valley and on the Culmea cu Larice (Niculescu, 2006). This plant community is also frequently found on the shady and steep valleys of the Buila-Vânturarița Massif. The phytocoenoses of the Căpățâanii Mountains have a well-individualized cenotic core, along with the edifying species, numerous species characteristic of the *Salicion cinereae* alliance, *Alnion incanae*, but also of the *Alnetalia glutinosae* class are found. The shrub cover is between 70-90%, the grassy layer is poorly developed, *Sphagnum recurvum* being absent in some phytocoenoses or having a low abundance-dominance.

3. The plant community *Salicetum albae*

Issler is not widely distributed in the mountain area. Phytocoenoses of this plant community are found in the Luncavățului Valley, the Râmești Valley, in the localities of Ifrimești and Râmești, but also in the Olănești Valley. Some of the analyzed phytocoenoses are presented in the form of narrow strips. These phytocoenoses are dominated by *Salix alba* and achieve a coverage of 60-85%, with a heterogeneous, well-developed grassy layer formed mainly by species belonging to the *Salicetea purpurea* class and which participate together with the edifying species in the fixation of the alluvial substrate, of the pebbles. With a relatively low constancy, species from the *Molinia-Arrhenatheretea* class are also found, migrated from the contact plant communities. As a result of the high level of soil humidity, a series of meso-hygrophilous and even hygrophilous species also participate in the floristic composition of these phytocoenoses.

4. *Salici purpureae-Myricarietum* Moor

1958 (Figures 1, 2) is a rarely encountered plant community in the Căpățâanii Mountains.

The phytocoenoses of this plant community are found on the floodplain pebbles of the mountain meadows, on alluvial soils in several locations in the upper basin of the Luncavăț at an altitude of 750 m (Niculescu, 2006). In the Căpățâanii Mountains, such phytocoenoses were also found fragmentarily in the Costești Valley and Izvorul Mare (on the northern slope of these mountains). The edifying species of this association are *Salix purpurea* and *Myricaria germanica*. In the floristic composition, a series of characteristic species of *Salicion-elaeagni* and *Salicetalia purpureae* are found, such as: *Salix alba*, *S.*

fragilis, *Mentha longifolia*, *Lysimachia numularia*, *Saponaria officinalis* (Nuță et Niculescu, 2019).



Figure 1. *Salici purpureae-Myricarietum* Moor 1958 plant community in the upper basin of the Luncavăț river Luncavățului

Also present are numerous species belonging to the *Alno-Ulmion* alliance, including *Alnus incana*, *Alnus glutinosa*, *Stellaria nemorum*, *Impatiens noli-tangere*, *Aegopodium podagraria*. The presence of species from this alliance indicates that this group is evolving towards phytocoenoses built by *Alnus incana* (Niculescu, 2006; 2015).



Figure 2. *Salici purpureae-Myricarietum* Moor 1958 plant community in the Costești Valley

5. *Saliceto silesiacae-Alnetum alnobetulae* Colic et al. 1962 (Syntax. Syn.: *Alnetum viridis* auct roman) plant community includes the mountain alder thickets that are found along shady valleys, on steep slopes, in rocky and humid places. In the Căpățanii Mountains, this plant community is widespread in the upper basins of most valleys in the mountain and

subalpine levels, often at the border of spruce forests or mixed forests with fir and beech. The plant community built by Silesian willow and Green alder was identified in the Luncavăț Basin (Niculescu, 2006; 2016), Cernei de Olteț (Răduțoiu, 2008), Bistriței-Vîlcii (Popescu, 1974). Following the research we conducted in the Căpățanii Mountains, this plant community was also identified in the Olteț, Govorei, Olănești, Cheia, Suhăioasa, Izvorul Mare basins, on the shady and humid valleys, especially with western and northern exposure, in the Buila - Vânturarița Massif. Although this association presents the most extensive development in the subalpine level, in the upper Luncavăț basin, such phytocoenoses were also frequently encountered in the mountain level. Thus, in the upper Luncavăț basin, this plant community has a wide amplitude, meeting in the Curpenilor Valley, in the area of Lacul Ursu, Stâna Balota and Culmea cu Larice, at altitudes between 900-1800 m. They settle on slopes with an inclination between 10-35° and a generally western exposure and have a predominantly mesophilic, microthermal and acidoneutrophilic character (Niculescu, 2006). From the Cerna de Olteț stream basin, it was collected from the Recea Valley, the Țiganului River, the Strâmtori Hill and the Marița River Valley (Răduțoiu, 2008).

The coenotic nucleus includes, in addition to the two edifying species, a series of weed species belonging to the *Adenostyilion alliariae* alliance and the *Betulo-Adenostyletea* class: *Doronicum austriacum*, *Leucanthemum waldsteini*, *Senecio germanicus*, *Valeriana tripteris*, *Ranunculus platanifolius*, *Viola biflora*. Considering that the phytocoenoses of this plant community are located in the immediate vicinity of spruce forests, a series of species from neighboring spruces are also present in the floristic structure, such as: *Picea abies*, *Vaccinium myrtillus*, *Rubus hirtus*, *Viola reinchenbachiana*, *Veronica urticifolia*. This plant community is of particular importance in soil fixation, and intervenes in regulating water runoff from melting snow (Niculescu, 2006).

III. *Mountain deciduous shrubs*

Within this category, we have included two less researched plant communities in Romania and which were cited from few places in the country,

from the Căpățâni Mountains being cited only from the upper Luncavăț basin.

1. *Ruboplicatae-Prunetum spinosa* Web. 1974 em. Oberd. 1992 (Syntax. Syn.: *Ruboplicatae-Coryletum avellanae* Oberd. 1957) plant community has been little researched in our country, being cited only from the Crișului Gorge. It was cited for the first time from Oltenia, from the upper Luncavăț basin (Niculescu, 2006). Thus, in the studied territory the plant community is found in the lower mountain substratum, preferring especially humid places, at the edge of forests. Phytocoenoses of this association were analyzed on V. Râmestî, in the localities: Ifrimești, Râmestî and Bălănești (Niculescu, 2006). From an ecological point of view the analyzed phytocoenoses have a strong mesophilic, micromesothermic and euryonic character.

From a structural point of view, alongside the edifying species - *Rubus plicatus*, *Prunus spinosa* and *Corylus avellana*, the following species are also found with high abundance-dominance and high constancy: *Ligustrum vulgare*, *Euonymus europaeus*, *E. verrucosa*, *Cornus sanguinea*, *Clematis vitalba*, *Crataegus monogyna*, *Sambucus nigra*, *Urtica dioica*, *Brachypodium sylvaticum*, *Veronica chamaedrys*, *Geum urbanum*, *Campanula rapunculoides*, *Astragalus glycyphyllos*, *Prunella vulgaris*, *Euphorbia amygdaloides*.

2. The plant community *Pruno spinosae-Ligustretum vulgare* Tx. 1952 (Syntax. Syn.: *Euonymo-Prunetum spinosae* (Hueck 1931) Tx. 1952 em. Pass. et Hofm. 1968, *Pteridio-Crataegetum monogynae* Rațiu et Gergely 1970, *Carpino-Prunetum* Tx. 1952, *Rosetum rhamnosum* sensu Borza 1959) (Figure 3) like the previous plant community, it represents a less researched coenotaxonomic group of shrubs in our country. This plant community is edified up by *Ligustrum vulgare* and *Prunus spinosa* and was cited for the first time from Oltenia, from the Căpățâni Mountains (Niculescu, 2006; 2020). Following the studies carried out, the floristic structure and ecology of the phytocoenoses of this plant community on the Râmestî Valley in the Râmestî and Bălănești localities were described. The phytocoenoses are established in humid places, on nutrient-rich soils, on the edges of roads or forests, on slopes

with an inclination between 5-30° and generally facing west.

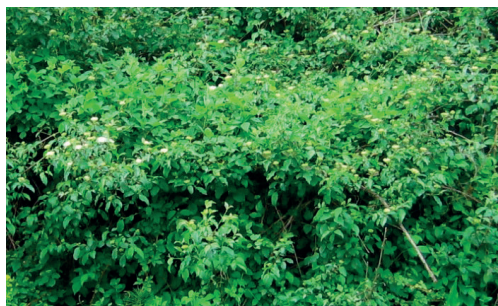


Figure 3. *Pruno spinosae-Ligustretum vulgare* Tx. 1952 plant community in the Râmestî Valley

The coenotic nucleus is well individualized, characteristic of marginal forest vegetation and includes a series of species belonging to the *Crataego-Prunetea* class and the *Prunetalia spinosae* order: *Euonymus europaea*, *Cornus sanguinea*, *Rosa canina*, *Clematis vitalba*, *Crataegus monogyna*, *Clinopodium vulgare*, *Glechoma hederacea*, *Veronica chamaedrys*, *Origanum vulgare*. At the same time, the species that differentiate the *Carpino-Prunion* alliance - *Dactylis glomerata*, *Geum urbanum*, *Urtica dioica* frequently appear in some phytocoenoses. Sometimes the phytocoenoses of this plant community form the hedges at the border of some localities in the upper basin of the Luncavăț river and the Bistrița-Vilcea Valley, on heat-loving and richly alkaline soils. The plant community is of particular importance from a pedogenetic and conservation point of view.

IV. Low shrubs from the montane and subalpine levels

This group of plant communities groups together low bushes from the Căpățâni Mountains in which camephytes and nanophanerophytes species predominate and have a heterogeneous floristic structure because in this ecotonal area there is the influence of several different coenotaxonomic vegetation units.

1. The plant community *Campanulo abietinae - Juniperetum alpinae* (Buia et al. 1962) Boșcaiu 1971 (Syntax. Syn.: *Juniperetum nanae* Soó 1928, *Juniperetum sibiricae* Rațiu 1965) is dominated by dwarf juniper, and is

frequently found in the upper montane substratum and the subalpine stage, on slightly inclined and semi-sunny slopes. This plant community has a wide distribution in almost all basins of the Căpățâni Mountains: the upper basin of the Luncavăț river, (Șaua Funicelul, Mountains Piatra Roșie, Ursulețul, Dârjale, Cășăriei, La Colțul Marginii, under Balota and Căpățâna Peaks), Oltețului basin (Curmătura Oltețului, Boul Peak), Bistrița-Vîlcii basin (Văleanu, Zonoaga and Zmeurăț Peaks, Curmătura Rodeanu) as well as on the northern slope of the Căpățâni Mountains (Piatra Târnovului, Vârful lui Stan, Culmea Durducului), the Olănești basin (Folea Mountain) and the Cheia basin (Oale Mountain). From the point of view of the coenotic structure, along with the edifying species *Juniperus communis* ssp. *alpina* and *Campanula patula* ssp. *abietina*, the following species participate with high constancy: *Vaccinium myrtillus*, *V. vitis-idaea*, *Chamaenerion angustifolium*, *Rubus idaeus*, *Luzula luzuloides*, *Senecio ovatus*, *Bruckenthalia spiculifolia*, *Rhododendron myrtifolium*, *Homogyne alpina*, *Deschampsia flexuosa*, *Cetraria islandica*.

The phytocoenoses of this plant group are of particular importance from a conservative but also pedogenetic point of view, and in unfavorable ecological conditions they can evolve into *Nardus stricta* or *Festuca nigrescens* meadows.

2. *Campanulo abietinae-Vaccinietum myrtilli* (Buia et al. 1962) Boșcaiu 1971 (Syntax. Syn.: *Vaccinietum myrtilli* Buia et al. 1962, *Junceto trifidi-Vaccinietum* Resmeriță 1976) plant community (Figure 4) is widely distributed in the Căpățâni Mountains, occurring in the montane and subalpine layers. The plant community edified up by the blueberry is found at the upper limit of the spruces, on sunny and semi-sunny slopes in all hydrographic basins of the Căpățâni Mountains, including the Buila-Vânturarița Massif, which is an integral part of these mountains. In the upper basin of the Luncavăț river, phytocoenoses of this plant community occupy large areas in the Șaua Funicelul, on Piatra Roșie Mountain, Dârjale Mountain, Ursulețul Mountain, Blajului Valley and Izvorul Sec. These thickets have developed greatly on the cleared areas of the border forests. In the Olteț basin, the plant community is found

in Curmătura Oltețului, on the Boul, Turcinu and Negoveanu Peaks, on the valleys of the Datcului, Curmăturii, Urlieșul, Dracului streams. In the Cerna de Olteț basin, this group of species occupies large areas on Mount Pleșa, Zăvidanu, Corșor, Senănrile, Milescu. From this basin, the plant community was cited from the Buciumu, Corșoru and Beleoaia Peaks (Răduțoiu, 2008). In the floristic composition of these phytocoenoses, along with *Vaccinium myrtillus* and *Campanula patula* ssp. *abietina*, the following species are also frequently found: *Vaccinium vitis-idaea*, *Deschampsia flexuosa*, *Bruckenthalia spiculifolia*, *Rhododendron myrtifolium*, *Homogyne alpina*, *Cetraria islandica*.

From a syndynamically point of view, we can say that blueberry phytocoenoses settle in spruce forest clearings and can evolve into nardete. They are of particular importance from a conservative, economic and eco-pedogenetic point of view.



Figure 4. *Campanulo abietinae-Vaccinietum myrtilli* (Buia et al. 1962) Boșcaiu 1971 in the Căpățâni Mountains

3. *Junipero alpinae-Bruckenthalietum spiculifoliae* Horv. 1936 (Syntax. Syn.: *Juniperetum intermediae* Nyár. 1956 n.n., *Bruckenthalietum spiculifoliae* Buia et al. 1962 p.p., ass. with *Bruckenthalia spiculifolia* and *Antennaria dioica* Șerbănescu 1961, ass. with *Nardus stricta* and *Bruckenthalia spiculifolia*) plant community it is less widespread in the Căpățâni Mountains, the upper basin of the Luncavăț river, Bistrița-Vîlcii, Otăsău, Olteț, Repede, Cărpănoasa, Horezu, Bacea, Roșu and Funicelu Valleys. Important areas of these plant communities are also found in the Buila-Vânturarița Massif, especially on Vânturarița

Mare, Cumătura Builei and Curmătura Oale where they have a very good development, *Bruckenthalia spiculifolia* is almost absent and there is a strong intercalation of the community and the steep built-up plant community of dwarf mountain pine. In the upper basin of Luncavăț river, the phytocoenoses of this plant community are widely spread, meeting in the following resorts: Piatra Roșie, Balota, Dârlăla, Cășăriei Mountains, Șaua Funicelul, Ursu and Căpățâna Sheepfolds (Figure 5) (Niculescu, 2006).

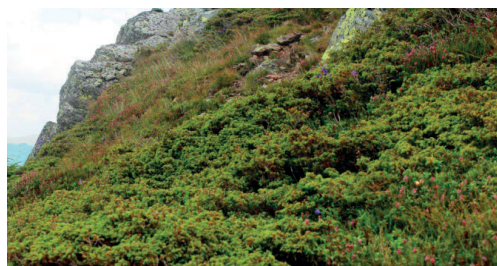


Figure 5. *Junipero alpinae-Bruckenthalietum spiculifoliae* Horv. 1936 on the Balota Mountain

From the Cerna de Olteț basin this plant community was classified as *Antenarion dioicae-Bruckenthalietum spiculifoliae* I. Șerbănescu 1961 from the Corșoru, Beleoaia, Buciumu, La Nedei Peaks at altitudes between 1600-1850 m (Răduțoiu, 2008).

The phytocoenoses of these plant communities are edified by *Juniperus communis* ssp. *alpina* and *Bruckenthalia spiculifolia* and have a general coverage between 80-100%. In the floristic composition of these phytocoenoses, in a fairly large number of cormophytes species, of which a high constancy or in the following species: *Campanula patula* ssp. *abietina*, *Vaccinium myrtillus*, *V. vitis-idaea*, *Potentilla aurea* ssp. *chrysocrapeda*, *Homogyne alpina*, *Nardus stricta*, *Descampsia flexuosa*, *Pulsatilla alba*, *Geum montanum*, *Genista tinctoria* ssp. *oligosperma*, *Antennaria dioica*. From a synanthropic point of view, these phytocoenoses are similar to the *Nardus stricta* meadows and this plant community plays a very important role from a conservative and eco-pedogenetic point of view.

4. *Cetrario islandicae-Loiseleurietum procumbentis* Br.-Bl. et. al 1939 (Syntax. Syn.: *Loiseleurietum procumbentis* Rüb. 1931) plant

community (Figure 6) is edified by the species popularly called alpine azalea and true iceland lichen. *Loiseleuria procumbens* (L.) Desv. (Syn. *Kalmia procumbens* (L.) Gift & Kron & P. F. Stevens ex Galasso, Banfi & F. Conti; *Azalea procumbens* L.

Chamaecistus procumbens (L.) Kuntze) in association with *Cetraria islandica* (L.) Ach. it develops on the ridges and gentle slopes of high peaks in the subalpine zone, exposed to cold winds, at altitudes between 1900 m and 2050 m (Niculescu, 2003; 2006). The largest areas of this plant community were found in the upper basin of Luncavăț river, on the Balota, Căpățâna, Ursu Peaks and Curmătura Funicelul (Niculescu, 2003; 2006).

In the Cerna de Olteț basin, such phytocoenoses were identified on small areas on two mountain peaks: Buciumu and Corșoru (Răduțoiu, 2008). The plant community was also cited from the Bistrița-Vâlcii basin, where it also occupies areas on high, windy plateaus with skeletal, superficial soils, poor in nutrients.

From an ecological point of view, these phytocoenoses have a strong mesophyle, microthermic, criophyle and acidophyle character. The coenotic nucleus is dominated by this dwarf azalea, with creeping stems. The floristic structure of the phytocoenoses includes a small number of species, due to the harsh ecological conditions, of which, in addition to the species characteristic of the alliance, we can mention: *Phyteuma confusum*, *Campanula alpina*, *Juncus trifidus*, *Primula minima*, *Agrostis rupestris*, *Festuca airoides*, *Hieracium alpinum* etc. The degree of vegetation coverage is between 75% and 100%.



Figure 6. *Cetrario islandicae-Loiseleurietum procumbentis* Br.-Bl. et. al 1939 on the Căpățâna Peak

5. The plant community *Cetrario islandicae-Vaccinietum gaultherioidis* Boşcaiu 1971 prefers the strongly windy ridges and plateaus on the tops of the mountains. This plant community is found in the following hydrographic basins: Luncavăț, Olteț, Bistrița-Vilcii, Cerenei de Olteț, Olanești, Cheia, Roșu, Repedea, Huluzu, Funicelu, Groșetu, Cărpănoasa, Grotului. In the upper basin of Luncavăț, these low bushes are found on Mount Piatra Roșie, Căpățâna, on the Balota, Căpățâna, Coșana and Ursu Peaks, at altitudes between 1810 m and 2100 m, growing on skeletal, strongly podzolic soils (Niculescu, 2003; 2006). In the Cerna de Olteț basin, this association is present on the ridges of three mountain peaks: Corșoru, La Nedei and Buciumu, at variable altitudes between 1800 and 2000 m (Răduțoiu, 2008). The phytocenoses marked by good development and a well-individualized species nucleus are also found in the Buila-Vânturarița Massif.

From an ecological point of view, the phytocenoses of this plant community are characterized by the predominance of mesophyle, microthermic and acidophyle species. The floristic structure of these phytocenoses includes, along with the two edifying species, a series of subalpine and alpine species: *Loiseleuria procumbens*, *Thamnia vermicularis*, *Agrostis rupestris*, *Pulsatilla alba*, *Homogyne alpina*, *Carex curvula*, *Hieracium alpinum*, *Campanula alpina* etc. This plant community plays a very important role in soil protection. This plant community is also of particular importance from a conservation point of view, also edifying the 4060 Alpine and Boreal heaths natural habitat.

6. *Rhododendro myrtifolii-Vaccinietum* Borza (1955) 1959 em. Boşcaiu 1971 (Figure 7) is a plant community edified by carpathian rhododendron and bilberry it is quite widespread in the Căpățâni Mountains, having a particularly important role from a floristic, ecological and especially conservative point of view. In the upper basin of the Luncavăț river, such thickets occupy important areas and are spread in the subalpine layer, occupying relatively large areas on the Balota, Căpățâna, Coșana, Ursu Peaks, at Izvorul Sec and in the Funicelul Saddle. Also important areas of this plant community are found in the Bistrița Vilcii

basin (Popescu, 1974), Olețului, on Piatra Târnovului, on the Nedei Peaks, Negoveanu, Turcinu, Boul, on the Roșu, Funicelu, Groșetu, Cărpănoasa, Căprăreasa streams. The phytocenoses of this plant community have a distinct floristic structure, characteristic of the slopes of the subalpine layer, with humic-silicate, superficial, nutrient-poor and highly acidic soils. Among the species that participate in the floristic composition, the following are frequently encountered: *Vaccinium gaultherioides*, *V. myrtillus*, *Juniperus communis* ssp. *alpina*, *Homogyne alpina*, *Agrostis rupestris*, *Juncus trifidus*, *Potentilla aurea* ssp. *Chrysocraspeda*, *Hypericum richeri* ssp. *grisebachii*, *Campanula serrata*. In the upper basin of the Luncavăț river, these plant communities have a secondary character. Those established on the Căpățâna and Ursu Peaks can evolve into meadows of *Festuca airoides* or *Juncus trifidus* but also into the plant community edified up by *Pinus mugo*, thus contributing to the conservation of the natural heritage in the area. This group of plants has a special importance from a conservative, phytopharmaceutical, eco-pedological, economic point of view.



Figure 7. *Rhododendro myrtifolii-Vaccinietum* Borza (1955) 1959 em. Boşcaiu 1971 in the Șaua Funicelu

7. *Juniperetum sabinae* Csűrös 1958 is a plant community found on sunny limestone cliffs, on very steep slopes of the Vânturarița-Buila Massif, on the Costești Gorges, the Cheia Valleys and the Olănești Valleys. The phytocenoses that build this plant community have the appearance of elongated bushes with a maximum shrub layer coverage of 85%. In the floristic structure of the phytocenoses, a small

number of cormophyte species are found, characteristic of the rocky substrate of the Southern Carpathians, many of which belong to the *Sesleritalia* class. This plant community is of great importance from a conservation point of view. The edifying species has a special role against the erosion of the substrate on which it develops. Also, in the floristic composition, many rare and endemic species are found.

V. *Plant communities built by dwarf mountain pine*

1. *Rhododendro myrtifolii*-*Pinetum mugo* Coldea 1985 (Syntax. Syn.: *Pinetum mugo carpaticum* auct. roman) is a plant community spread in the subalpine storey of the Căpățâanii Mountains (Figure 8), at the upper limit of spruces, on gentle slopes but also on steep slopes, occupying the largest areas in the upper basin of the Luncavăț river. *Pinus mugo* forms thick and difficult to cross underwoods, at an altitude between 1,650 and 1,950 m.

In the upper basin of the Luncavăț river we find it under Balota Peak, Căpățâna Peak, Șaua Funicelu, Izvorul Sec (Niculescu, 2003; 2006). The shrubby phytocoenoses built up by *Pinus mugo* have a more restricted area in the researched territory. They are located at variable altitudes, between 1700-1900 m on 2 mountain peaks: La Nedei and Beleoia (Răduțoiu, 2008).



Figure 8. *Rhododendro myrtifolii*-*Pinetum mugo* Coldea 1985 in the Căpățâanii Peak

In the Căpățâanii Mountains, this plant community occupies relatively large areas and in the Bistrița-Vilcii basin (Popescu, 1974). At the same time, it is found on Tîrnovul Mare, Piatra Târnovului, in the Buila-Vânturarița Massif (on Vânturarița Mare, Stogu, Creasta Builei, Curmătura Builei, Curmătura Oale) especially among the limestone rocks. In the

upper basin of the Luncavăț river, phytocoenoses edified by *Pinus mugo* are also found in the upper mountain floor, descending under the spruce forests, up to an altitude of approx. 1400 m.

This was observed in the summer of 2003, in the place called Izvorul Sec (Niculescu, 2006). Many years ago, during the communist period, there was a desire to intensify pastoral activity in the mountain area, so an increasingly larger pasture area was needed. In order to increase this area for expansion, intense actions of burning and deforestation of junipers in the Căpățâanii Mountains took place.

This led to the destruction or considerable reduction of the areas of the juniper habitat in this area, but also in other mountainous areas in Romania. The clearing of the junipers in the Funicelu Saddle and at Izvorul Sec was done in the form of transverse strips (Figure 9), which explains their current appearance (Niculescu, 2006).



Figure 9. *Pinus mugo* phytocoenoses in the form of bands in the Șaua Funicelu

In the composition of the shrub layer, along with the dominant species *Pinus mugo*, such as: *Sorbus aucuparia*, *Juniperus communis* ssp. *alpina*, *Picea abies* also participate. In the grass layer, the following species are frequently found: *Vaccinium myrtillus*, *V. vitis-idaea*, *Soldanella hungarica* ssp. *major*, *Deschampsia flexuosa*, *Homogyne alpina*, *Bruckenthalia spiculifolia*.

Following deforestation, these phytocoenoses can evolve into meadows of *Nardus stricta* or *Festuca nigrescens*. In some stations established following the burning of junipers, the establishment of phytocoenoses of mountain peony with blueberry was observed.

In the Căpățâni Mountains, this group of plants is interspersed especially with phytocoenoses of *Juniperus communis* ssp. *alpina* (Figure 10).



Figure 10. Intercalation of *Juniperus communis* ssp. *alpina* and *Pinus mugo* phytocoenoses on Căpățâna Peak

From a conservation point of view, most of the shrubby plant communities described in the Căpățâni Mountains constitute Natura 2000 sites of community or priority interest as follows:

1. 4060 - Alpine and Boreal heaths (CLAS. PAL.: 31.4) habitat (Gafta and Mountford, coord., 2008) in the Căpățâni Mountains is edified by the following plant communities:

- *Cetrario-Loiseleurietum procumbentis* Br.-Bl. et al. 1939;
- *Rhododendro myrtifolii-Vaccinietum* Borza (1955) 1959 em. Boșcaiu 1971;
- *Junipero-Bruckenthalietum* Horvat 1936;
- *Cetrario- Vaccinietum gaultherioidis* Boșcaiu 1971;
- *Campanulo abietinae-Vaccinietum* (Buia et al. 1962) Boșcaiu 1971;
- *Campanulo abietinae-Juniperetum* Simon 1966;
- *Juniperetum sabinæ* Csűrös 1958;

2. 4070* Bushes with *Pinus mugo* and *Rhododendron hirsutum* (Mugo-*Rhododendretum hirsute* habitat (CLAS. PAL.: 31.5) Gafta and Mountford, coord., 2008) in the Căpățâni Mountains is edified by the following plant community:

- *Rhododendro myrtifolii-Pinetum mugo* Coldea 1985 (Syntax. Syn.: *Pinetum mugo carpaticum* auct. roman).

3. 3230 Alpine rivers and their ligneous vegetation with *Myricaria germanica* habitat (CLAS. PAL.: 24.223 x 44.111) (Gafta and Mountford, coord., 2008) in the Căpățâni Mountains is edified by the following plant community:

- *Salici purpureae-Myricarietum* Moor 1958.

4. 4080 Sub-Arctic *Salix* spp. Scrub (CLAS. PAL.: 31.6211, 31.6214, 31.6215, 31.622) (Gafta and Mountford, coord., 2008) in the Căpățâni Mountains is edified by the following plant community:

- *Salici-Alnetum viridis* Čolić et al. 1962

5. 40A0* Subcontinental peri-Pannonic scrub (CLAS. PAL.: 31.8B12p, 31.8B13, 31.8B14, 31.8B3p) habitat (Gafta and Mountford, coord., 2008) in the Căpățâni Mountains is edified by the following plant communities:

- *Pruno spinosae-Ligustretum vulgare* Tx. 1952 (Syntax. Syn.: *Euonymo-Prunetum spinosae* (Hueck 1931) Tx. 1952 em. Pass. et Hofm. 1968, *Pteridio-Crataegetum monogyne* Rațiu et Gergely 1970, *Carpino-Prunetum* Tx. 1952, *Rosetum rhamnosum sensu* Borza 1959);
- *Spiraeo-Coryletum* Ujv. 1944 (Syntax. Syn.: *Calamagrostio arundinaceae – Spiraeetum ulmifoliae* Resmeriță et Csűrös 1966).

6. 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) habitat (CLAS. PAL.: 44.3, 44.2 și 44.13) (Gafta and Mountford, coord., 2008) in the Căpățâni Mountains is edified by the following plant community:

- *Salicetum albae* Issler.

CONCLUSIONS

The shrub vegetation in the Căpățâni Mountains is very diverse, having a complex structure and often creating natural habitats of community interest or priority within protected natural areas.

In this paper we wanted to present a synthesis of the shrubby plant communities spread across two large montane and subalpine vegetation levels, on substrates and in very varied ecological conditions, each type with its own characteristics and a well-individualized cenotic core.

The described communities have a major conservative role, they build protected habitats

that are particularly important for the Romanian Carpathians.

At the same time, the described plant communities build a number of 6 Natura 2000 habitats of community or priority importance, spread across the montane and subalpine levels on smaller or larger areas, having a very varied and rich floristic structure characteristic of the Romanian Carpathians. The geobotanical study of the shrub vegetation in the Căpățanii Mountains, carried out over a long period of time, starting in 1997, plays a particularly important role in understanding the chorology, floristic and ecological complexity of this type of vegetation, in order to ensure a correct, sustainable conservative management in close correlation with the current eco-pedo-climatic conditions that are constantly changing and have a very great influence on the development and evolution of the entire vegetation cover and, consequently, of the entire biodiversity.

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