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TAXONOMIC AND ECOLOGIC STRUCTURE OF COMMUNITIES OF EDAPHIC ALGAE FROM THE AGROPHYTOCENOSES OF THE NORTHERN DISTRICTS OF MOLDOVA

ŞALARU VICTOR*, TROFIM ALINA*,
MELNICIUC CRISTINA*, DONŢU NATALIA*

Abstract: In this work was to establish the taxonomic and ecologic structure of algocenoses from different agricultural cultures and the conservation „in situ” through the separation in pure cultures of trunks of nitrogen fixation algae that can be used in the process of soil fertility increase, as a source of nitrogen. It is worth studying the ecologic structure of algae communities, reflected by vital forms.

Key words: edaphic algae, agrophytocenoses, ecobiomorphs.

Introduction

In the last years, edaphic algae are the object of study of a number of specialists because these organisms have an important role in stimulating soil fertility [1, 2, 3]. The study of edaphic algae is determined by their degree of participation in soil processes (the circuit of biogenic substances), in the creation of relations between different representatives of the micro-flora and superior plants. Thus, it is possible to diagnose the processes of soil creation and regulation of the agrophytocenosis productivity. On the other hand, based on the taxonomic structure and ecologic structure of the algoflora, especially with the help of some specific species of algae from the green algae phyla, cyanophyta or xantophyta that serve as test-cultures, we can appreciate the changes that occur under the influence of different factors, including the anthropogenic ones [1].

The main purpose of this work was to establish the taxonomic and ecologic structure of algocenoses from different agricultural cultures and the conservation „in situ” through the separation in pure cultures of trunks of nitrogen fixation algae that can be used in the process of soil fertility increase, as a source of nitrogen.

Materials and methods

The edaphic algae communities have been analyzed from samples collected in 2007 from the chernozem occupied by different agricultural cultures: wheat, barley, sunflower, oats, sugar beet, corn etc. from the northern districts of Moldova. The collection and processing of soil samples have been carried out using the methods accepted in modern algology [2].

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Results and discussions

The investigations made on algae communities have shown a varied algoflora, both by the taxonomic structure and by the biologic particularities of species, which includes a total of 63 species and genera of algae from 10 families and 22 genera. The largest number of algae has been detected on agricultural lands occupied by barley, sunflower and corn cultures, and the minimum value has been identified in wheat and sugar beet cultures. If we speak about the structure of phyla, the development of green-blue algae is predominant in all the cultures.

The second place by the variety of species is held by bacillariophyta that vegetate actively in the soil occupied by barley and potato cultures. The relatively high diversity is probably due to the use of water from reservoirs for irrigation. Thus, these two groups make up from the number of algae.

The most sensible are the xantophyta algae that are present only in the fields of wheat and soya, which shows the lack of pollution with chemical substances (pesticides, herbicides, etc.). The *Euglenophyta* have disappeared from the list of species, which proves that they are not typical of algocenoses from the soil (tab. 1).

Table 1

Taxonomic structure of algae communities that vegetate the agrocenoses in the north of Moldova.

Fields with cultures Groups of algae	Potato	Soya	Sunflower	Corn	Barley	Wheat	Sugar beet	Lucern
Cyanophyta	11	12	15	13	20	7	7	12
Chlorophyta	1	-	1	1	2	1	3	1
Xantophyta	-	1	-	-	-	2	-	-
Bacilariophyta	2	2	1	2	5	2	-	2
Euglenophyta	-	-	-	-	-	-	-	-
Total no. of sp.	14	15	17	16	27	12	10	15

Data from the previous table on the distribution of species by phyla show that the established laws are generally maintained:
Cyanophyta (46) – *Bacilariophyta(6)* – *Xantophyta (3)* – *Chlorophyta (8)* — *Euglenophyta* (missing). The field with sunflower culture is predominantly occupied by cyanophyta, soya has two species of diatom from the *Navicula* variety, as compared to algocenosis from the wheat culture that includes all the representatives of phyla (tab. 1), a proof of the optimal conditions for the development of edaphic algae.

By comparing the structure of predominant species in cultivated crops and non-cultivated crops, we can see that there are differences. For instance, agrocenoses with cultivated crops are dominated by *Phormidium* species (*Ph. molie*, *Ph. jadinianum*, *Ph. foveolarum*) and *Nostoc*, the non-cultivated crops are dominated by *Phormidium* species and by *Lyngbia* species (*L. cryptovaginata*, *L. attenuata*, *L. martensiana*), the intensive development creates a gelatinous film on the soil surface. Thus, the action of mechanic soil processing creates unstable and diverse conditions, creating preconditions for the development of algae species of different groups: *Phormydium*, *Oscilatoria*, *Nostoc*, *Cylindrospemum*, *Navicula*, *Hantzchia*, *Symploca* etc.

It is also worth mentioning that species of nitrogen fixation algae that exercise an obvious action on the balance of nitrogen from the soil that is required for the growth of superior plants. The presence of a sufficient number of species is a proof of natural soil fertility. Some trunks of species have been selected in pure cultures: from the soya field - *Nostoc* sp., *Cylindrospermum* sp. and from the sunflower field - *Nostoc punctiforme* (Quitz), that develop intensely on different nutritive media and fix to a large extent the free nitrogen in atmosphere to be then proposed as sources of enrichment of the soil with nitrogen with a view to increase its fertility.

It is worth studying the ecologic structure of algae communities, reflected by vital forms. The distribution of algae by ecobiomorphs is represented in figure 1.

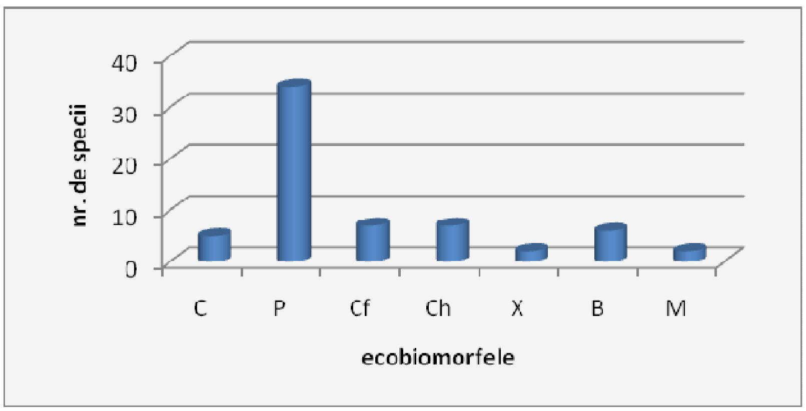

Fig. l. Distribution of algae from the agrocenoses of the northern region of Moldova by ecobiomorphs.

A specific particularity of agrophytocenoses is the full predominance of P forms making up 80% and are represented by *Oscillatoria, Phormidium, Symploca şi Lyngbya* genera that are found in all the agricultural cultures.

An important role of the ecologic state of soils is usually held by xantophyta algae that represent species of algae resistant to shadow, but sensible to draught and extreme temperatures. The most typical for the studied agrocenoses are the species *Chlorellidium tetrabotrix*, *Chlorocloster terrestris.* The nitrogen fixation species from *Nostoc, Anabena, Cylindrospermum* genera are close to this group and are joined in ecobiomorph. Cf. Overall, these forms are represented by 7 species that make up about 11% of the total number of species, a proof of natural soil fertility.

Conclusion

The complex analysis of edaphic algoflora from agrocenoses has demonstrated that specific environment conditions are created in these soils, in relation to the use of irrational agricultural technologies. These conditions are reflected in the change of the structure of algae group species and in the modification of the relation between the main phyla of algae. These are the reasons for the number of green and blue algae and the considerable reduction of the diversity of *xantophyta* algae in most of the cultures.

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TAXONOMIC DIVERSITY AND THE ROLE OF ALGAEFLORA FOR BIOLOGICAL DEPURATION OF WATERS FROM RIVER COGÂLNIC (R. MOLDOVA)

ŞALARU VICTOR*, TROFIM ALINA*, ŞALARU VASILE*

Abstract: During 2004-2005 there were performed studies regarding the taxonomic structure of the algaeflora in river Cogâlnic in order to point out the role of the algae during the process of water quality improvement and the role of the indicator of the most representative species. River Cogâlnic, or Cunduc, starts from nearby village Iurceni, district Nisporeni and flows into lake Sasac, and runs for a distance of 243 km. Decrease of the analyzed water quality from the river is caused by the sewerage waters from different sectors from town Hinceshti and Cimishlia that are directed into the river without any depuration. We've studied about 118 samples in which we've discovered about 382 species and intraspecific taxonomic units of algae of the following types: *Cyanophyta* -73, *Euglenophyta*-75, *Chlorophyta*-111, *Xantophyta*-3, *Bacillariophyta*-118 and *Chrysophyta*-2. Mass development of the euglena within Colgalnic river, among which are the following types of species *Euglena*-26, *Trachelomonas*-14 and *Phacus*-13, demonstrate a high level of trophicity in water. Among the chloride algae predominate the following species *Scenedesmus*-21, and from cyanophyta species predominates *Oscillatoria*-23. The high taxonomic level of the bacillariophyta algae is determined by species as *Navicula*-27, *Nitzschia*-24 and *Surirella*-16. Most of species refer to categories β and β-α , demonstrating a high level of water pollution. This fact speaks about the high concentration of nitrogen and phosphor compounds in water. It was demonstrated that as far as we go from the places were the sewerage waters flow into the river, the excessive quantities of biological elements decrease clearly. Also, go down the quantity of bicarbonates and oxidizers. Numeric growth of the algae is nothing else but a positive role for water depuration.

Key words: algaeflora, phytoplankton, taxonomy, depuration, pollution.

Introduction

During recent decades, small rivers from Republic of Moldova became significant reservoirs of different residual waters. As a result there takes place considerable modifications within the hydro chemical composition of the water and of the algae community. Monitoring studies of the current ecological state of facts of the surface waters continue and demonstrate a high level of water pollution determined by increase of the quantity of ammonium ions, nitrites, nitrates, phosphates, phenols, microelements and of the petrol compounds [1, 3, 4, 6, 7, 8, 9]. Under the influence of the antropical factors there takes place redistribution, concentration and migration, first of all of the hydrobionts.

This phenomenon leads to taxonomic restructuring in algaecenosis phytoplankton, a fact also stated by other authors, too. [4, 5, 10, 11, 12]. Algae, as units that produce the primary organic substance, play an important factor for existence of the living organisms from the aquatic and ground ecosystems. On the basis of the photosynthesis and respiration, algae contribute to the maintenance of the oxygen balance in water and while assimilating the polluted substances contributes to hydro chemical balance of the water and lead to its biological depuration [4, 10, 11].

River Cogâlnic, or Cunduc is a small river which starts from nearby village

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Iurceni, district Nisporeni and runs for about 243 km and flows into the North part of lake Sasac, situated in Ukraine is also influenced by the actions of the antropic factor.

Degradation of the water qualities of the river is mainly caused by the sewerage waters from industrial, agricultural sectors, as well as from blocks of building ands houses. Because of this, the pollution level still remains quite high, the water quality is of class IV (pure quality) – V (polluted) [1, 7, 9]. Taking into consideration the respective situation there appears the necessity to study the taxonomic structure of the algaeflora of the Cogalnic river in order to determine the diversity of the species from algaecenosis and determine their role in the phytoamelioration process of the river waters.

Materials and methods

In order to determine the taxonomic structure of the phytoplankton in river Cogâlnic and of its two effluents within the area of town Cimishlia, during years 2004 - 2005 there were collected and analyzed 118 samples of plankton algae according to the methodology applied in modern algaeology. The segment of the studied river comprises town Hanceshti, village Gradishte, 6 collection points in town Cimishlia, were are included samples from the effluents before entering and leaving the limits of the town and collection point, village Bogdanovca. The materials were analyzed in the Algological Laboratory of the State University of Moldova using microscope Ergaval being preserved and partially alive. At the same time there was performed the chemical analyses of the river waters within the laboratory of the Republic center for agrochemical maintains applying the methods from gravimetric, photocolitmetric, complexometric etc., hydrochemistry examination of the results has led to discovery of the biological depuration process of the water [2].

Results and discussions

The taxonomy of the studied phytoplankton algaecenosis is conditioned by the organoleptical, hydrochemical characteristics and the speed with which the water of the rivers is running. The high level of mineralization, being over the limit 2-3 times and the low running speed lead to existence and development of halophyte forms specific to stagnant waters or to those with a very small running (*Caloneis amphisbaena, Navicula rhinchocephala, N. cryptocephala, N. pygmaea, Nitzschia hungarica, N. tryblionella, N. frustulum, Cymbella prostrata Oscillatoria amphibia, O. animalis, O. agardhii, Spirulina subtilissima*) and of the alcofile forms: *Cosmarium formosum, Cocconeis pediculus, Caloneis amphisbaena, Cymatopleura solea, Gomphonema olivaceum*, conditioned by alkali pH-from the water (7,6- 8,85). The small depth of the river assures development of benthonic and planktonic forms, so the separation of the species is practically impossible. Within the flora spectrum there were discovered specific taxons for high atrophied waters*:* *Scenedesmus disciphormis, Tetrastrum elegans, Eutetramorus tetrasporus*, *Nitzschia acicullaris, Surirella ovalis,* a fact that may serve an index for water pollution.

The algaeflora of the studied units during the investigation period (2004-2005) comprises **382 species** and intraspecific species of taxonomic units: *Cyanophyta* -73 comprising 19,1% from the total number of discovered species, *Euglenophyta*-75 (19,6%), *Chlorophyta*-111 (29,1%), *Bacillariophyta*-118 (30,9%) and *Xantophyta*-3 with *Chrysophyta*-2 all in all less that 2%. The analyses of the flora spectrum of the planktonic algaecenosis has pointed out the structural complexity and the wide variety of the species from 4 filumi: *Bacillariophyta*, *Chlorophyta, Cyanophyta, Euglenophyta*, from which predominates for the entire period of observations, as a rule bacillariophyta. During spring and autumn season along with diatomite intensely develops *cyanophyta* and *chlorofyta*. During the cold weather period the number of the river's algaeflora diminishes intensely, with domination during this period of the *cyanophyta*, nevertheless the blue-green algae are considered thermofile. Domination of cyanobacteries is due not to the low temperature but to the high concentration of the organic substances in water, because the quantity of the chemical consumption of oxygen before fall in of the sewerage waters from village Gradiste is more that 2,66 times, the maximal admissible concentration being 79,7 mgO/l, and within area of town Cimishlia during winter 2005, the deviations are between 52,2 and 95,4 mgO/l, being with more that 1,74 – 3,18 over the admissible limit. It is widely known the fact that the *cyanophyta* is a mixotrophic organism algae and during the cold water period they pass to the heterotrophic way of nutrition which is not common to other groups of taxonomic algae. %

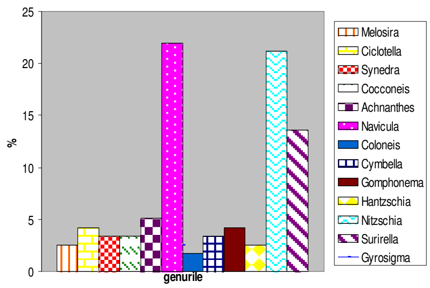

Fig. 1. Taxonomic diversity of diatomite from river Cogâlnic, during 2004-2005

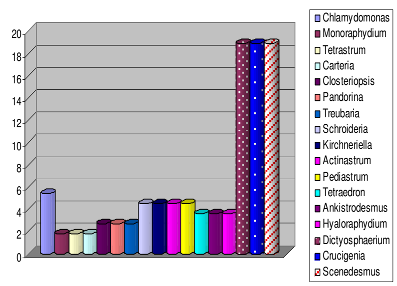

Fig. 2. Taxonomic diversity of *Chlorophyta* river`s algaeflora

Filumi ***Bacillariophyta*** is represented through its highest number of species and intraspecific taxonomic varieties, among which are *Navicula* with 27 species*, Nitzschia*-24 and *Surirella*-16*.* As we can observe from figure 1, the most numerous from the point of their taxonomic difference are genders *Navicula* the quantity of which is about 22,9% from the total number of the discovered diatomite followed by *Nitzschia*-20,3%*, Surirella* -13,6%, all the rest are less varied but anyway create a different flora spectrum. Among the analyzed samples were discovered quite frequently species *Navicula hungarica, N. cryptocephala, N. placentula, N. pusilla, N. vulpina* and others*.* From gender *Nitzschia* more frequently is discovered *Nitzschia hungarica, N. triblionella, N. kützingiana.* From the other genders, during the entire period of studies, there were discovered: *Caloneis amphisbaena, Gyrosigma acuminatum, Cymatopleura solea* etc*.* The variety of species change radically depending on their place of collection, for example in the water of the effluents and old course of the river is discovered quite frequently different species of β *and β-α mezosaprobs.* They are mostly discovered nearby the river mouth, but as we go away from it, the diversity of the species decrease, meaning that it affects and modifies the cyanosis algae being affected by polluted waters that flow into the river. High saprobe of the filumi, determined by 30 species among which 25 are *β – mezosaprobs,* denotes clearly a high level of pollution of the waters with organic substances.

From those 111 species of algae from the filumi ***Chlorophyta*** 10 species belong to order *Volvocales* that belong to following genders: *Chlamydomonas, Carteria, Eudorina* and *Pandorina.* The majority of them live in the area were the residual waters flow into the river, having the saprobe ρ and *β – mezosaprobs.* One of the rare met species here from

Chlorophyta is *Actinochloris sphaerica*.

Quite numerous and different are algae from class *Chlorococcophyceae*. Within the phytoplankton of the river these dominate during spring, though some species live during the entire year period: *Monoraphidium contortum, M. minutum, Scenedesmus acuminatus, S. quadricauda* etc. The climate conditions during summer period contribute to a more intense vegetation of the respective algae. The most numerous and diverse from the taxonomic point of view is class *Chlorococcales.* Among the samples were discovered 102 species from genders *Monoraphidium, Hyaloraphidium, Actinastrum, Coelastrum, Crucigenia, Kirchneriella* etc. From this filumi, as it can be seen from (fig. 2) predominate genders *Scenedesmus*-21 and *Monoraphidium*-6, being quite diverse. These are discovered mainly in polluted waters and genders *Coelastrum, Crucigenia* are ubiquitous and are met anywhere in a quite high quantity.

From the representatives of filumi ***Cyanophyta*** most rich in species and genders is *Oscillatoria* -23, the representatives of which constitute about 31,5% from the total number of cyanophytes, followed by *Anabaena* with 5 species, constituting about 6,8% and *Spirulina* with 4 species. The most frequent met cyanophytae are: *Oscillatoria tenuis, O. redekei, O. planctonica* and *Dactilococcopsis acicularis*, which very often provoke „water flowering". The number of the saproindicating species - 18 is dominant by *β – mezosaprobs* - 6, also indicating a moderate pollution of the water.

Algaeflora of the river is characterized by a big variety of **euglenophytae** with dominating species of: *Euglena acus, E oxyuris, E. viridis, Lepocinclis playfairiana* and *Phacus pleuronectes*. From the total variety, the richest species are genders *Euglena*-26 species, *Trachelomonas*-14 and *Phacus*-13 followed by the representatives of the gender *Lepocinclis,* characteristic to very polluted waters, because from 36 species indicating saprobe dominates *β – mezosaprobs* - 19 denoting moderate pollution of the water with adulterate organic substances. ***Xantophyta,*** as a rule does not present an important role in the studied algaecyanosis. Within the phytoplankton there were discovered only **3** species, vegetating mainly during spring β – oligosaprobate, with saprobate indices of – 1,5.

In order to point out the phyto improvement of the algae over the river's water there was analyzed the dynamics of the biogenic compounds during summer period 2004-2005. After analyzing the results it was concluded that during month of June 2004 the quantity of the biogenic substances under the influence of the algae has been reduced.

The content of the nitrate ions in the place were the sewerage waters flow into the river is higher 2,8 times than downstream, where under the development influence of the quantity of algae takes place reduction of the compound quantity from 2,3mg/l to 8,1mg/l. At the same time takes place reduction of the phosphates quantities with 33,3%, their content decreases from 0,12 mg/l to 0,04 mg/l and of the ammonium ions with about 41,7%, oscillating from 3,6 to 1,5mg/l.

As a result of massive assimilation of different forms of nitrogen, *cyanophyta* develops to such a degree that it causes „water flowering". Quite intensely develop species of the gender *Oscillatoria* and *Dactylococcopsis*, which creates rust crust under the substratum of silt of the river and sometimes it, gives to the water a green blue shade. This is also confirmed by decrease with about 58,3 % of the ammonium ions, that upstream of town Cimishlia was 3,6 mg/l, center area – 1,5 mg/l, and downstream of the town Cimishlia it is lower about 12 times than upstream the town equal to 0,3 mg/l.

The dynamics of the biogenic substances in the following month of the year is more evident. So, the quantity of the nitrates under the influence of the hydrobionts decrease with 48,0%, from 24,4 to 11,7 mg/l, ammonium ions are reduced from 3,4 to 0,4 mg/l, sulphates - from 723 mg/l to 670 mg/l, and phosphates are completed consumed, their oscillation being from 0,09mg/l, in the place where the sewerage water flows into the river, and downstream phosphates were not discovered. Also, decreased the quantity of the chemic consumption of oxygen from water from 67,7 to 58,6.

In August 2004 there was attested a net decrease of the biooxidization from 142 to 49,5 mgO/l, the nitrate ions concentration decreased under the influence of mass development of algae from 22,8 mg/l, from the place of pollution to 15,4mg/l. At a distance of 500 m from the place where the sewerage waters flow into river with a content of 26,8 mg/l nitrates, the quantity of the ions decreases with 4,8 times and increase to 5,6 mg/l. Also is to be mentioned that during August 2005 were determined the most representative data which confirms the contribution of the algae for water depuration. The concentration of ammonium ions oscillates between 0,4 – 0,9 mg/l, and in area of town Hanceshti its quantity is almost reduced. Nitrates in the river's water in areas of Cimishlia oscillates between 6,3 and 43,6 mg/l. After the sewerage waters flow into the river the quantity of ions increase to 17,3 mg/l and is reduced under the influence of hydrobionts up to 6,3 mg/l.

Conclusions

- Within the algae communities of the studied river Cogâlnic, segment from town Hanceshti - village Bogdanovca, there were discovered 382 species and intraspecific taxonomic units of algae from the following branches: *Cyanophyta* -73, *Euglenophyta*-75, *Chlorophyta*-111, *Xantophyta*-3, *Bacillariophyta*-118 and *Chrysophyta*-2. Mass development in the waters of Cogâlnic river of the euglenae algae among which dominates genders *Euglena*-26, *Trachelomonas*-14 and *Phacus*-13, demonstrates a high level of trophycity of the water. From the chlorophyta algae dominate gender species of Scenedesmus-21, and from the cyanophyta – genders species *Oscillatoria*-23. The high taxonomic variety of the *bacillariophyta* algaes is determined by gender species *Navicula*-27*, Nitzschia*-24 *and Surirella*-16. The majority of the dominant species refer to category β and *β-α mezaprobs*, denoting a net level of water pollution. For this also speaks the high concentration in water of the nitrogen and phosphate compounds.
- On the basis of the above mentioned it may be concluded that: with the diversity of the sewerage waters in river Cogâlnic increases the quantity and variety of the diatomic algae, *chlorophyta* and *cyanophyta*, that in the result contribute to the biological depuration process of the water through assimilation and mineralization of the toxic substances. In general, atrophy of the river's water positively influences development of the algae, both from the point of view of species variety and their quantitative effect.
- It was determined that if we go away from the place where the sewerage waters flow into the river, the excessive quantities of the biogenic elements decrease essentially on the base of the criteria that the quantity of the algae increase. As a result of water flowering in 2004 the level of nitrates decreased with 38,0 %, and the ammonium ions with 68,3 %. Also, under the influence of the algae decrease the quantity of the bicarbonates and of the oxidization process. Increase of the algae quantity, has a positive role for water depuration process.

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USAGE OF ALGAE SPECIES *CHAETOMORPHA GRACILIS* AND *CH. AEREA* FOR DEPURATION PROCESS OF THE RESIDUAL WATERS

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Abstract: Rapid increase of the population on the globe scale imposes maximum exploration of the natural resources and first of all of the aquatic resources. As a result are obtained an enormous quantity of residual waters which pollute the waters from rivers, lakes, freatic and underground waters. Elaboration of the depuration methods for residual waters the quantity of which grows continuously, is one of the most up to dated issue of the world. The physical-chemical depuration methods of the residual waters are very expensive and lack the efficiency we would like to have. The most efficient method proved to be the biological method using some species of algae and superior aquatic plants. In our experiences we have involved filamentous green algae *Chaetomorpha gracilis* and *Ch. aerea* for depuration of the sewerage water from town Cimishlia. The concentration of the mineral nitrogen compounds in the residual water is around 92,5 mg/l, and of the phosphates 10,1 mg/l. There were used the following concentration of the sewerage water: 10%, 25% and 50%. The most intense development of algae *Chaetomorpha aerea* was observed in the variant with 10% of residual water, in which the total concentration of the nitrogen was 10,24 mg/l, and of the phosphates 1,05 mg/l. For this variant the depuration water level was about 56,9%. For the case with *Chaetomorpha gracilis,* the depuration level for the same concentration of the residual water constituted 55,9 %. Increase of the concentration of the polluted water inhibits development of the algae reducing to the minimum their capacity to assimilate the nitrogen and the phosphor. In the solutions with 50 % of residual waters, the algae didn't die, but at the same time they didn't develop. From this results that both algae may be used in the phytoamelioration of the residual waters being diluted at 10% with purified water.

Key words: nitrogen, phosphor, residual water, depuration, inoculate, green filamentous algae.

Introduction

During the recent years, pollution of the atmosphere has become one of the most important issue for the society. Residual waters from towns and industrial, agricultural factories flow into natural basins of water, being a danger for all living aquatic organisms and for the health of the human being [1, 2, 3].

Is being intensified eutrophication of the natural basins of water and appeared the necessity for elaboration of new methods of depuration of the polluted waters. There were performed studies in this direction using algae and superior aquatic plants during the autodepuration process of the polluted waters[4, 5, 6].

The results have proved the efficiency of some green filamentous algae and aquatic plants from genders: *Cladophora*, *Chara, Rhizoclonium, Lemna* during the depuration process of the residual waters [8, 9]. Some authors have used for this scope species of algae from genders *Oscillatoria, Scenedesmus, Navicula, Nitzschia, Chlorella, Chlamydomonas* etc [7].

The scope of our work is to use some species of green filamentous algae *Chaetomorpha aerea* and *Chaetomorpha gracilis* for the depuration process of the sewerage waters from town Cimishlia.

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Materials and methods

In order to elaborate new methods for phytoamelioration of the residual waters of sewerage origin from town Cimishlia, there were made experiments on two species of green filamentous algae, *Chaetomorpha gracilis* and *Ch. aerea.*

These algae were collected from the lake of village Danceni and from village Calimaneshti during summer period of 2006 and maintained in laboratory conditions in the water from the respective lakes, at the room temperature and natural illumination. For our studies there were used the following concentrations of sewerage waters: 10%, 25% and 50%. The inoculation was done with 5 g of green biomass for each sample.

The experiments were performed during 29.05.06 - 26.06.06. The experiments were performed in glass containers with a volume of 10l. There were analyzed the following chemical parameters of the water at the beginning and end of the experiment: (PO_4^{3-}, *CCO-Mn*, NO_2^-, NO_3^-, NH_4^+). The chemical analyses of the water was done within the Algaeology Laboratory of the State University of Moldova and in the analytical laboratory of the Republican Center for Agrochemicals Maintenance, using contemporary methods for estimation of the water qualities.

Results and discussions

In order to determine the oscillations of the chemical composition of the water, the inoculates of the respective algae being exposed, we have determined the quantities of the ions from the nitrogen group as well as the phosphates and oxidization of the polluted water used for experiments. As a result we've concluded that in the polluted water the quantity of the respective ingredients is over about 2-10 times the admissible limits.

The total concentration of the mineral nitrogen compounds from the residual waters diluted at 50% is about 50,32 mg/l, and of the phosphates - 5,2 mg/l. Also, is quite high the content of the chemical oxygen consumption (CCO-Mn), determined through permanganatometry, the quantity of which being higher 7,4 times in respect to the admissible limit which is 222 mgO/l, pHl of the water - 8,3, being determined by the high concentration of the bicarbonates (719 mg/l) and of the ammonium ions (16,3 mg/l), the quantity of which is 8,2 times higher than the admitted limit for the waters with destination for fish growing.

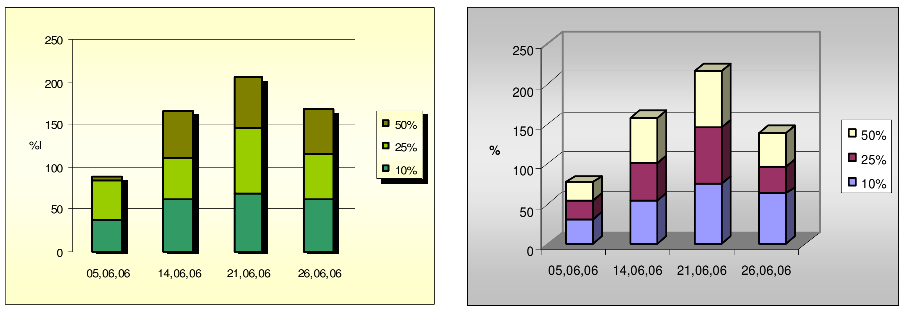
At the beginning of the studies there was determined the maximal and optimal concentration of the polluted water in which the algae develops. There was established that most intensely the algae develop in the concentration of 10% and the tolerance limit of the algae towards the complex of the proposed chemical compounds is 25-50%.

The comparative analyses of the obtained results clearly demonstrate that the most intense development of the algae *Chaetomorpha aerea* and *Chaetomorpha gracilis* is in the variant with 10% of residual waters, where the level of nitrogen, phosphor assimilation constituted 56,9 % and respectively 55,9% (fig.1A, B). according to fig. 1, the assimilation process of the biogenic substances from water is more accelerated during the second and third week of the experiment, when the quantity of the pollutant decrease with about 47-77%, after which, during the last week the accelerated increase of the algae mass leads to alteration and damages the quality of the water.

That is why after two weeks from inoculation, the algae biomass shall be extracted from the water at least around 50 %.

The depuration process of the water off **phosphor ions**, shown in fig. 2

demonstrates slow decrease of the respective element during the first week. In the variant with 10 % with *Chaetomorpha aerea* the decrease is between 7,7 % and 42,8% oscillating from 1,05 up to 0,60 mg/l, and in the variant with 25% of residual water - between 2,62-2,0mg/l and in the variant with 50 % between 5,2-4,8mg/l. According to fig. 2 the maximal depuration values were observed in variant with 10% surplus of sewerage water, and the minimal in the variant with 50%.



A B

Fig. 1. Depuration dynamics of the polluted water under the influence of the inoculate
A - *Chaetomorpha aerea* and **B -** *Ch. gracilis*

Similar is the decrease of the phosphates in the variant with *Ch. gracilis,* where the assimilation of the phosphor in the variant with 10% was the maximal. After seven days of algae cultivation there were stated decrease from 1,05 up to 0,3 mg/l, or with 42,8% of the phosphates. In the variant with 50% there were assimilated only 11,5% from their total initial quantity. The complete assimilation of the phosphor ions was observed in the variant with 10% with *Chaetomorpha aerea.*

For the experiments with the second species - *Chaetomorpha gracilis (fig. 2 B)* there was observed decrease of the phosphates in the variant with 25 % from 2,6 up to 1,8 mg/l with about 31,3 %. During the first week the phosphates quantity decreased from 2,6 up to 2,3 mg/l or about 16,0 % and after 16 days the phosphates concentration comes to its minimal value, around 1,8 mg/l.

As a result of assimilation of nutrition substances, considerable increases the algae biomass which covered the entire water surface. During the last week started decomposition of the biomass, a fact which contributes to secondary pollution of the water, reducing in such a way the depuration process to 1%. Analyses of the witness sample where the decrease of the phosphates come only up to 4% demonstrate the contribution of the algae for the amelioration process of the sewerage waters.

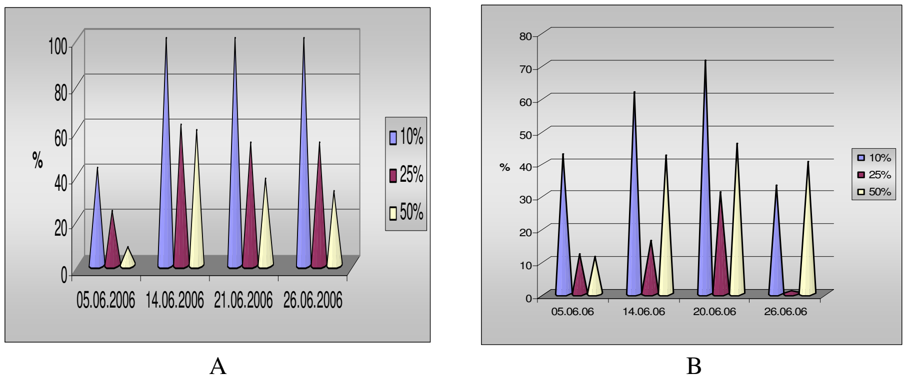


Fig. 2. Dynamics of the phosphor ions from the water subject to experiment with inoculate (5g) **A -** *Chaetomorpha aerea* and **B** - *Ch. gracilis*

It is well known the fact that the most important chemical value that characterizes the sewerage waters is the ammonium ion (NH4+), being very intensely assimilated by algae. In the variant with 50 % sewerage water, *Chaetomorpha aerea* during first seven days has assimilated from 16,3 mg/l up to13,8 mg/l reducing with 15,3 % from its initial concentration. After 16 days of cultivation, the concentration of the ammonium ions has been reduced from 16,3 up to 5,9 mg/l constituting 63,8 %. After 28 days of cultivation, the concentration of the ammonium for this variant has decreased up to 5,2 mg/l (fig.3).

As we can see, during the first week of cultivation of both species of algae there takes place consumption of the ammonium ions. In the variant with 50% and 25% of sewerage water with *Chaetomorpha aerea* (fig.3 A), the most intense assimilation of the ammonium ions has been reduced from 8,0 up to 2,8 mg/l with about 25 % sewerage water and from 16,3 up to 5,9 mg/l in that with 50 % addition of polluted water, constituting 65,0 % and 63,8 %. This demonstrates the role of the algae for the depuration process of the residual waters.

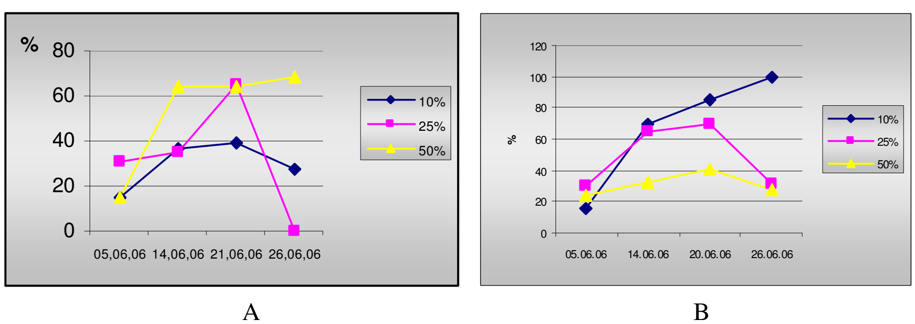
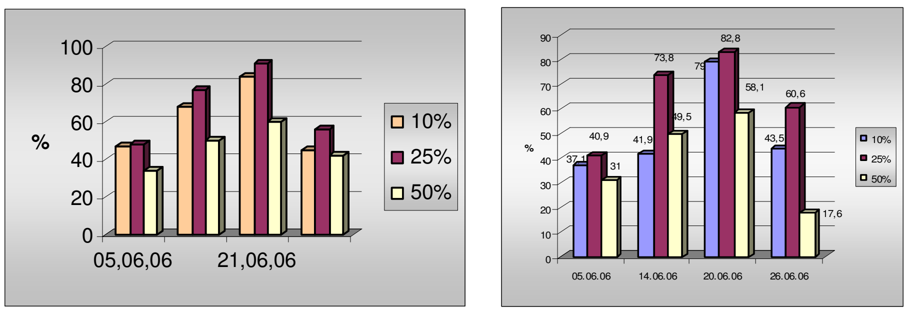


Fig. 3. Decrease in % of the ammonium ions concentration in the polluted water cultivated with **A -** *Chaetomorpha aerea* and **B –** *Ch.gracilis*

An index that characterizes intensity of the pollution process of the sewerage waters is the oxidization process which mainly depends on the activity of the algae. As result of photosynthesis the algae enrich the water with oxygen and reduce the quantity of the organic substances which alterate in water. The maximal decrease of the oxidization in the variant with 10% of residual water with *Chaetomorpha aerea* were observed during the third week of cultivation and constituted 83,9 % from the initial value, oscillating between 62 and 10mgO/l. During the first week of algae cultivation the oxidization has been reduced from 62 up to 33mgO/l and after 16 days came to a level equal to 20 mgO/l. During the last week of algae cultivation, the oxidization increased up to 34 mgO/l, a fact that speaks about the decomposition of the algae biomass. In the variant with 25 % residual waters, the oxidization has been reduced from 122 up to 54 mgO/l. And in this variant the most intense decrease of oxidization was observed during the third week of algae cultivation, when the content of the chemical oxygen consumption has been reduced up to 11 mgO/l constituting 91,0 % from the initial mass.

In the variant with 50 % residual waters, the oxidization during the first week has been reduced from 222 mgO/l up to 147 mgO/l, and after 16 days constituted 110 mgO/l. Like with other two variants the consumption of chemical oxygen comes to its minimal values during the third week of algae cultivation, its content being not more than 89 mgO/l.



A B

Fig. 4. Dynamics in % of the content for the chemical oxygen consumption in the polluted water of different concentration, cultivated with **A -** *Chaetomorpha aerea* and **B -** *Ch.gracilis*

During the last week the oxidization, increases (fig.4A). The same oscillations are observed in the variant with *Ch. gracilis (*fig.4B*).* In the variant with 10 % of residual waters, the oxidization has been reduced from 62 mgO/l up to13 mgO/l, and in the solutions with 25 % of polluted water - from 122 mgO/l up to 21 mgO/l constituting 82,8 % from the initial quantity. In the variant with 50 % residual waters, the oxidization has been reduced from 222 up to 93 mgO/l. During the last week of experiments was observed a slow increase of chemical oxygen, process based on excessive development and partial extermination of the biomass.

Conclusions

- It was observed and concluded that algae species *Chaetomorpha aerea* and *Ch. gracilis* assimilate the nitrogen and phosphor from the polluted waters and may be used as agent for biological depuration;
- Both species of algae develop most intensely in mediums that contain up to 10 % of sewerage water. Concentration increase of the sewerage water inhibits development of algae;
- Both, *Chaetomorpha aerea* and *Ch. gracilis* during the cultivation process assimilates up to 100% from the concentration of the phosphates and up to 84,8 % of the nitrogen;
- Chemical oxygen consumption under the influence of the algae up to third week decreases with 91,0 %, than it increases. Increase of the concentration of the residual water in the nutrition medium higher than 10 % slows down development of the algae and in some cases, even after these die out.

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CONTRIBUTIONS TO THE STUDY OF SAXICOLOUS LICHENS COMMUNITIES FROM BISTRITA MOUNTAINS

(EASTERN CARPATHIANS)

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Abstract: The study of saxicolous lichens communities from Bistrita Mountains had as result the identification of two lichens associations: *Parmelietum conspersae* Felfödy 1941 and *Umbilicarietum cylindricae* Frey 1933, instaled on siliceous rocks, in 3 locations: Pietrosul Bistriței, Zugreni and Cheile Barnarului. These two lichens communities presented in this paper are mentioned for the first time from Bistrița Mountains territory and described by phytosociological tables and analyzed from the bioforms, floristic elements and ecological indices perspectives.

Key words: saxicolous lichens, associations, Bistrița Mountains.

Introduction

The study area belongs to Bistrița Mountains, that are localized in the central-northern part of the Eastern Carpathians, between Rarău and Giumalău Massifs to north, Giurgeului and Ceahlău Mountains to south, Suhardului and Călimani Mountains to west and Stânişoarei Mountains to the east. They have a complex structure, the geological substratum being represented by cristaline, porphyroid and calcareous rocks. The study of lichens communities from these mountains has been realized in 2004, during several field trips in various locations. The purpose of the field trips was to identify saxicolous lichens communities and to realize phytosociological relevées in order to characterize them.

Material and methods

The method of working adopted in this study of saxicolous lichens associations from Bistrița Mountains is that established by Klement [9] in concordance with the principles of Central European phytosociology school, used and adapted to our country lichens vegetation by Ciurchea et al. [4]. Identification of these associations has been made on the basis of the characteristic species indicated in the literature [1], [2], [4], [7]. For each association, an analysis of bio-forms and floristic elements has been made. In text, we used the next abbreviations for the bio-forms [3] and floristic elements [3]:

- HE Pa – epiphyte hemicryptophyte lichens having an *Parmelia* thallus type;
- HE ex – epiphyte hemicryptophyte lichens presenting external crust;
- HE Um – epiphyte hemicryptophyte lichens having an *Umbilicaria* thallus type;
- arct.-mid.eur.-med.mo. – arctic – middle european – mediterranean montane;
- arct.-mid.eur. mo. – arctic – middle european montane;
- arct.-bor. mo. – arctic – boreal montane;
- arct.-bor.-med. – arctic – boreal – mediterranean;
- arct.-med. – arctic – mediterranean;
- bor.-med. – boreal – mediterranean;
- bor.-med. mo. – boreal – mediterranean mountain;
- south bor.-atl.-med. – south boreal – atlantic – mediterranean;

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An analysis (after Ellenberg [8]) of ecological indices (L-light, U-humidity, T-temperature, R-substratum pH), expressing the ecological requests of the associated lichens species has been also realized.

Results and discussions

Table 1

RHIZOCARPETEA GEOGRAPHICI Wirth 1972

ASPICILIETALIA GIBBOSAE Wirth 1972

Parmelion conspersae Čern. & Hadač 1944

1. Ass. *Parmelietum conspersae* Čern. & Hadač 1944

L	U	T	R	BF	FE	Substratum	saxicolous (siliceous rocks)					K
						Altitude (m)	1700	900	800	1750	800	
						Slope (º)	5	25	15	15	10	
						Coverage (%)	80	60	75	70	70	
						Aspect	NV	V	NV	N	NV	
						Plot area (m²)	0.5	0.5	0.5	0.5	0.5	
						Nr. of relevé	1	2	3	4	5	
Car. ass.												
9	3	5	4	HE Pa	Bor.-med.	Xanthoparmelia conspersa	3	3	3	4	4	V
6	5	4	3	HE Pa	Arct.-mid.eur.-med.mo.	Parmelia saxatilis	3	2	2	1	+	V
Aspicilietalia gibbosae												
9	0	0	3	HE ex	Arct.-bor.mo.	Rhizocarpon geographicum	+	+	+	-	-	III
9	0	0	5	HE ex	Bor.-med.mo.	Acarospora fuscata	+	+	1	-	-	III
6	5	4	3	HE ex	Bor.-med.mo.	Rhizocarpon obscuratum	+	-	-	-	-	I
5	4	5	3	HE Pa	Bor.-med.	Melanelia glabratula	-	-	-	+	1	II
Rhizocarpetea geographici												
8	0	0	8	HE Pa	Arct.-med.	Physcia caesia	-	+	1	+	-	III
Variae syntaxa												

7	3	0	3	HE Pa	Arct.-med.	Hypogymnia physodes	+	+	-	+	+	IV
8	3	4	2	HE Pa	Bor.-med. mo.	Pseudevernia furfuracea	+	-	-	-	+	II
7	3	5	7	HE Pa	Bor.-med.	Xanthoria parietina	-	-	+	+	+	III
7	6	5	6	HE ex	Mid.eur.-subatl.med.	Lecanora gangaleoides	-	+	-	-	-	I
7	3	0	6	HE Pa	Arct.-bor.-med.	Physcia tenella	-	-	+	-	-	I
9	7	2	3	HE Um	Arct.-mid.eur.-med.mo.	Umbilicaria cylindrica	-	+	-	-	-	I

Place and date of relevées: 1,2 - Pietosul Bistritei (14.09.2004); 3 - Cheile Barnarului (19.06.2004); 4,5 - Zugreni (14.09.2004)

Stations conditions and chorology: The *Parmelietum conspersae* association prefers the siliceous rocks, developing itself commonly in the place of *Aspicilietum cinereae* association, whose component species died under pressure of lichens presenting a *Parmelia* thallus type that dominates by their abundance. This association is easily outspreading due to the numerous isidious species that enter in the floristic composition. The association is described by five relevées. It grows on siliceous rocks, being identified in Pietrosul Bistritei, Zugreni and Cheile Barnarului, at altitudes of 800-1750m, on north, north-west and west oriented and gentle inclined slopes.

Floristic and phytosociological composition. The floristic composition is characterized by a reduced number of species (only 13) and an average of 7 species per relevée. The coverage degree varies from 60 to 80%. In the phytosociological composition the characteristic species, *Xanthoparmelia conspersa* and *Parmelia saxatilis* are dominating due of foliose thallus that populates the most part of plot area. Also, high constancy classes present species from *Aspicilietalia gibossae* (*Rhizocarpon geograficum*, *R. obscuratum*, *Melanelia glabratula* etc.) and *Rhizocarpetea geographici* (*Physcia caesia*). (**Table 1**).

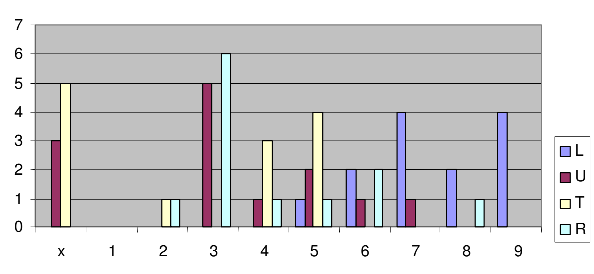

Fig. 1. Ecological indices spectrum of *Parmelietum conspersae* association

The ecological indices spectrum reveals that this association is developing itself well on sunny (L_9 – 31%, L_8 – 15%, L_7 – 31%) and dry siliceous rocks (U_3 – 38%). Most of the component species are eurythermic (T_x – 38%) and mesothermophylous (T_5 – 31%) and prefers as substratum acid siliceous rocks (R_3 – 45%) (**Fig. 1**).

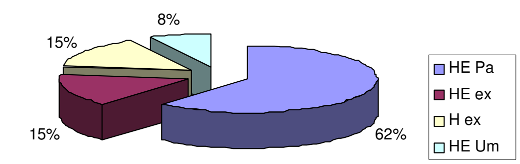

Fig. 2. Bioforms spectrum of *Parmelietum conspersae* association

The bioforms spectrum indicates the prevalance of epiphyte hemicryptophyte species presenting an *Parmelia* thallus type (HE Pa – 62%) and epiphyte hemicryptophyte species presenting an *Umbilicaria* thallus type (HE Um – 8%) that are growing on epiphyte hemicryptophyte lichens presenting external crust (HE ex – 15%, H ex – 15%) (**Fig. 2**).

The floristic elements spectrum presents the prevalance of boreal-mediterranean and boreal-mediterranean montane elements (each of these categories representing approximately 23%) and the presence in equal proportions (15%) the other floristic elements (arctic-middle european-mediterranean montane, arctic-boreal montane and arctic-mediterranean). The middle european-subatlantic-mediterranean element represent about 8% of the total (**Fig. 3**).

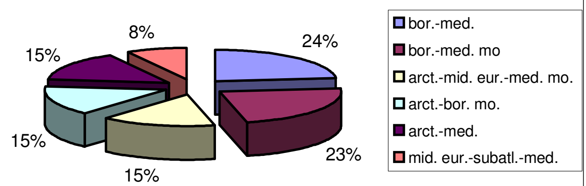

Fig. 3. Floristic elements spectrum of *Parmelietum conspersae* association

Table 2

RHIZOCARPETEA GEOGRAPHICI Wirth 1972

UMBILICARIETALIA CYLINDRICAE Wirth. 1972

Umbilicarion cylindricae Gams 1927

2. Ass. *Umbilicarietum cylindricae* Frey 1933

L	U	T	R	BF	FE	Substratum	saxicolous (siliceous rocks)					**K**
						Altitude (m)	1700	1700	1750	1750	1750	
						Slope (º)	10	35	10	15	25	
						Coverage (%)	70	75	70	75	70	
						Aspect	N	NV	NV	N	NV	
						Plot area	0,5	0,5	0,5	0,5	0,5	
						Nr. of relevé	1	2	3	4	5	
Car. ass.												
9	7	2	3	HE Um	Arct.-mid.eur.mo.	Umbilicaria cylindrica	3	4	3	4	3	V
Umbilicarion cylindricae												
9	7	3	4	HE Um	Arct.-bor.mo.	Umbilicaria deusta	2	1	2	1	3	V
8	7	2	3	HE Um	Arct.-bor.mo.	Umbilicaria proboscidea	1	1	1	1	+	V
-	-	-	-	HE Um	Arct.-bor.mo.	Umbilicaria crustulosa	+	-	-	-	-	I
Umbilicarietalia cylindricae												
9	0	0	3	HE ex	Arct.-bor.mo.	Rhizocarpon geographicum	1	1	+	1	+	V
6	5	4	3	HE Pa	Arct.-mid.eur.-med.mo.	Parmelia saxatilis	+	-	-	+	1	III
9	0	0	5	HE Pa	Bor.-med.mo.	Acarospora fuscata	+	+	+	-	-	III
9	3	5	4	HE Pa	Bor.-med.	Xanthoparmelia conspersa	-	-	1	+	-	II
Rhizocarpetea geographici												
5	7	4	4	HE Pa	South bor.-atl.-med.	Menegazzia terebrata	-	-	+	-	-	I
Variae syntaxae												
7	3	0	3	HE Pa	Arct.-med.	Hypogimnia physodes	-	-	+	+	-	II

Place and date of relevées: Pietrosul Bistritei (14. 09.2004)

Stations conditions and chorology: The *Umbilicarietum cylindricae* association has been identified on siliceous rocks, in the sub-alpine and alpine zones, at high altitudes (over 1200m) in Pietrosul Bistritei peak, on north, north-west oriented and gentle inclined slopes (10-35º).

Floristic and phytosociological composition: The floristic composition is characterized by a reduced number of species (only 10). The coverage degree vary from 70 to 75%. In the phytosociological composition the characteristic species, *Umbilicaria cylindrica* dominates. Also, high constancy classes present species from *Umbilicarion cylindricae* (*Umbilicaria deusta, U. proboscidea* etc.), *Umbilicarietalia cylindricae* (*Rhizocarpon geographicum, Parmelia saxatilis, Acarospora fuscata* etc.) and *Rhizocarpetea geographici* (*Menegazzia terebrata*). (**Table 2**).

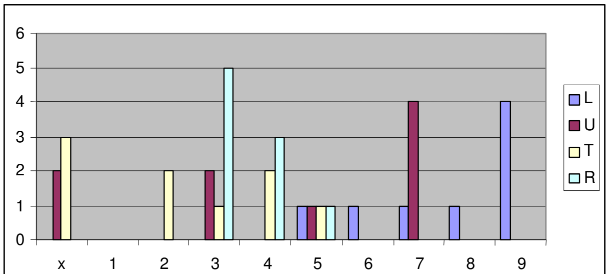

Fig. 4. Ecological indices spectrum of *Umbilicarietum cylindricae* association

The ecological indices spectrum shows the preponderance of light (photophylous) species (L_9 – 56%). Most of the component species are mesohygrophytes (U_7 – 45%), can tolerate large variations of temperature factor – eurythermic (T_x – 45%) and prefers acid rocks as substratum (R_3- 56%) (**Fig. 4**).

The bioform spectrum presents the dominance of epiphyte hemicriptophyte lichens with *Umbilicaria* thallus type (HE Um – 55%) and epiphyte hemicriptophyte lichens with *Parmelia* thallus type (HE Pa – 36%) that are growing on epiphyte hemicryptophyte lichens presenting external crust (HE ex – 9%) (**Fig. 5**).

The floristic elements spectrum indicates the prevalance of arctic-boreal montane species (40%) and arctic-middle european montane species (20%). Each of the other categories (boreal-mediterranean, boreal-mediterranean montane, arctic-mediterranean and south boreal-atlantic-mediterranean) represents approximately 10% (**Fig. 6**).

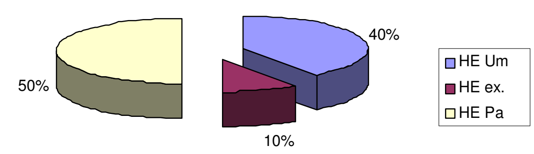

Fig. 5. Bioforms spectrum of *Umbilicarietum cylindricae* association

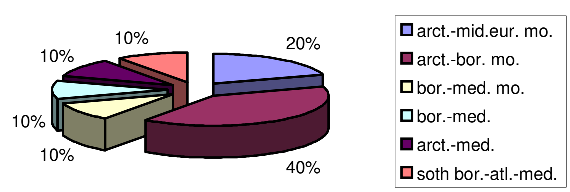

Fig. 6. Floristic elements spectrumspectrum of *Umbilicarietum cylindricae* association

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LATHYRUS LINIFOLIUS (REICHARD) BÄSSLER IN THE ROMANIAN FLORA

CIOCÂRLAN VASILE *

Résumé. On confirme présence en Roumanie pour *Lathyrus linifolius* (Reichard) Bässler, dans l'herbier CL sous le nom synonime *Orobus tuberosus* L.

Mots clé: *Lathyrus linifolius*, Roumanie.

The research upon the vascular Romanian flora hasn't finished yet with the last edition of the Romanian Flora compendium. Numerous subsequent floristical references have demonstrated this item. A lot of questions, referring to the presence of some species in the old papers, still exist and there are numerous errors in determining the herbarium plants, error perpetuated without rigorous examination.

Sometimes we appreciate only the internet references and we do not verify the herbarium or the plants in terrain or, worst, we do not use the remarkable opera "*Flora of Romania*". Therefore, the knowledge of the vascular Romanian flora isn't complete, that is why it is necessary to continue the investigations.

As a sequel of his true affirmations, the author verified the presence in Romanian flora of some species belonging to the neighbouring countries, described and iconografied into the "Romanian Flora" in the 5th volume, with a question mark, where there is mentioned that this species, *Lathyrus linifolius*, „is not present in our herbarium". The species is not present in the "Critical List of the Romanian vascular plants" (A. Oprea, 2005). Nevertheless, this species exist and we are still presenting it.

We find it for the 1st time in the "Romanian Flora Prodrom" (Brândză, 1879-1883), under the name *Lathyrus macrorrhizus* Wimm.; then in the "Flora used to determine and describe the plants growing in Romania" (Prodan, 1939), „in Moldavian forests", then in "Conspectus Florae Romaniae" (Borza, 1947), called *Lathyrus montanus* Bernh., as well as in recent papers, called *Lathyrus montanus.*

Lathyrus linifolius (Reichard) Bässler in Feddes Repert., **82**: 434 (1971) (*Orobus tuberosus* L., Sp. Pl. 728(1753), *Orobus linifolius* Reichard, in Hanauisches Mag., **5**:26 (1782), *Lathyrus montanus* Bernh., Syst. Verz., **247** (1800), *L. macrorrhizus* Wimm., Fl. Schles., **166** (1841).

This species is minutely described and iconografied in the "Romanian Flora", 5th tome, page 412. The authors are: I. Grințescu and E. I. Nyárády, who verified the presence of the species in the herbarium from Cluj, only in *Lathyrus* genera, where the species is not present, but it is present with the synonym *Orobus tuberosus* L., page 31419, Herb. Pávai Vajna, without a specific location, only „Transilvania".

The interesting point is that the species appears under question mark called *L. montanus* (Meusel, 1964), in the central Transilvania, near Aiud, where Pávai practiced as a teacher and worked in Ardelean Museum of Cluj.

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We have to mention that the species is cultivated in the Central and West Europe as a green crop.

We hope that the species will be found in oak and beech forests.

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RECTIFYING A FEW ERRORS IN THE ROMANIAN EXSICCATAE

CIOCÂRLAN VASILE [*]

Résumé: l'auteur publie les erreurs rencontrées dans les exsiccates: FRE=Flora Romaniae Exsiccata; FOE=Flora Olteniae Exsiccata; FMD= Flora Moldaviae et Dobrogeae Exsiccata; FEGL= Flora Exsiccata Graminearum et Leguminosarum Romaniae. En même temps, on publie le nom correct.

Mots-clé: erreurs, exsiccates, Roumanie.

The correct identification of the fitotaxons from a geografical or administrative region is a hard work, full of responsabilities. It is very hard to eliminate an error occuring in the literature, that is why it is perpetuated and it appears in subsequent publications. Taking about exsiccates, the errors are distributed at similar institutions in- and outward. The informations from the exsiccates is credible and become a standard, that is why the botanists use them in order to determine the floristic material.

The correct identification of the species became more important due to the requirement of knowing the areal of the species, of their distribution and correct mapping of their distribution, as well as the necessity of protecting those rare and vulnerable species.

In the present paper, we shall mention a few errors, occuring in the Romanian exsiccates, thinking that the authors should analyse more patiently and with better references the floristic material and then they should pronounce on the nomenclature and the sistematic value of a certain taxa.

The information is presented in a table; the left part consists of the name and the value of the taxon from the various Romanian exsiccatae, while the right part present the correct name and value of the taxa. The abbreviations of the exsiccatae are: FRE=Flora Romaniae Exsiccata; FOE=Flora Olteniae Exsiccata; FMD= Flora Moldaviae et Dobrogeae Exsiccata; FEGL= Flora Exsiccata Graminearum et Leguminosarum Romaniae. The taxa are alphabetically presented:

The name of the species in the exsiccatae	The correct name of the taxa
Achillea collina Becker ex Rchb. FOE 1057	*A. setacea* Waldst. et Kit.
Ajuga chamaepytis (L.) Schreb. FOE 717	*A. pseudochia* Schost.
Ajuga chamaepytis (L.) Schreb. FRE 2071	*A. pseudochia* Schost.
Alyssum saxatile FOE 238	*A. saxatile* subsp. *orientale* (Ard.) Rech. f.
Aristolochia pallida Willd. FRE 1469	*A. lutea* Desf.
Asparagus maritimus (L.) Mill. FRE 941	*A. officinalis* L.
Callitriche verna L. FOE 629	*C. cophocarpa* Sendtn.
Carduus nutans L. FRE 2081	*C. thoermeri* Weinm.
Carex praecox Schreb. FRE 1876	*C. praecox* Schreb. subsp. *intermedia* (Čelak.) Schultze-Motel
Centaurea napulifera Roch. FRE 2074	*C. thirkei* Schult.-Bip.
Cornus sanguinea L. FOE 690	*C. australis* C.A. Meyer

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Cornus sanguinea L. FRE 2260	*C. australis* C. A. Meyer
Cytisus austriacus L. FOE 968	*Chamaecytisus rochelii* (Wieryb.) Rothm.
Cytisus heuffelii Wierzb. FOE 969	*Chamaecytisus danubialis* (Velen.) Rothm.
Cytisus heuffelii Wierzb. var. *romanicus* Prodan FRE 260	*Chamaecytisus danubialis* (Velen.) Rothm.
Daucus carota L. subsp. *carota* var. *hispidus* Lej. FOE 25	*D. broteri* Ten.
Epipactis atropurpurea Raf. FRE 3097	*E. helleborine* (L.) Crantz
Gypsophila glomerata Pall. FRE 1028	*G. pallasii* Ikonn.
Hierochloë odorata (L.) Wahlbg. FEGL 137	*H. repens* (Host) Simk.
Hierochloë odorata (L.) Wahlbg. FRE 338	*H. repens* (Host) Simk.
Hypecoum procumbens L. FRE 1945	*H. ponticum* Velen.
Juncus bulbosus L. FRE 3488	*J. capitatus* Weigel
Linaria genistifolia (L.) Mill. var. *procera* Sims FRE 2963	*L. dalmatica* (L.) Mill. subsp. *transsilvanica* (Schur) Ciocârlan
Orchis morio L. FOE 299	*O. morio* L. subsp. *picta* (Loisel.) K. Richt.
Oxalis corniculata L. FRE 2240	*O. dilenii* Jacq.
Ranunculus polyanthemos L. subsp. *polyanthemos* FRE 2668	*R. polyanthemos* L. subsp. *polyanthemoides* (Boreau) Ahlfv.
Rochelia disperma subsp. *disperma* (L.) K. Koch FRE 2459	*R. disperma* subsp. *retorta* (Pall.) E. Kotejowa
Saxifraga cuneifolia L. subsp. *cuneifolia* FRE 550	*S. cuneifolia* L. subsp. *robusta* D. A. Webb.
Saxifraga stellaris L. subsp. *stellaris* FRE 1257	*S. stellaris* L. subsp. *robusta* (Engler) Gremli
Senecio nemorensis L. subsp. *fuchsii* (C. C. Gmel.) Čelak. FOE 1063	*S. hercinicus* Herborg
Silene densiflora D'Urv. FRE 1689	*S. exaltata* Friv.
Solidago canadensis L. FRE 2284	*S. gigantea* Aiton
Statice latifolia Sm. FOE 703	*Limonium tomentellum* (Boiss.) O. Kuntze
Suaeda maritima (L.) Dumort. FRE 306b	*S. confusa* Iljin
Trinia kitaibelii M. Bieb. FRE 461	*T. ramosissima* (Fisch.ex Trev.) W. D. J. Koch.
Xanthium italicum Moretti FOE 1051	*X. saccharatum* Walr.
Xanthium riparium Itzigsohn et Hertsch FMD 584	*X. saccharatum* Walr.

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SPECIES INTRODUCED BY MISTAKE INTO THE ROMANIAN FLORA

CIOCÂRLAN VASILE [*]

Résumé. L'auteur présente 6 espèces introduites par erreur dans la flore de Roumanie, qui se trouvent dans le dérniere traveau Liste critique des plantes vasculaires de Roumanie (A. Oprea 2005).

Mots clé: espèces erronées, flore de Roumanie.

In a few anterior papers [3, 4, 5] we presented some taxa – species and subspecies, which do not grow into the Romanian flora. Their majority is introduced in the "Illustrated Flora" [5]. In the present paper we will still mention a few species which do not grow in Romania, but they are presented in the most recent synthesis work [19] which refers to the vascular species. Their presentation is in alphabetic order.

1. ***Asparagus maritimus*** (L.) Mill. – this Mediterranean species is mentioned by Brandza [28] as *A. scaber* Brign. on the Romanian littoral and Siret's shore and by other authors [29, 31, 32] on the Romanian littoral. The species is presented in the herbarium – FRE no. 941. C. Zahariadi [24] shows that 'the plants belonging to the Romanian littoral have nothing in common with this Mediterranean species'. His point of view is confirmed by recent publications [2, 5, 30], including Valdés [23]. So, the material from FRE no. 941 is not *A. maritimus*, but *A. officinalis*.

2. ***Carduus nutans*** L. – although there are affirmations which pay for its presence all over the country [18], Franco J. [12] shows that the mentioned that this species is absent from Romanian flora. Analyzing the herbarium materials we ascertain that the species do not grow in Romania. Even in FRE no. 2081, *C. thoermeri* Weinm. is present and not *C. nutans* L. Gh. Dihoru [10] analyses the same problem and comes to the same conclusion.

3. ***Doronicum glaciale*** (Wulfen) Nyman. The species is mentioned for the first time in Rodnei Mountains – "Pietrosul Mare" Natural Reserve [14] and for the 2nd time in 2005 [19]. It is very important to say that in a list with the main species from Pietrosul Mare Natural Reserve, the author [14] mentions the species *D. glaciale*, but he does not mention the species *D. stiriacum* (Will.) Dalla Tore. In order to elucidate this problem, we analyzed at Cluj (CL) a very rich material, 16 herbarium sheets with plants collected from Rodnei Mountains, their majority belonging to Pietrosul Mare Natural Reserve and we come to the conclusion that *D. glaciale* does not grow in Romania, but in Austria, Germany, Italy [11] .

4. ***Phyteuma nigrum*** F. W. Schmidt. – Brandza [28] published this plant species from 'Ceahlău, Bacău Mountains, Buzău Mountain – Penteleu Peak, Prahova Mountains', later from Penteleu Massive [33] and recently retaken by Oprea [19]. This taxon is not present in recent publications, that is why we verify its presence in Romania after 1939 [33]. We found out that the species is mentioned in two places: 'Lilieci' and 'Crucea Fetii' from Penteleu Massive [33]. But the problem is that E. Ghişa [13] presents the same

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coordinates for *P. wagneri* in Penteleu Massive. Further more, Gh. Dihoru [8] do not mention *P. nigrum* in Siriu Mountain, but *P. wagneri* A. Kern. Al. Beldie [1] and all recent publications mention only *P. wagneri* species. So, there is an identification error, because *P. nigrum* grows in Austria, Germany, France, Belgium and Czech Republic [7].

5. ***Soldanella alpina*** L. – *Soldanella* L. genus contains 10 [21] or 16 [26] species in Europe. Regarding Romania, the information is debatable. Morariu et all. [15] says that there are 3 species, but Zhang and Kadereit [26] sustain that there are 7 species, 4 of them being quoted for the first time in the Romanian flora. Those new species are under debate [16], because they are created only by molecular analysis. The species *S. alpina* has been published for the first time by Brandza [28] from Ceahlău and Bucegi Mountains and for the 2nd time by Prodan [31] and then by Borza [32], when he mentioned as „the dubiety from the Carpathians". The species is present in BUCA Herbarium, mentioned from Poiana Braşov, but it is a wrong determination recently retaken by Oprea [19]. The species grows only in Pyrenees, Alps, Apennines, Dinarics [21, 25, 26].

6. ***Soldanella carpatica*** Vierh. – the species is mentioned in Farcău, Rodnei and Făgăraşi Mountains [19]. It is presented in BUCA herbarium, too, collected from Făgăraşi Mountain – Podragu Peak. The information is wrong because the species grows only in Tatra Mountain [21, 25, 26].

We conclude that it is still necessary a hard work to know the Romanian Flora.

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ALIEN PLANT SPECIES FROM STÂNIŞOARA MOUNTAINS (EASTERN CARPATHIANS – ROMANIA)

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Abstract: Our field research in the last years, over the flora, vegetation and habitats, has been identified a number of 93 alien plant species which grow up in more or less disturbed habitats from the Stânişoara Mountains (Eastern Carpathians). These species are discussed regarding their impact to the ecosystems, immigration modes, invasive status, geographical origins, dispersal mechanisms, their distribution, principal infestation sites etc. The most dangerous alien species for anthropic, semi-natural and natural habitats in the investigated territory were identified.

Keywords: vascular flora, alien plants, Stânişoara Mountains, Romania.

Introduction

One of the most important factors that cause the susceptibility of habitats and vegetal communities to be invaded by alien plants is their great degree of disturbance [1]; [32]; [37] etc. Disturbed (semi-natural and anthropic) habitats are well represented in Stânişoara Mountains (which are situated in the central part of the Eastern Carpathians, east of the valleys of Bistriţa river, between Ostra in North and Piatra Neamţ in South), especially along water courses, where human settlements are usually situated (over 70 localities, among which four towns: Piatra Neamţ, Bicaz - at the Southern boundary, Gura Humorului, and Frasin - at the Northern boundary), but also in the vicinity of the numerous monasteries (Agapia, Văratec, Slatina, Horăicioara, Pângăraţi, Bistriţa etc.), sheepfolds, mines (Tarniţa, Crucea, Leşul Ursului etc.), forest cantons etc. During their long history in this territory, humans have greatly promoted the immigration of alien (non-native) plants, through migrations, trade, agriculture, forestry, urbanization, wars, and other activities.

In the Stânişoara Mountains, the anthropic disturbance of habitats and the invasion of alien plants are facilitated by the low altitude of the relief (maximum 1531 m in the Bivolul Peak) and also by the numerous and accessible roads, such as: DN 15 (between Piatra Neamţ and Poiana Largului), DN 17b (between Poiana Largului and Holda), DJ 117a (Holda - Tarniţa Pass - Ostra - Frasin), DE 58 (Frasin - Gura Humorului), DN 15b (Leghin - Petru Vodă Pass - Poiana Largului), DJ 209b (Cornu Luncii - Crucea Talienilor Pass - Borca), numerous other secondary roads (communal, forest), and mountain paths.

In this context, an important presence of alien weeds in the flora of these mountains is presumable. A commented list of the alien species recorded in this territory is presented in this paper.

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Materials and methods

We documented the presence, distribution in the territory and invasive character of alien plant species on the grounds of our recent (2005-2008) field works. Data from some herbarium collections and information in the literature are also used. The species nomenclature is given following the next authors: Tutin et al. (eds) 1964 -1980 [36], Ciocârlan 2000 [9], Oprea 2005 [21]. The terminology associated with alien (non-native) plants is according to Richardson et al. (2000) [31], and Pyšek et al. (2002) [26].

Abbreviations - origin: Am - America; Afr-Africa, As-Asia, Atl-Atlantic regions, B-Balcanic region; Cc-Caucasian region, Eur-Europe, Md - Mediterranean region; P-Pontic region; **intr**. (introduced): acc.-accidentally, delib. - deliberately (orn.-ornamental, alim.-alimentary, med.-medicinal, fodd.-fodder, arom.-aromatic, spi.-spicy, ol.-oleaginous, mell.-melliferous, ant.-er.-anti-erosional, tinct.-tinctorial, forest.-forestry, ser.-sericicultural, text.-textile; other-other uses); **dissem**. - dissemination (germs propagation): antr - anthropochory; aut - autochory, an - anemochory, enz - endozoochory; epz - epizoochory, bar-barrochory, hydr - hydrochory, vg-vegetative propagation; **Lf**-life forms: T-therophytes; H-hemicryptophytes, TH-hemitherophytes; G-geophytes; Ch-chamaephytes; Ph-phanerophytes; **genom**: D-diploid; P-polyploid; **habitat**: h-human-made (anthropic), sn-semi-natural, n-natural; **syntaxa**: Al-Frax - *Alno-Fraxinetalia*; Arr-*Arrhenatheretalia*; Ag. r-*Agropyretalia repentis*; Atr-*Atropetalia*; Bi-*Bidentetalia*; Br-*Brometalia erecti*; Ccy-*Centauretalia cyani*; Ch-*Chenopodietalia albi*; Cse-*Convolvuletalia sepii*; Er-*Eragrostetalia*; Fg. s-*Fagetalia sylvatici*; Fv-*Festucetalia valesiacae*; L-Ch-*Lamio albi-Chenopodietalia boni-henrici*; Oa-*Onopordetalia acanthi*; PP-*Polygono-Poëtalia annuae*; Pr-*Prunetalia*; Pt-*Potametalia*; Si-*Sisymbrietalia*; Sp-*Salicetalia purpureae*; **character: c**-casual (alien plants that may flourish and even reproduce occasionally in an area, but they need repeated introductions for their persistence); **n**-naturalized (alien plants that form stable populations without human intervention), **i**-invasive (naturalized populations that produce reproductive offspring at a considerable distance from parent plants)

Results and discussions

According to our field results, at which we add some data from the reference materials, now, the alien (non-native) flora of the Stânişoara Mountains consists of 93 vascular plant species, with 7 subspecies, belonging to 70 genera and 35 families.

On the whole, the next families are best represented: *Asteraceae* (22 species), *Fabaceae* (6 species), *Brassicaceae* (6 species), *Amaranthaceae* (6 species), *Lamiaceae* (6 species), *Chenopodiaceae* (5 species) etc.

We give below an alphabetical list of the identified species, with their main characteristics and localizations in the territory of the Stânişoara Mountains:

Acer negundo L. - origin: N Am; intr.: delib. (orn., forest., ant.-er.); dissem.: antr., an.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: Fg.s, (Si, L-Ch, Ag.r); character: i; spread: Buhalniţa peak [10], Gura Humorului, Bicaz, Piatra Neamţ, Gârcina, Horaiţa Monastery.
Ailanthus altissima (Mill.) Swingle - origin: As; intr.: delib. (orn.); dissem.: antr., an.; Lf: Ph; genom: D; habitat: h; syntaxa: Oa, Ag.r; character: (c) n.; spread: Piatra Neamţ.
Alcea rosea L. - origin: Md (?); intr.: delib. (orn.); dissem.: antr., an..; Lf: H; genom: P; habitat: h; syntaxa: Si, Oa; character: c; spread: Nemţişor river basin [25], Bicaz (leg. Zanoschi 1967-herb. IASI), Piatra Neamţ.
Amaranthus albus L. - origin: N Am; intr.: acc.; dissem.: antr., an., enz.; Lf: T; genom: D; habitat: h; syntaxa: Si, Er, Ch; character: c(n); spread: Piatra Neamţ, Gârcina.
Amaranthus blitoides S. Watson - origin: N Am; intr.: acc.; dissem.: antr., an., enz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa; character: c(n); spread: Piatra Neamţ.
Amaranthus blitum L. subsp. ***blitum*** - origin: Md; intr.: acc. (? delib.: alim.); dissem.: antr., an., enz.; Lf: T; genom: D; habitat: h; syntaxa: Si, CCy, Ch; character: c(n); spread: Piatra Neamţ [15], Gura Humorului [17].
Amaranthus deflexus L. - origin: S Am; intr.: acc.; dissem.: antr., an.; Lf: T; genom: D-P;

habitat: h; syntaxa: PP, Si; character: c(n); spread: Piatra Neamț [15].
Amaranthus powellii S.Watson: origin - N Am; intr.: acc.; dissem.: antr., an., enz., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Ch, Er; character: i; spread: Gârcina, Bistrița, Piatra Neamț, Gura Humorului, Agapia, Horaița Monastery.
Amaranthus retroflexus L. - origin: N Am; intr.: acc.; dissem.: antr., an., enz., epz.; Lf: T; genom: D; habitat: h, sn; syntaxa: Si, Ch, Er, Oa; character: i; spread: Gura Humorului (!) [17], Procov stream [10], Agapia, Bicaz, Bistrița, Borca, Cotârgaşi, Crucea, Cuejdi, Doroteia, Frasin, Galu, Găineşti, Gârcina, Mălini, Negrileasa, Ostra, Pângărați, Petru Vodă, Piatra Neamț, Pipirig, Pluton, Plutonița, Poiana Largului, Poiana Teiului, Slatina, Stulpicani, Vadu Negrilesei, Voroneț, Horaița Monastery, Horăiciora Hermitage.
Ambrosia artemisiifolia L. - origin: N Am; intr.: acc.; dissem.: antr., an.; Lf: T; genom: P; habitat: h; syntaxa: Si, Ch, Er, Oa; character: i; spread: Piatra Neamț, Vaduri, Bistrița, Pângărați, Bicaz, Gîrcina, Gura Humorului.
Amorpha fruticosa L. - origin: N Am; intr.: delib. (orn., ant.-er.); dissem.: antr., vg.; Lf: Ph; genom: ?; habitat: h, sn; syntaxa: Sp, Pr, Ag.r; character: n(i); spread: Piatra Neamț [11], Vaduri, Bistrița, Cuejdi, Frasin.
Anethum graveolens L. - origin: SW As ; intr.: delib. (arom.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c(n) ; spread: Piatra Neamț, Cuejdi river bed-upstream of Piatra Neamț, Gârcina, Doroteia.
Antirrhinum majus L. - origin: Md; intr.: delib. (orn.); dissem.: antr., an.; Lf: H; genom: D-P; habitat: h; syntaxa: Si; character: c; spread: Piatra Neamț.
Aquilegia vulgaris L. - origin: W,C,S Eur; intr.: delib. (orn.); dissem.: antr., an.; Lf: H; genom: D; habitat: n; syntaxa: Arr; character: c (n); spread: Icoana Hermitage [10], Fărcaşa on the homonymous stream.
Armoracia rusticana P. Gaertn., B. Mey. & Scherb. - origin: SE Eur- W As; intr.: delib. (spi.); dissem.: antr., vg.; Lf: G; genom: P; habitat: h, sn; syntaxa: Oa, Ag.r; character: n(i); spread: Gura Largu [5], Almaş, Ciumârna stream at Găineşti, Doroteia, Crucea, Găineşti, Gârcina, Gura Humorului, Piatra Neamț, Pângărați.
Atriplex hortensis L. - origin: C As; intr.: delib. (alim.); dissem.: antr, an; Lf: T; genom: D; habitat: h; syntaxa: Si, Ch; character: c(n); spread: Gârcina, Gura Humorului, Piatra Neamţ; Horaița Monastery.
Bidens frondosa L. - origin: N Am; intr.: acc.; dissem.: antr., epz., hd.; Lf: T; genom: P; habitat: h; syntaxa: Bi, (Si); character: n; spread: Piatra Neamț [35].
Borago officinalis L. - origin: Md; intr.: delib. (orn., mell., med.); dissem.: antr., bar.; Lf: T; genom: D; habitat: h; syntaxa: Oa, Si; character: c; spread: Piatra Neamț [11].
Brachyactis ciliata (Ledeb.) Ledeb. - origin: As; intr.: acc; dissem.: antr., an.; Lf: T; genom: D; habitat: h, sn; syntaxa: ?; character: n; spread: Gura Humorului [17], Cuejdi river bed upstream of Piatra Neamț.
Brassica nigra (L.) W. D. J. Koch: origin – S & W Eur; intr.: acc., delib (alim., spi., med.); dissem.: antr., aut., an., bar.; Lf; genom: D; habitat: h; syntaxa: Si, Ch; character: (c) n; spread: Piatra Neamț, Horaița Monastery.
Calendula officinalis L. - origin: Md; intr.: delib. (orn., med.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: n; spread: Piatra Neamț, Vaduri, Bistrița, Bistrița Monastery, Neagra, Gârcina, Fărcaşa, Pângărați, Horaița Monastery.
Callistephus chinensis (L.) Nees. - origin: E As; intr.: delib. (orn.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Almaş.
Centaurea cyanus L. - origin: Md; intr.: acc.; dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Ccy, Si; character: c; spread: Piatra Neamț.
Chamomilla suaveolens (Pursh) Rydb. - origin: N Am; intr.: acc; dissem.: an., antr.; Lf: T;

genom: D; habitat: h, sn; syntaxa: PP, Si, (Arr); character: i; spread: Agapia, Bistrița, Borca, Crucea, Crucea Talienilor, Doroteia, Frasin, Galu, Ostra, Găineşti, Găineşti (pr. Ciumârna), Gârcina, Cuejdel lake, Gura Humorului, Mălini, Negrileasa, Petru Vodă, Piatra Neamț, Pipirig, Pluton, Plutonița, Poiana Largului, Stulpicani, Vadu Negrilesei, Horăiciora Hermitage.

Chenopodium foliosum (Moench) Asch. - origin: Md; intr.: delib. (alim.); dissem.: antr., enz.; Lf: T ; genom: D; habitat: h, sn; syntaxa: L-Ch, Si, PP; character: n(i); spread: Hangu [12], Gura Largu [5], Pângărați (leg. Zanoschi 1963-Herb. IASI), Vânători Forest Park [8], Gura Humorului (leg. Oescu 1949-Herb. IASI).

Chenopodium schraderanum Schult. - origin: Afr; intr.: delib. (med., arom.); dissem.: antr., an.; Lf: T; genom: ?; habitat: h; syntaxa: Si, Er; character: n; spread: Pipirig, Pâțâlâgeni, Boboeşti [24].

Conyza canadensis (L.) Cronq. - origin: N Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: D; habitat: h, sn; syntaxa: Si, Oa, Er, Ch; character: i; spread: Gura Humorului (!) [17], Bicaz Lake [5], Bistriței river bank (Panțu 1911, in Daraban 2007) [10], Piciorul Afinişului [10], Agapia, Bicaz, Bistrița, Bistrița Monastery, Borca, Crucea, Cuejdi, Doroteia, Farcaşa, Frasin, Galu, Găineşti, Gârcina, Cuejdel lake, Mălini, Mitocu Bălan, Negrileasa, Ostra, Petru Vodă, Piatra Neamț, Pipirig, Pluton, Plutonița, Poiana Mărului, Poiana Largului, Poiana Teiului, Sabasa, Slătioara, Stulpicani, Vadu Negrilesei, Horaița Monastery, Horăiciora Hermitage.

Coreopsis tinctoria Nutt. - origin: N Am; intr.: delib. (orn., tinct.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Cuejdi river bed-upstream of Piatra Neamț.

Cosmos bipinnatus Cav. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an.; Lf: T ; genom: D; habitat: h; syntaxa: Si; character: c (n); spread: Piatra Neamț [34], Gârcina, Ostra, Leşul Ursului, Cuiejdi, Pângărați.

Cucurbita pepo L. - origin: C Am; intr.: delib. (fodd., alim., orn.); dissem.: antr., bar.; Lf: T; genom: P; habitat: h; syntaxa: Si; character: c; spread: Piatra Neamț, Gârcina.

Cuscuta campestris Yunck. - origin: N Am; intr.: acc; dissem.: antr., bar., enz., vg.; Lf: T; genom: P; habitat: h, sn, n; syntaxa: Si, Ch, Oa, Ag.r, Fv, Arr; character: n; spread: Piatra Neamț (!) [3], Gura Humorului [17], Gârcina.

Datura stramonium L. - origin: N Am; intr.: acc.; dissem.: antr., an., bar.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa, Ch; character: n; spread: Gura Humorului [17], Galu, Piatra Neamț.

Dipsacus strigosus Willd. - origin: W As; intr.: acc.; dissem.: an., antr., bar.; Lf: TH; genom: D; habitat: h, sn; syntaxa: Arr, (Fg.s), Oa; character: i; spread: Piatra Neamț [35], Slatina Monastery, Găineşti, Ciumârna-Găineşti, Plutonița, Negrileasa stream, Agapia.

Dracocephalum moldavica L. - origin: As; intr.: delib. (orn.); dissem.: antr.; Lf: T; genom: P; habitat: h; syntaxa: Si; character: c; spread: Agapia Monastery, Văratec Monastery [28].

Echinocystis lobata (Michx) Torrey & A. Gray - origin: N Am; intr.: acc.; dissem.: antr., bar.; antr, enz, vg; antr, bar; Lf: T; genom: ?; habitat: h, sn; syntaxa: Cse, L-Ch; character: i; spread: Piatra Neamț (!), Găineşti-Slatina [15], Gura Humorului (!) [17], Voroneț, Frasin, Găineşti, Lungeni, Ciumârna stream at Găineşti, Vl. Stânişoarei, Mălini, Muncel, Negrileasa, Ostra, Plutonița, Văleni-Stânişoara, Voroneț.

Elaeagnus angustifolia L. - origin: As; intr.: delib. (orn., for., ant.-er.); dissem.: antr., enz., vg.; Lf: Ph; genom: P; habitat: h, sn; syntaxa: Pr, Ag.r, (Oa); character: c; spread: Piatra Neamț.

Elodea canadensis Michx. - origin: N Am; intr.: acc.; dissem.: antr, vg; Lf: Hd; genom: D-P; habitat: sn, n; syntaxa: Pt; character: n; spread: Piatra Neamț (in Bâtca Doamnei reservoir), Pângărăcior stream.

Elsholtzia ciliata (Thunb.) Hyl. - origin: As; intr.: acc.; dissem.: an., antr.; bar, hydr.; Lf: T; genom: ?; habitat: h, sn; syntaxa: Cse, Bi, Sp; character: i; spread: Piatra Neamţ (!) [30], Gura Humorului [20], Poiana Teiului [16], Audia stream valley (the left bank of Bicaz lake) [5], Borca [22], Bicaz, Valea Mare stream at Bistriţa, Broşteni, Satu Mare, Crucea, Holda, Cuejdi river bed upstream of Piatra Neamţ, Doroteia, Frasin, Galu, Gârcina, Holda, Negrileasa, Pângăraţi.

Erigeron annuus (L.) Pers. - origin: N Am; intr.: acc.; dissem.: an., antr.; Lf: TH ; genom: P; habitat: h, sn, n; syntaxa: Si, Oa, Ag.r., Cse, Fgs, Arr; character: i; spread: – subsp. ***annuus***: the left bank of Bicaz lake [5], Gura Humorului [17], Nemţişo river basin (Afinişului Hill, Piciorul Afinişului), Icoana Hermitage, Mitocu Balan, Buhalniţa peak [10], Bicaz, Bistriţa, Borca, Crucea, Cuejdi river bed-upstream of Piatra Neamţ, Doroteia, Farcaşa, Frasin, Crucea Talienilor, Galu, Găineşti, Gârcina, Cuejdel lake, Mălini, Negrileasa, Ostra, Petru Vodă, Piatra Neamţ, Pluton, Plutoniţa, Poiana Largului, Stulpicani, Vadu Negrilesei, Horaiţa Monastery, Horăiciora Hermitage; –ssp. ***strigosus*** (Mühl. ex Willd.) Wagenitz: Piatra Neamţ, Poiana Mărului.

Galinsoga parviflora Cav. - origin: S Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Ch, Si; character: i; spread: Vl. Pr. Hangu, Gura Largu [5], Gura Humorului [17], Buhalniţa Buhalniţa peak [10], Agapia, Bistriţa, Borca, Plutoniţa, Crucea, Cuejdiu, Frasin, Doroteia, Galu, Găineşti, Gârcina, Mălini, Muncel, Negrileasa, Ostra, Petru Vodă, Piatra Neamţ, Pipirig, Pluton, Plutoniţa, Poiana Largului, Poiana Mărului, Stulpicani, Vadu Negrilesei, Horaiţa Monastery, Horăiciora Hermitage.

Galinsoga quadriradiata Ruiz & Pav. - origin: S Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: P; habitat:h, sn; syntaxa: Ch, Si, Sp, L-Ch; character: i; spread: Procov Hermitage [7], Buhalniţa peak [10], Almaş, Bistriţa Monastery, Broşteni, Ciumârna stream at Găineşti, Crucea, Cuiejdi, Doroteia, Galu, Găineşti, Gârcina, Holda, Holdiţa stream, Muncel, Ostra, Piatra Neamţ, Poiana Mărului, Viişoara, Horaiţa Monastery.

Helianthus annuus L. - origin: N Am; intr.: delib. (ol.); dissem.: antr., bar., an.; Lf: T; genom: D; habitat: h; syntaxa: Si ; character: c; spread: Piatra Neamţ.

Helianthus tuberosus L. - origin: N Am; intr.: delib. (fodd.); dissem.: antr., an., bar., vg.; Lf: G; genom: P; habitat: h; syntaxa: Oa, Ag.r, L-Ch; character: c(n); spread: Bicaz, Găineşti, Ciumârna stream at Găineşti, Piatra Neamţ.

Impatiens balsamina L. - origin: SE As; intr.: delib. (orn.); dissem.: antr., aut.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Piatra Neamţ.

Impatiens glandulifera Royle - origin: As; intr.: delib. (orn.); dissem.: antr., aut.; Lf: T; genom: D; habitat: h, sn; syntaxa: Cse, L-Ch; character: i; spread: Broşteni [14], Bicaz [22], Bistriţa, Crucea, Găineşti, Lungeni on the Fagului stream, Bistriţa Monastery, Ostra, Pângăraţi stream valley.

Impatiens parviflora DC. - origin: C As; intr.: acc; dissem.: antr., aut.; Lf: T; genom: D-P; habitat: h; syntaxa: Si, L-Ch; character: n ; spread: Piciorul Arşiţei [10], Piatra Neamţ;

Ipomoea purpurea Roth - origin: Tr Am; intr.: delib. (orn.); dissem.: antr., bar.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa; character: c; spread: Piatra Neamţ, Bistriţa Monastery.

Iva xanthifolia Nutt. - origin: N Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: ?; habitat: h; syntaxa: Si, Oa, Ch; character: n(i); spread: Piatra Neamţ (!) [4], Cozla, Pângăraţi, Gârcina, Almaş.

Juglans regia L. - origin: C Eur-B-Cc; intr.: delib. (alim., med., tinct., ind.); dissem.: antr., epz., bar.; Lf: Ph ; genom: P; habitat: h, sn, n; syntaxa: Pr; character: c(n); spread: Gura Humorului [13], Piatra Neamţ, Gârcina.

Juncus tenuis Willd.- origin: N Am; intr.: acc.; dissem.: an., antr., bar.; Lf: G; genom: P; habitat: (h), sn, n ; syntaxa: Arr; character: i; spread: Nemţişor river basin [7], Piciorul Arşiţei, Alunişului Hill, Livada Mare, Poiana Gaftonesele [10], Gura Humorului [17], Bistriţa, Bistriţa Monastery, Borca, Broşteni, Cotârgaşi (Peştele Monastery), Crucea, Doroteia, Crucea Talienilor, Fărcaşa on the homonymous stream, Frasin, Galu, Gârcina, Cuejdel lake, Holda, Mălini, Negrileasa, Ostra, Petru Vodă, Piatra Neamţ, Plutoniţa, Poiana Largului, Slatina, Stulpicani, Valea Mare stream at Bistriţa, Văleni, Văleni-Stânişoara, Horăiciora Hermitage.
Kochia scoparia (L.) Schrad. - origin: E, S As; intr.: acc (delib. ?); dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Si, Er; character: (n)i; spread: Piatra Neamţ, Agapia, Almaş, Bistriţa, Vaduri, Gura Humorului, Horaiţa Monastery.

Kochia sieversiana (Pallas) C. A. Mey. - origin: As; intr.: acc; dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Si, Er; character: c(n); spread: Piatra Neamţ [23], Pângăraţi.

Lepidium densiflorum Schrad. - origin: N Am; intr.: acc.; dissem.: antr., an., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa ; character: n; spread: Gura Humorului [21], Piatra Neamţ.
Lepidium virginicum L. - origin: N Am; intr.: acc; dissem.: antr., an., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa, PP; character: c(n); spread: Piatra Neamţ.
Lolium multiflorum Lam. - origin: Md; intr.: delib. (fodd.); dissem.: antr., an.; Lf: T; genom: 2x; habitat: h, sn; syntaxa: Si, Oa, Arr; character: n; spread: Nemţişor river basin (Solacolu 1922, in Chifu et al. 1974) [7], Gârcina [15], Voroneţ.
Lycium barbarum L. - origin: E As; intr.: delib. (orn.); dissem.: enz., antr., vg.; Lf: Ph; genom: P; habitat: h, sn; syntaxa: L-Ch, Oa, Ag.r, Pr; character: n; spread: Piatra Neamţ (!) [11], Gârcina; Horaiţa Monastery.
Malva moschata L. - origin: Atl-Md ; intr.: delib. (orn.); dissem.: antr., an.; Lf: H ; genom: P; habitat: h; syntaxa: Si; character: c; spread: Gura Humorului [29].
Malva verticillata L. - origin: As; intr delib. (orn.); dissem.: antr., an.; antr, enz; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa; character: c; spread: Gura Humorului (as *M. crispa* L.) [19].
Medicago sativa L. - origin: As; intr.: delib. (fodd.); dissem.: antr., enz.; Lf: Ch; genom: P; habitat: h, sn, n; syntaxa: Arr, Ag.r, Oa; character: n; spread: Piatra Neamţ, Pângăraţi; Horaiţa Monastery.
Medicago × varia Martyn - origin: hybrid; intr.: acc ?, delib. (fodd.) ?; dissem.: antr., enz.; Lf: Ch; genom: P; habitat: h, sn; syntaxa: Ag.r, Oa; character: n(i); spread: Nemţişorului river basin (Petrescu 1923, in Chifu et al. 1974) [7], Piatra Neamţ (Bistriţei St., Dărmăneşti), Bistriţa, Pângăraţi.
Melissa officinalis L. - origin: SW As, B; intr.: delib. (med., mell., arom.); dissem.: antr., bar., vg.; Lf: H ; genom: P; habitat: h, sn, n; syntaxa: Oa, Pr; character: c; spread: Neamţ (Czihack & Szabo 1873, in Brândză 1879-83) [2].
Mentha × piperita L. - origin: hybrid; intr.: delib. (med., arom.); dissem.: antr., bar., vg.; Lf: H; genom: ?; habitat: h ; syntaxa: Oa; character: c; spread: Agapia.
Mentha × ***spicata*** L. - origin: hybrid (Atl.-Md); intr.: delib. (med., arom.); dissem.: antr., bar., vg.; Lf: H; genom: P; habitat: h; syntaxa: Oa; character: c; spread: Agapia.
Morus alba L. - origin: E As; intr.: delib. (orn., alim., ser., ind.); dissem.: antr., enz.; Lf: Ph; genom: P; habitat: h; syntaxa: (Oa); character: c; spread: Piatra Neamţ.
Oenothera biennis L. - origin: N Am; intr.: acc; dissem.: antr., an.; Lf: TH; genom: D; habitat: h, sn; syntaxa: Si, Oa; character: i; spread: Pintec stream, on the Bistriţa river, Bistricioara, Mălini [18], Gura Humorului [17], Lungeni, Petru Vodă, Piatra Neamţ.

Oenothera glazioviana Micheli - origin: N Am?; intr.: delib. (orn.); dissem.: antr., an.; Lf: TH; genom: D; habitat: h, sn; syntaxa: Oa, Sp; character: c; spread: Agapia, Cuejdi river bed upstream of Piatra Neamț.
Oxalis dillenii Jacq. - origin: N Am; intr.: acc; dissem.: aut., antr., vg.; Lf: H ; genom: P; habitat: h; syntaxa: Si, Er; character: c(n) ; spread: Piatra Neamț [35].
Oxalis stricta L. - origin: N Am; intr.: acc; dissem.: aut., antr., vg.; Lf: H; genom: P; habitat: h, sn; syntaxa: Ch, Si, (Arr); character: i; spread: Gura Humorului [17], Valea Mare stream at Bistrița, Doroteia, Holda, Piatra Neamț, Poiana Mărului.
Parthenocissus inserta (A. Kerner) Fritsch - origin: N Am; intr.: delib. (orn.); dissem.: antr., enz., vg.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: L-Ch, Oa, Sp; character: n; spread: Bicaz, Piatra Neamț.
Parthenocissus quinquefolia (L.) Planchon - origin: N Am; intr.: delib. (orn.); dissem.: antr., enz., vg.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: L-Ch, Oa; character: n; spread: Bicaz; Boboiești, Pângărați.
Phalaris canariensis L. - origin: Afr; intr.: delib. (orn.); dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Gura Humorului [17].
Phytolaca americana L. - origin: N Am; intr.: delib. (orn, tinct); dissem.: antr., enz.; Lf: H; genom: P; habitat: h; syntaxa: L-Ch; character: c; spread: Piatra Neamț.
Portulaca oleracea L. var. ***oleracea*** - origin: S Eur ?; intr.: acc (alim. ?); dissem.: antr., bar., an.; Lf: T; genom: P; habitat: h; syntaxa: Er, Si, Ch; character: i; spread: Piatra Neamț, Bistrița, Vaduri, Almaș, Gârcina, Gura Humorului, Frasin, Mălini, Ostra, Horaița Monastery.
Prunus cerasifera Ehrh.: origin: B-P; intr.: delib.(alim.); dissem.: antr., bar., enz., vg.; Lf: Ph; genom: D; habitat: h; syntaxa: ?; character: c; spread: Piatra Neamț.
Raphanus raphanistrum L. subsp. ***landra*** (Moretti ex DC.) Bonnier & Layens - origin Md; intr.: acc; dissem.: antr., bar.; Lf: T; genom: D; habitat: h; syntaxa: Si, Ch ; character: c(n); spread: Piatra Neamț.
Raphanus sativus L. - origin: Md; intr.: delib. (alim.); dissem.: antr., bar.; Lf: T-TH; genom: D; habitat: h; syntaxa: Si; character: c; spread: Gârcina, Piatra Neamț.
Reynoutria × bohemica Chrtek & Chrtková: origin - E As (C Eur hybrid ?); intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: G; genom: P; habitat: h, sn, n; syntaxa: L-Ch, Cse, Al-Frax; character: i; spread: Bicaz, Broșteni, Galu, Crucea, Gura Humorului (Moldova river bank, at „Arini"Complex), Negrileasa, Piatra Neamț [33], Arini, Holda, Ostra, Pietroasa, Potoci.
Reynoutria japonica Houtt. - origin: E As; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: G; genom: P; habitat: h, sn, n; syntaxa: L-Ch, Cse, Al-Frax; character: i; spread: Broșteni, Cotârgași, (Peștele Monastery), Galu, Holda, Lungeni (on the Fagului stream), Negrileasa, Petru Vodă, Sabasa.
Ribes rubrum L. - origin: C, W Eur; intr.: delib. ? (alim., orn.); dissem.: antr., enz.; Lf: Ph; genom: D; habitat: n; syntaxa: ?; character: n; spread: Neamțului Mountains at Sihla Hermitage [27], Crucea (Tarnița Rock).
Robinia pseudacacia L. - origin: N Am; intr.: delib. (orn., forest., mell.); dissem.: antr., an., vg.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: Pr, Fg. s, (Ag.r, Oa); character: i; spread: Buhalnița peak [10], Galu, Găinești, Gârcina, Holdița, Piatra Neamț, Neagra, Horaița Monastery.
Robinia viscosa Vent - origin: N Am; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: Ph; genom: D; habitat: h ; syntaxa: ?; character: c; spread: Buhalnița peak [10], Piatra Neamț.

Rudbeckia hirta L. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an.; Lf: TH; genom: D; habitat: h, (n); syntaxa: Si, (Sp); character: c; spread: Cuejdi river bed upstream of Piatra Neamţ.
Ruta graveolens L. - origin: Md; intr.: delib. (orn., med., arom.); dissem.: antr., aut.; Lf: Ch; genom: P; habitat: h; syntaxa: ?; character: c; spread: Piatra Neamţ (cult. ?) [11].
Satureja hortensis L. - origin: Md; intr.: delib. (med., arom.); dissem.: antr., an., bar.; Lf: T; genom: ?; habitat: h, sn; syntaxa: Si, Sp; character: c; spread: Piatra Neamţ (!) [6], Cuejdi river bed-upstream of Piatra Neamţ, Gârcina.
Sisyrinchium montanum Greene - origin: N Am; intr.: acc.; dissem.: antr., an., enz.; Lf: G; genom: P; habitat: n; syntaxa: Arr; character: (n)i; spread: Gura Humorului [17], Muncel, Crucea (near the sterile dump deposits), Ostra.
Solidago canadensis L. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: H; genom: D; habitat: h, sn; syntaxa: Cse, Arr, Oa, Ag.r; character: c; spread: Piatra Neamţ.
Tagetes patula L. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an.; Lf: T; genom: P; habitat: h; syntaxa: Si; character: c; spread: Bicaz.
Tanacetum parthenium (L.) Sch. Bip. - origin: Md; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: H; genom: D; habitat: h; syntaxa: Oa, Ag.r, Si; character: n; spread: Cuiejdi, Găineşti, Ciumârna stream at Găineşti, Piatra Neamţ.
Thladiantha dubia Bunge - origin: As; intr.: delib. (orn.); dissem.: antr., bar.; Lf: G; genom: D; habitat: h; syntaxa: Si, Cse, Oa; character: n; spread: Piatra Neamţ, Neagra, Agapia Monastery.
Trigonella caerulea (L.) Ser. - origin: Md; intr.: delib. (fodd.); dissem.: antr., enz.; Lf: T; genom: D; habitat: h, sn; syntaxa: Si, Oa, Ag.r , Fv; character: (n)i; spread: Piatra Neamţ, Bistriţa, Vaduri, Voroneţ.
Veronica persica Poir. - origin: As; intr.: acc.; dissem.: antr, an., enz., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Ch; character: i; spread: Lacul Bicaz [5], Gura Humorului [17], Secu Monastery [10], Pârâul Cârjei, Piatra Neamţ, Horaiţa Monastery.
Xanthium orientale L. - origin: SE Md; intr.: acc.; dissem.: antr., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Bi, Ch, Er, Oa; character: i; spread: - subsp. ***riparium*** (Čelak.) Greuter: Bicaz; - subsp. ***italicum*** (Moretti) Greuter: Piatra Neamţ, Gârcina, Cuejdel lake, Frasin, Bistriţa, Horaiţa Monastery.
Xanthium spinosum L. - origin: S Am; intr.: acc.; dissem.: antr., epz.; Lf: T; genom: P; habitat: h, sn; syntaxa: Oa, Si; character: i; spread: Lacul Bicaz [5], Gura Humorului [17], Piatra Neamţ, Magazia, Voroneţ, Agapia, Horaiţa Monastery, Horăiciora Hermitage.

Our recordings point out the fact that the number of alien plants in different localities from Stânişoara Mountains is positive correlated with the intensity of the anthropic influence relative to the environment. So, the largest number of alien species was met in the urban localities situated in the peripheral regions of the mountain area (Piatra Neamţ - 71 species; Gura Humorului - 31 species), while the smallest number of alien species was registered in the uninhabited regions, usually situated at the greater altitude (for example, at the Crucea Talienilor Pass, at 1243 m altitude, we have identified three alien species, only: *Chamomila suaveolens, Juncus tenuis*, and *Erigeron annuus* sensu lato).

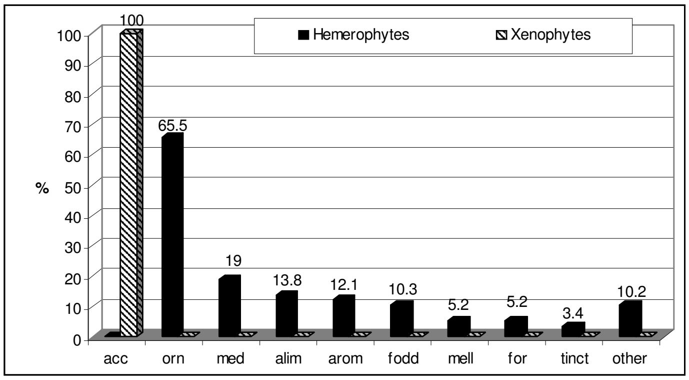

Fig. 1. Introduction mode - accidentally (acc) or deliberately as cultivated plants for various uses: ornamental (orn), medicinal (med), alimentary (alim), aromatic (arom), fodder (fod), melliferous (mell), forestry (for), tinct.-tinctorial etc.

Of the total number of alien plant species, 36 species (38.7%) are xenophytes, and 57 species (61.3%) are hemerophytes. In contrast with the xenophytes, which have been accidentally introduced in the region (through humans and animals movements, displacement of military troupes, transports, urbanisation, tourism activities, agriculture, buildings, mining exploitations, forest activities etc.), the hemerophytes were initially introduced by man, as cultivated plants, for various uses, chiefly in ornamental (65.5%), medicinal (19%), alimentary (13.8%), aromatic (12.1%), or fodder (10.3%) purposes, and less as forest, tinctorial or oleaginous plants; subsequent, these plants escaped from cultures, spreading by themselves in anthropic or natural habitats (**Fig. 1**).

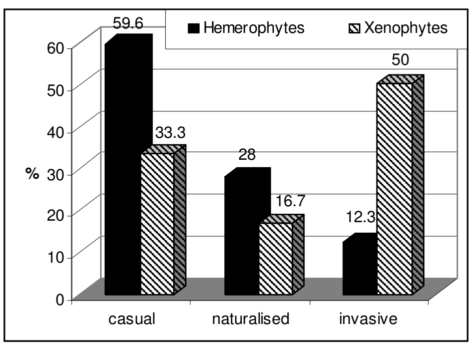

Fig. 2. Alien plants status

With regard to the status of the xenophytes in Stânişoara Mountains, we assess that 50% of them have in present an invasive character (i), while 16.7% are naturalised (n), and 33.3% are casual (c) in the region. In contrast, the majority of hemerophytes (59.6%) have a casual status, and only 28.0% are naturalized and 12.3% are invasive (**Fig. 2**).

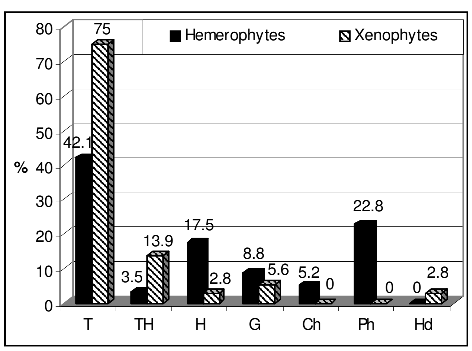

Fig. 3. The structure of Raunkiaer's life forms

Of the main species with an invasive character, that are or could be detrimental to the natural and anthropic ecosystems in the Stânişoara

Mountains, we can enumerate: *Amaranthus powellii, A. retroflexus, Ambrosia artemisiifolia, Chamomilla suaveolens, Conyza canadensis, Echinocystis lobata, Elsholtzia ciliata, Erigeron annuus, Galinsoga parviflora, G. quadriradiata, Juncus tenuis, Oenothera biennis, Oxalis stricta, Veronica persica, Xanthium orientale* subsp. *italicum, X. spinosum* (xenophytes), *Acer negundo, Impatiens glandulifera, Reynoutria* × *bohemica, R. japonica, Robinia pseudacacia* (hemerophytes) etc.

Regarding the structure of Raunkiaer's life forms (**Fig. 3**), we can find a very important proportion of therophytes (species with pioneer character, with short biological cycles and which prefer the disturbed habitats), both in the case of xenophytes (75%) and hemerophytes (42.1%). The other life forms are less represented. Nevertheless, in the case of alien plants that were voluntary introduced by man and subsequently escaped from cultures (hemerophytes), we remark an important proportion of phanerophytes (22.8%) and hemicryptophytes (17.5%). Among the alien plants that were accidentally introduced in the studied territory (xenophytes), we see a total absence of phanerophytes (trees, shrubs), and a very little proportion of hemicriptophytes (2.8%). A possible explanation of this situation can be that when the woody plants and the herbaceous perennial ones (plants which don't produce seeds in the first years of life) are intentionally introduced in a new territory, they benefit all the time by protection and care on the part of man, which increase their chance of acclimatization and naturalization, in their new country, after a certain number of years; while the herbaceous perennial and woody plants accidentally arrived on a new territory, since the germination of the seeds and formation of the seedlings, have to suffer a great number of edaphic, climatic and zoo-anthropic adversities, which leads to their loss, in a great proportion, before the producing of seeds and their spreading into surroundings.

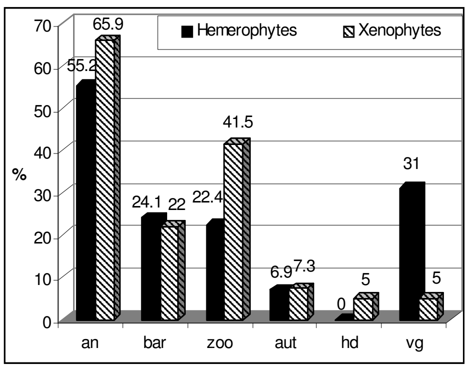

Fig. 4. Means of natural spreading of the germs: an-anemochory, bar-barrochory, zoo- zoochory, aut-autochory, hd-hydrochory, vg-vegetative

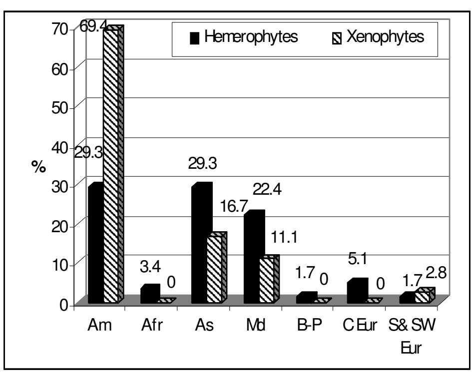

Fig. 5. The origin of the species: Am-America, Afr-Africa, As-Asia, Md-Mediterranean region, B-Balcanic region, P-Pontic region, Eur-Europe (S-south, C-central, W-west)

On the whole, the alien flora from the Stânişoara Mountains contains almost the same proportion of diploid (D) and polyploid (P) species. Nevertheless, polyploids prevail among xenophytes (ID_X=0.71), while the hemerophyte flora contains more diploids than polyploids (ID_H=1.4).

Besides anthropochory, met at all analyzed species, the main means of natural spreading of the germs (seeds, fruits) are the next: the anemochory (65,9% - xenophytes, and 55,2% - hemerophytes), the zoochory (41,5% -

xenophytes and 22.4% - hemerophytes) and the barrochory (22% - xenophytes and -24.1% - hemerophytes). The autochory (7.3 - 6.9%) and hidrochory are less important (5.0-0%). The vegetative propagation (by radicular buds, rhizomes, stolons etc.) is met more frequent at hemerophytes (31%) than xenophytes (5%) (**Fig. 4**).

Most xenophytes came from America (especially North America) (69.4%), and fewer came from Asia (16.7%), Mediterranean region (11.1%) etc. Also, the most hemerophytes have their origin in America (29.3%), Asia (29.3%), and Mediterranean region (22.4%), and fewer came from Central Europe (5.1%) or other regions (**Fig. 5**).

The habitats invaded by alien plants in the Stânişoara Mountains are especially the anthropic disturbed ones (ruderal places, crops, surroundings of villages, roads, waste depots etc.), over 95% of the alien plants species being identified in such kind of habitats. The semi-natural and natural habitats are also invaded by 37.9%, respectively 12.1% of the hemerophytes and 44.7%, respectively 15.8% of the xenophytes (**Fig. 6**).

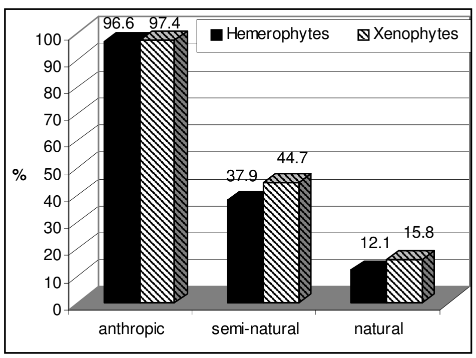

Fig. 6. The habitats invaded by alien plants

As a whole, the alien species from the Stânişoara Mountains are identified (as accompanying, dominant or characteristic species) in vegetation units integrated in 20 orders of the coenotaxonomic system. Ruderal communities of *Sisymbrietalia* order harbor 76.3% of xenophytes and 53.3% of hemerophytes. Other important vegetal communities that also harbor alien species belong to the next orders: *Onopordetalia* (39,5% of xenophytes and 44,8% of hemerophytes), *Chenopodietalia albi* (particularly xenophytes - 39.5%), *Agropyretalia repentis* (particularly hemerophytes - 22.4%), *Eragrostetalia* (particularly xenophytes -15.8%), *Lamio-Chenopodietalia* (particularly hemerophytes - 15.5%) etc.

The natural vegetation affected by the invasion of the alien plants is represented in the territory, especially by meadows, shrub and riparian communities, from several orders, such as: *Arrhenatheretalia* (15.8% of xenophytes), *Prunetalia* (10.3% of hemerophytes), *Salicetalia purpureae* etc.

Conclusions

- The alien (non-native) flora of the Stânişoara Mountains consists of 93 vascular plant species, with 7 subspecies, belonging to 70 genera and 35 families. These species are discussed regarding their impact to the ecosystems, immigration modes, invasive status, geographical origins, dispersal mechanisms, their distribution, principal infestation sites etc.
- The number of alien plants in different localities from Stânişoara Mountains is positive correlated with the intensity of the anthropic influence relative to the environment.
- Of the total number of alien plant species, 38.7% were accidentally introduced in the territory, while 61.3% were deliberately introduced and then escaped in the wild.
- The most dangerous alien species for semi-natural and natural habitats in the investigated territory are identified.

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RARE PLANTS IN STÂNIŞOARA MOUNTAINS (EASTERN CARPATHIANS)

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Abstract: In the natural ecosystems from the Stânişoara Mountains (Eastern Carpathians), there have been identified a number of 145 rare vascular plant species, belonging to 98 genera and 38 families.

Keywords: vascular flora, rare plants, Stânişoara Mountains.

Introduction

The Stânişoara Mountains are situated in the central part of Eastern Carpathians (Romania), on the flysch area, between the valleys of Bistrița and Moldova rivers. The area of its is around 2000 sq. Km; the maximum altitude is of 1531 m (in Bivolu peak); the mean altitude is of 800 m, with an energy of relief of 300-400 m, and a general relief declivity of 17º (**Fig. No. 1**).

There are developed an extremely varied structural lithologic conditions. The structures were formed in a long-lasting tectonic process, starting in Lower Cretaceous period (with the emergence of the geosynclinal flysch) and finishing in the Sarmatian period.

Regarding the relief induced by the action of the exogenous processes, the Stânişoara Mountains display the next morphosculptures types: fluvial denudational, fluvial, denudational, periglacial, lacustrine, and anthropical.

An important part of the slope morphology was played by land slides. Its development was favoured by the presence of rock clusters on account of which thick deluvial covers were formed. It is the case of two major landslides, nowadays, in the area of the middle basin of Cuiejdel stream.

On the basis of the evolution and genesis, the geographers [5] pointed out three major relief units, namely: the Suha Mountains, the Sabasa Mountains, and the Neamțu Mountains.

The vegetation: a large part of the area is covered by the mixed forests (coniferous and broadleaved deciduous forests); only on small patches, there are stands of coniferous forests; along the rivers and streams are alluvial forests; large area are covered by natural meadows, though they have a secondary origin [2].

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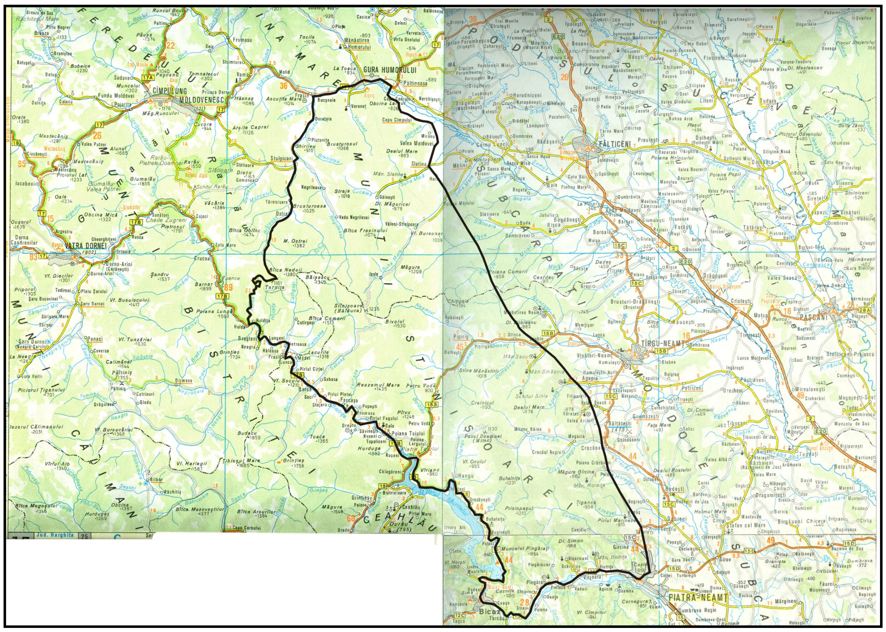

Fig. No. 1 Map of the Stânişoara Mountains (Eastern Carpathians)

Material and methods

Our field investigations began in 2006. We carried out intensive field surveys over the whole territory, in order to identify flora and vegetation of the Stânişoara Mountains. The surveys were made on transects, most of them on West–East directions. They included all the relief forms and vegetation types in the area. The vascular plants identification was performed according to works such as: Săvulescu, Tr., 1952-1976 – Flora R. P. Române-R. S. România [10], I-XIII, Beldie, Al., 1977-1979 – Flora României. Determinator ilustrat al plantelor vasculare, I-II [1], and Ciocârlan, V., 2000 – Flora ilustrată a României, Pteridophyta et Spermatophyta [3].

Further, all the rare plant species present into the flora of Stânişoara Mountains, are categorised according to their registration category, under some international regulations (e. g. *Habitat Directive 92/43/EEC* [12], *Bern Convention* [12], other (e. g. Walter K. S. & Gillet J. H., 1998 [11]; Oldfield S., Lusty C. & MacKinven A., 1998 [8], [14] or at http://www.ec.europa.eu/environment/nature/legislation/habitatsdirective; http://www.conventions.coe.int [17]) (column no. 4 in the **Table no. 1**) or internal documents as Romanian Red List [9] (column no. 6 in the Table no. 1) and into the national regulations [15, 16] (column no. 7 in the Table no. 1). For each species, a certain category is applied to, being accompanied by their threaten degree according to IUCN [11], their endemic status into the romanian flora, and localities where these species have been identified by other authors or by ourselves.

The sozological categories applied to our species are made according to our field investigations, having in mind their population status, their distribution on the scale of the Stânişoara Mts., their threatened status, and so on. It means that we follow our own investigations in designation those threatened categories (column no. 3 in the Table no. 1).

In the column no. 5 in the Table no. 1, there are given the endemic status of species identified by us in Stânişoara Mountains. In the the column no. 8 of the Table no. 1, each species is given on the localities where it was identified in the Stânişoara Mountains.

Abbreviations: **HD** (*Habitat Directive 92/43/EEC*), **BC** (*Bern Convention*, 1979), **RRL** (*Romanian Red List*, 1994 [9]), **GRL** (*Global Red List*), **WLT** (*World Tree Red List*, 1998), **IUCN** (International Union for Conservation of Nature – Red List Categories and Criteria, 2003) [14]; **R** (a rare plant in Romania, according to [9]); **nt** (a plant is not threatened in Romania, according to [9]); **K** (not enough known in Romania, according to [9]).

Results and discussions

There have been identified 900 vascular species on the whole area of Stânişoara Mountains, some of them, being pretty rare on the surveyed territory.

A number of 145 species are listed in our paper only, being considered by us as pretty rare in the flora of the above mentioned territory.

A first category is those 21 plant species, which are considered to be a priority to preserve, on a short and medium term. They are registered under some international regulations, as: *Habitat Directive 92/43/EEC* (Dir. Hab.) [13], *Global Red List* (GRL), *World Tree Red List* (WLT, 1998), *Bern Convention* (BC, 1979) [12]. Some of these international regulations are also adopted by the Romanian Government, as different laws or resolutions [16] (see the columns no 7 in the Table no. 1).

A second category comprise those endemic and near-endemic plants in the vascular flora of Romania, being met the Stânişoara Mountains also, requiering conservation measures. Thus, we have identified 31 vascular plant species of this category on that territory (3% from the whole number of the plant species in the Stânişoara Mountains) (see the columns no 5 in the Table no. 1).

A third category is those species registered on the Romanian Red List [9], also. There are 93 species (10.33% of the flora of Stânişoara Mountains) (see the columns no 6 in the Table no. 1).

The last but one analyzed category in our paper is those species which are reflected into the romanian legislation concerning the preserving of them, 9 species (1% – see the columns no 7 in the Table no. 1).

A last category of plants are those of other rare plants, not yet mentioned in the other categories, which are to be met in a few localities only, in the Stânişora Mountains (see the columns no 8 in the Table no. 1).

Table no. 1 The rarest plant species registered in the Stânişoara Mountains

	1	2	3	4	5	6	7	8
No. crt.	**Family**	**Taxon name**	**Sozo-logical cate-gory**	**Interna-tional Regula-tions**	**Ende-micity status in Ro-mania**	**Red Data List of Romania (Oltean & al., 1994)**	**Recorded in national legisla-tion**	**Distribution in Stânişoara Mts.**
1	*Astera-ceae*	*Achillea oxyloba* (DC.) Sch. Bip. subsp. *schurii* (Sch. Bip.) Heimerl	LR	BC	near End.	R	-	Tarniţa Mare Rocks
2	*Astera-ceae*	*Arnica montana* L. subsp. *montana*	VU	Dir. Hab. 92/43, Annex Vb	-	VU	[15, 16]	Southern of Tarniţa Pass, Borca, Cotârgaşi, near the „Peştele" Monastery, Fărcaşa along the homonymous stream, Crucea, Satu Mare
3	*Asplenia-ceae*	*Asplenium adulterinum* Milde	VU	Dir. Hab. 92/43 Annex IIb	-	R	[15, 16]	Bicaz Mountains [7] ?
4	*Campanula ceae*	*Campanula patula* L. subsp. *abietina* (Griseb.) Simonk.	LR	BC, App. 5/1998	near End.	-	-	frequent in Stânişoara Mountains
5	*Campa-nulaceae*	*Campanula serrata* (Kit.) Hendrych	LR	Dir. Hab. 92/43 Annex IIb, Annex IVb	near End.	-	[15, 16]	frequent in Stânişoara Mountains
6	*Orchida-ceae*	*Cypripedium calceolus* L.	EN	HD 92/43 Annex IIb; BC App. I	-	VU/R	[15, 16]	Nemţişor water basin [7], Pietroasa, Sabasa
7	*Amarylli-daceae*	*Galanthus nivalis* L.	VU	Dir. Hab. 92/43, Annex Vb	-	nt	[15, 16]	Pietroasa, along the valley of Sabasa stream
8	*Brassica-ceae*	*Hesperis oblongifolia* Schur	VU	GRL	near End.	R	-	Tarniţa Mare Rocks
9	*Pinaceae*	*Larix decidua* Mill. subsp. *carpatica* (Domin) Šiman	VU	WLT 1998	near End.	R	[15, 16]	„Piatra Pinului" at Gura Humorului (cultivated ?)
10	*Lycopo-diaceae*	*Lycopodium annotinum* L.	-	Hab. Dir. 92/43, Annex Vb	-	-	[15, 16]	Pietroasa
11	*Lycopo-diaceae*	Lycopodium clavatum *L.*	-	Hab. Dir. 92/43, Annex Vb	-	-	[15, 16]	Pietroasa, Tarniţa Pass

12	*Lycopo-diaceae*	Lycopodium selago *L.*	-	Hab. Dir. 92/43, Annex Vb	-	-	[15, 16]	Pietroasa, the natural reserve „Piatra Pinului" at Gura Humorului, Plutonița Monastery, Tarnița Mare Rocks
13	*Typhaceae*	*Typha shuttleworthii* Koch & Sonder	LC	BC, App. I/1998	-	VU/R	-	Văleni [7], Pângărați
14	*Ranuncu-laceae*	*Aconitum moldavicum* Hacq. subsp. *moldavicum*	LC		near End.	-	-	Nemţişor river basin [7], Tarnița Mare Rocks, the valley of Fărcaşa stream
15	*Ranuncu-laceae*	*Aquilegia vulgaris* Schur	NT		-	-	-	the valley of Fărcaşa stream
16	*Rubiaceae*	*Asperula carpatica* I. Morariu	NT		End.	R	-	Tarnița Mare Rocks
17	*Campa-nulaceae*	*Campanula carpatica* Jacq.	VU	BC	near End.	R	-	Tarnița Mare Rocks, Tarnița Pass, Pietroasa, the valley of Fărcaşa stream, between Satu Mare and Cojoci
18	*Astera-ceae*	*Centaurea pinnatifida* Schur subsp. *pinnatifida*	NT		End.	R	-	Tarnița Mare Rocks
19	*Caryo-phyllaceae*	*Dianthus spiculifolius* Schur	LC		near End.	R	-	Tarnița Mare Rocks
20	*Caryo-phyllaceae*	*Dianthus tenuifolius* Schur	NT		near End.	nt	-	Crucea, Holda under the Tarnița Mare Rocks Peak, between Satu Mare and Cojoci
21	*Poaceae*	*Helictotrichon decorum* (Janka) Henrard	LC	BC	End.	nt	-	Tarnița Mare Rocks
22	*Ranuncu-laceae*	*Hepatica transsilvanica* Fuss	LC		near End.	nt	-	Nemţişor river basin [7], Borca, Cuiejdel lake
23	*Brassica-ceae*	*Hesperis moniliformis* Schur	NT		End.	R	-	Tarnița Mare Rocks
24	*Asteraceae*	*Hieracium pojoritense* Woł.	LC		near End.	R	-	Tarnița Mare Rocks
25	*Poaceae*	*Poa rehmannii* (Asch. & Graebn.) Woł.	LC		near End.	R	-	Tarnița Mare Rocks, between Satu Mare and Cojoci
26	*Primula-ceae*	*Primula elatior* (L.) Hill subsp. *leucophylla* (Pax) Hesl.-Harr. f. ex W. W. Sm. & H. R. Fletcher	LC		near End.	R	-	Pângărați [7], Southern of the Tarnița Pass, under Tarnița Mare Rocks, Boboieşti, Petru Vodă, Crucea

27	*Caryophy-llaceae*	*Silene nutans* L. subsp. *dubia* (Herbich) Zapał.	LC		near End.	R	-	Mount Cozla [7], Broşteni, Tarniţa Pass, the valley of Holdiţa stream, Tarniţa Mare Rocks, between Satu Mare and Cojoci
28	*Caryophy-llaceae*	*Silene zawadzkii* Herbich	LC		near End.	R	-	Tarniţa Mare Rocks
29	*Primula-ceae*	*Soldanella hungarica* Simonk. subsp. *hungarica*	LC		near End.	-	-	Borca
30	*Boragina-ceae*	*Symphytum cordatum* Waldst. & Kit. ex Willd.	LC		near End.	-	-	Pângăraţi [7], Nemţişor river basin [7]
31	*Violaceae*	*Viola jooi* Janka	VU		near End.	R	-	Mount Cozla [7]
32	*Pinaceae*	*Abies alba* Mill.	EN	BC	-	EN	-	everywhere in Stânişoara Mts.
33	*Orchida-ceae*	*Anacamptis pyramidalis* (L.) Rich.	VU		-	VU/R	-	Borca
34	*Apiaceae*	*Angelica archangelica* L.	VU		-	VU	-	cited from Pângăraţi [2], Borca [2] and Hangu [7], but not found by us
35	*Brassica-ceae*	*Cardamine glanduligera* O. Schwarz	LC		-	-	-	Nemţişor river basin [7], Bisericani, Pângăraţi
36	*Astera-ceae*	*Centaurea phrygia* L. subsp. *melanocalathia* (Borbás) Dostál	NT	BC	near End.	R	-	Poiana Comarnicului [4]
37	*Orchida-ceae*	*Cephalanthera damasonium* (Mill.) Druce	NT		-	nt	-	Bourului Hill [2], Poiana Strugăria [2], Jacotele Hill [2], Nemţişorului valley [2]
38	*Orchida-ceae*	*Cephalanthera longifolia* (L.) Fritsch	NT		-	nt	-	Agapia stream at homonymous Monastery; the valley of Almăşel stream; Cuiejdi
39	*Orchida-ceae*	*Cephalanthera rubra* (L.) Rich.	VU		-	R	-	Pângăraţi, Tarcău, Nemţişor stream [6]
40	*Ranuncu-laceae*	*Cimicifuga europaea* Schipcz.	VU		-	R	-	Vadu Negrilesei
41	*Asteraceae*	*Cirsium decussatum* Janka	VU	BC	-	R	-	Doroteia, Cotârgaşi, near the Monastery „Peştele"at Cotârgaşi, Crucea Talienilor, Plutoniţa Monastery, Sabasa

42	*Asteraceae*	*Cirsium furiens* Griseb. & Schenk	LC	BC	near End.	nt	-	Borca, Piatra Neamţ on Cârlomanul hill
43	*Orchida-ceae*	*Coeloglossum viride* (L.) Hartm.	VU		-	R	-	Nemţişor river basin [7]
44	*Orchida-ceae*	*Corallorhiza trifida* Châtel.	VU		-	R	-	Nemţişor river basin [7]
45	*Orchida-ceae*	*Dactylorhiza incarnata* (L.) Soó subsp. *incarnata*	VU		-	R		Nemţişor river basin [7]
46	*Orchida-ceae*	*Dactylorhiza maculata* (L.) Soó subsp. *maculata*	VU		-	R	-	Pietroasa
47	*Orchida-ceae*	*Dactylorhiza majalis* (Rchb.) P. H. Hunt & Summerh.	VU		-	R	-	Cuiejdi-Gârcina [7], Pietroasa
48	*Orchida-ceae*	*Dactylorhiza sambucina* (L.) Soó	VU		-	R	-	Nemţişor river basin [7], Piatra Neamţ on Cârlomanul hill [7]
49	*Caryophy-llaceae*	*Dianthus barbatus* L. subsp. *compactus* (Kit.) Heuff.	VU		-	R	-	Pângăraţi [herbarium of Botanic Garden of Iaşi], Tarniţa Pass, Chiril
50	*Caryophy-llaceae*	*Dianthus collinus* Waldst. & Kit. subsp. *glabriusculus* (Kit.) Thaisz	VU		-	R	-	Nemţişor river basin [7], Gârcina [6], Pângăraţi [7], Viişoara
51	*Caryophy-llaceae*	*Dianthus superbus* L. subsp. *alpestris* Kablík ex Čelak.	VU		-	R	-	Pietroasa, Muncel, Chiril
52	*Dipsaca-ceae*	*Dipsacus strigosus* Willd.	VU		-	R	-	Plutoniţa, Poiana Mărului, Găineşti, Slatina Monastery, Plutoniţa Monastery, Agapia stream at the homonymous monastery
53	*Orchida-ceae*	*Epipactis atrorubens* (Hoffm.) Besser	VU		-	R	-	Nemţişor river basin [7], Borca, Tarniţa Mare Rocks, Sabasa, Leşul Ursului

54	*Orchida-ceae*	*Epipactis helleborine* (L.) Crantz	VU		-	R	-	Nemţişor river basin [7], Pângăraţi [7], Crăcăoani [7], Cuiejdiu-Gârcina [7], Văleni-Stânişoara, Fărcaşa on the homonymous stream, Agapia stream at the homonymous monastery, Văratec, Cuiejdel lake, Tarniţa Mare Rocks
55	*Orchida-ceae*	*Epipactis palustris* (L.) Crantz	VU		-	R	-	Nemţişor river basin [7], Cuiejdiu-Gârcina [7]
56	*Orchida-ceae*	*Epipactis purpurata* Sm.	VU		-	R	-	Piatra Neamţ on Cârlomanul Hill [6]
57	*Orchida-ceae*	*Epipogium aphyllum* Sw.	VU		-	R	-	Nemţişor river basin [7], Slatina, Ciumârna stream at Găineşti
58	*Scrophula-riaceae*	*Euphrasia coerulea* Hoppe & Fürnr.	VU		-	R	-	Holda under Tarniţa Mare Rocks Peak
59	*Poaceae*	*Festuca carpatica* F. Dietr.	VU		near End.	R	-	Tarniţa Mare Rocks
60	*Poaceae*	*Festuca versicolor* Tausch subsp. *versicolor*	VU		-	R	-	Tarniţa Mare Rocks
61	*Orchida-ceae*	*Gymnadenia conopsea* (L.) R. Br. subsp. *conopsea*	VU		-	R	-	Pângăraţi [6], Nemţişor river basin [7], Voroneţ river valley
62	*Orchida-ceae*	*Gymnadenia odoratissima* (L.) Rich.	VU		-	R	-	Nemţişor river basin [7]
63	*Orchida-ceae*	*Herminium monorchis* (L.) R. Br.	VU		-	R	-	Nemţişor river basin [7]
64	*Brassica-ceae*	*Hesperis matronalis* L. subsp. *cladotricha* (Borbás) Hayek	VU		-	R	-	Zugreni Gorges
65	*Asteraceae*	*Leontopodium nivale* (Ten.) Hand.-Mazz. subsp. *alpinum* (Cass.) Greuter	VU		-	VU/R	-	Tarniţa Mare Rocks
66	*Asteraceae*	*Leucanthemum rotundifolium* (Willd.) DC., non Opiz	VU	BC	-	R	-	Bâtca Oblânc, Sabasa valley
67	*Orchida-ceae*	*Listera ovata* (L.) R. Br.	VU		-	R	-	Nemţişor river basin [7]
68	*Orchida-ceae*	*Listera cordata* (L.) R. Br.	VU		-	R	-	

69	*Caryophyllaceae*	*Lychnis viscaria* L. subsp. *atropurpurea* (Griseb.) Chater	VU		-	R	-	Neamţ Monastery [7]
70	*Scrophulariaceae*	*Melampyrum saxosum* Baumg.	VU		near End.	R	-	Tarniţa Mare Rocks
71	*Monotropaceae*	*Monotropa hypophegea* Wallr.	VU		-	-	-	Almăşel stream valley, Almaş, „Valea Mare" stream valley at Bistriţa
72	*Orchidaceae*	*Neottia nidus-avis* (L.) Rich.	VU		-	R	-	Piatra Neamţ on Cârlomanul hill [7], Pângăraţi [6], Nemţişor river basin [7], Borca, Voroneţ stream valley, the natural reserve „Piatra Pinului" at Gura Humorului, Holda near Tarniţa Mare Rocks, Agapia stream at the homonymous Monastery, Văratec, Cuiejdiu
73	*Orchidaceae*	*Nigritella nigra* (L.) Rchb. f. subsp. *rubra* (Wettst.) Beauverd	VU		-	VU/R	-	Nemţişor river basin [6]
74	*Boraginaceae*	*Omphalodes scorpioides* (Haenke) Schrank	VU		-	R	-	Cozla Mountain [6]
75	*Orchidaceae*	*Orchis coriophora* L. subsp. *coriophora*	VU		-	R	-	Piatra Neamţ on Cârlomanul hill [7], Nemţişor river basin [7]
76	*Orchidaceae*	*Orchis laxiflora* Lam. subsp. *elegans* (Heuff.) Soó	VU		-	R	-	Bâtca lake [7]
77	*Orchidaceae*	*Orchis militaris* L.	VU		-	R	-	Cozla Mountain [7], Pângăraţi [6], Pietroasa
78	*Orchidaceae*	*Orchis morio* L. subsp. *morio*	VU		-	R	-	Pângăraţi [7], Nemţişor river basin [6]
79	*Orchidaceae*	*Orchis purpurea* Huds.	VU		-	R	-	Pângăraţi [6]
80	*Orchidaceae*	*Orchis tridentata* Scop. subsp. *tridentata*	VU		-	R	-	Pângăraţi [6]
81	*Orchidaceae*	*Orchis ustulata* L.	VU		-	R	-	Nemţişor river basin [6]
82	*Scrophulariaceae*	*Pedicularis exaltata* Besser	VU		-	R	-	Sihla hermitage [10], Agapia Monastery [10]

83	*Campanu-laceae*	*Phyteuma tetramerum* Schur	VU		near End.	R	-	Fărcaşa
84	*Pinaceae*	*Pinus sylvestris* L.	VU		-	R	-	Nemţişor river basin [7], “Piatra Pinului” nature reserve
85	*Orchida-ceae*	*Platanthera bifolia* (L.) Rich.	VU		-	R	-	Pângăraţi [6], Nemţişor river basin [7], Borca, Tarniţa Pass, Piatra Neamţ on Cozla Hill
86	*Polygala-ceae*	*Polygala alpestris* Rchb.	DD		-	K	-	Tarniţa Mare Rocks
87	*Ranuncu-laceae*	*Ranunculus carpaticus* Herbich	VU		near End.	R	-	Pângăraţi [6], Borca
88	*Polygo-naceae*	*Rumex arifolius* All. (*R. alpestris* Jacq.) f. *carpaticus* Zapał.	DD		-	-	-	Stânişoarei Mountains [10] ?
89	*Grossula-riaceae*	*Ribes alpinum* L.	VU		-	R	-	Tarniţa Mare Rocks
90	*Salicaceae*	*Salix aurita* L.	VU		-	R	-	South of Tarniţa Pass
91	*Asteraceae*	*Saussurea discolor* (Willd.) DC.	VU		-	R	-	Tarniţa Mare Rocks
92	*Sparga-niaceae*	*Sparganium minimum* Wallr.	VU		-	R	-	Negrileasa in the „Bolătău” lake
93	*Liliaceae*	*Streptopus amplexifolius* (L.) DC.	VU		-	R	-	„Daniil Sihastru” Monastery, Vadul Negrilesei, Piatra Neamţ on Cârlomanul hill
94	*Asteraceae*	*Tanacetum macrophyllum* (Waldst. & Kit.) Sch. Bip.	VU	BC	-	R	-	Cuiejdiu
95	*Taxaceae*	*Taxus baccata* L.	CR		-	VU/R	-	Pietroasa, Borca (cultivated ?), Bisericani-Viişoara [6], Pângăraţi [6]
96	*Orchida-ceae*	*Traunsteinera globosa* (L.) Rchb.	VU		-	R	-	Nemţişor river basin [7], Tarniţa Pass, Fărcaşa on the homonymous stream
97	*Fabaceae*	*Trifolium spadiceum* L.	VU		-	R	-	Crucea
98	*Poaceae*	*Trisetum alpestre* (Host) P. Beauv.	VU		-	R	-	Tarniţa Mare Rocks

99	*Ranuncu-laceae*	*Trollius europaeus* L. subsp. *europaeus*	VU		-	R	-	Poiana Teiului [7], Bisericani-Viişoara [7], Nemţişor river basin [7], Văleni [7], Pângăraţi [7], Borca, Southern of the Tarniţa Pass, Voroneţ stream valley, Cotârgaşi, near the „Peştele" Monastery, Văleni-Stânişoara, Fărcaşa on the homonymous valley, Boboieşti, Pârâul Cârjei village
100	*Typhaceae*	*Typha shuttleworthii* W. D. J. Koch & Sond.	VU		-	VU/R	-	between Agapia Monastery and Secu Monastery
101	*Liliaceae*	*Veratrum album* L. subsp. *album*	LC		-	-	-	South of the Tarniţa Pass
102	*Scrophula-riaceae*	*Veronica catenata* Pennell	VU		-	R	-	Crăcăoani [7]
103	*Scrophula-riaceae*	*Veronica fruticans* Jacq.	VU		-	R	-	South of the Tarniţa Pass
104	*Ranuncu-laceae*	*Aquilegia vulgaris* L.			-	-	-	Fărcaşa along the homonymous stream
105	*Ranuncu-laceae*	*Aconitum napellus* L. subsp. *tauricum* (Wulfen) Gáyer			-	-	-	Tarniţa Mare Rocks
106	*Liliaceae*	*Allium senescens* L. subsp. *montanum* (F. W. Schmidt) Holub			-	-	-	Tarniţa Mare Rocks
107	*Primula-ceae*	*Androsace lactea* L.			-	-	-	Tarniţa Mare Rocks
108	*Asteraceae*	*Anthemis cotula* L.			-	-	-	Pângăraţi
109	*Ranuncu-laceae*	*Aquilegia nigricans* Baumg. subsp. *nigricans*			-	VU	-	Tarniţa Mare Rocks
110	*Rosaceae*	*Aruncus dioicus* (Walter) Fernald			-	-	-	Holdiţa, Holda, Tarniţa Pass
111	*Asteraceae*	*Aster alpinus* L.			-	-	-	Tarniţa Mare Rocks
112	*Asteraceae*	*Bidens cernua* L.			-	-	-	Leşul Ursului, Găineşti, Văleni-Stânişoara, Secu river valley, Plutoniţa Monastery, Negrileasa
113	*Poaceae*	*Bromus riparius* Rehmann			-	-	-	Slătioara

114	*Callitri-chaceae*	*Callitriche cophocarpa* Sendtn.			-	-	-	Slatina, Văleni-Stânişoara, Negrileasa in “Bolătău” lake
115	*Campanu-laceae*	*Campanula rotundifolia* L. subsp. *polymorpha* (Witašek) Tacik			near End.	-	-	Găineşti
116	*Cypera-ceae*	*Carex humilis* Leyss.			-	-	-	Tarniţa Mare Rocks
117	*Asteraceae*	*Carpesium cernuum* L.			-	-	-	Piatra Neamţ on Cârlomanul hill and on Cozla hill
118	*Gentiana-ceae*	*Centaurium pulchellum* (Sw.) Druce			-	-	-	Doroteia
119	*Caryophy-llaceae*	*Dianthus collinus* Waldst. & Kit. subsp. *collinus*			-	R	-	The forest „Codrii de Aramă”, Piatra Neamţ on Pietricica Hill
120	*Caryophy-llaceae*	*Dianthus deltoides* L.			-	-	-	Satu Mare (Suceava county)
121	*Oenothe-raceae*	*Epilobium dodonaei* Vill.			-	-	-	Piatra Neamţ, Agapia
122	*Brassica-ceae*	*Erysimum witmannii* Zaw.			near End.	-	-	Tarniţa Mare Rocks
123	*Scrophula-riaceae*	*Euphrasia salisburgensis* Funck			near End.	R	-	Tarniţa Mare Rocks
124	*Fagaceae*	*Fagus taurica* Popl.			-	-	-	Cotârgaşi, near „Peştele” Monastery, towards Sihăstria Monastery, Agapia stream at the homonymous Monastery, Pângăraţi valley
125	*Poaceae*	*Festuca ovina* L.			-	-	-	Tarniţa Mare Rocks
126	*Rubiaceae*	*Galium rotundifolium* L.			-	-	-	Ciumârna stream at Găineşti, Slatina, Slătioara
127	*Cistaceae*	*Helianthemum oelandicum* (L.) DC. subsp. *rupifragum* (A. Kern.) Breistr.			-	-	-	Tarniţa Mare Rocks
128	*Brassica-ceae*	*Hesperis matronalis* L. subsp. *matronalis*			-	-	-	Tarniţa Mare Rocks
129	*Poaceae*	*Lolium multiflorum* Lam.			-	-	-	Voroneţ valley
130	*Lamiaceae*	*Mentha* × *piperita* L.			-	-	-	Agapia
131	*Lamiaceae*	*Mentha spicata* L.			-	-	-	Agapia
132	*Poaceae*	*Molinia caerulea* (L.) Moench subsp. *caerulea*			-	-	-	Potoci
133	*Oroban-chaceae*	*Orobanche minor* Sm.			-	-	-	Tarniţa Mare Rocks

134	*Oroban-chaceae*	*Orobanche loricata* Rchb.			-	-	-	Tarniţa Mare Rocks
135	*Aspleni-aceae*	*Polystichum aculeatum* (L.) Roth			-	-	-	Tarniţa Mare Rocks, Leşul Ursului
136	*Rosaceae*	*Potentilla cinerea* Chaix ex Vill.			-	-	-	Tarniţa Mare Rocks
137	*Ranuncu-laceae*	*Ranunculus flammula* L.			-	-	-	Văleni-Stânişoara
138	*Ranuncu-laceae*	*Ranunculus serpens* Schrank subsp. *nemorosus* (DC.) G. López			-	-	-	Crucea Talienilor
139	*Grossula-riaceae*	*Ribes rubrum* L. s. str.			-	-	-	Tarniţa Mare Rocks
140	*Cyper-aceae*	*Scirpus setaceus* L.			-	-	-	Poiana Mărului
141	*Scrophu-lariaceae*	*Scrophularia umbrosa* Dumort.			-	-	-	Sihla
142	*Santala-ceae*	*Thesium alpinum* L.			-	-	-	Tarniţa Mare Rocks
143	*Typhaceae*	*Typha laxmannii* Lepech.			-	-	-	Pângăraţi
144	*Scrophu-lariaceae*	*Veronica persica* Poir.			-	-	-	Pârâul Cârjei village
145	*Scrophu-lariaceae*	*Veronica scutellata* L.			-	-	-	Văleni-Stânişoara

Some of the rarest plants are given here, as the next ones: Achillea oxyloba (DC.) Sch. Bip. subsp. schurii (Sch. Bip.) Heimerl, Hesperis oblongifolia Schur, Typha shuttleworthii Koch & Sonder, Asperula carpatica I. Morariu, Centaurea pinnatifida Schur subsp. pinnatifida, Dianthus spiculifolius Schur, Helictotrichon decorum (Janka) Henrard, Hepatica transsilvanica Fuss, Hesperis moniliformis Schur, Hieracium pojoritense Woł., Silene zawadzkii Herbich, Soldanella hungarica Simonk. subsp. hungarica, Viola jooi Janka, Anacamptis pyramidalis (L.) Rich., Centaurea phrygia L. subsp. melanocalathia (Borbás) Dostál, Cimicifuga europaea Schipcz., Leontopodium nivale (Ten.) Hand.-Mazz. subsp. alpinum (Cass.) Greuter, Leucanthemum rotundifolium (Willd.) DC., non Opiz, Melampyrum saxosum Baumg., Monotropa hypophegea Wallr., Omphalodes scorpioides (Haenke) Schrank, Orchis laxiflora Lam. subsp. elegans (Heuff.) Soó, Polygala alpestris Rchb., Ranunculus carpaticus Herbich, Ribes alpinum L., Salix aurita L., Saussurea discolor (Willd.) DC., Sparganium minimum Wallr., Tanacetum macrophyllum (Waldst. & Kit.) Sch. Bip, Trifolium spadiceum L., Trisetum alpestre (Host) P. Beauv., Veronica fruticans Jacq., Veronica catenata Pennell, Veronica fruticans Jacq., Aquilegia vulgaris L., Aconitum napellus L. subsp. tauricum (Wulfen) Gáyer, Allium senescens L. subsp. montanum (F. W. Schmidt) Holub, Androsace lactea L., Aquilegia nigricans Baumg. subsp. nigricans, Aster alpinus L., Bromus riparius Rehmann, Dianthus deltoides L., Erysimum witmannii Zaw., Euphrasia salisburgensis Funck, Helianthemum oelandicum (L.) DC. subsp. rupifragum (A. Kern.) Breistr., Hesperis matronalis L. subsp. matronalis, Ranunculus flammula L., Ranunculus serpens Schrank subsp. nemorosus (DC.) G. López, Ribes rubrum L. s. str., Scirpus setaceus L., Scrophularia umbrosa Dumort., Thesium alpinum L., Typha laxmannii Lepech., Veronica scutellata L., Veronica persica Poir., and so on. Thus, these species are to be met in one or two localities, only; also, their populations are pretty small and, in some particular cases, are in danger to dissapear, as the anthropic impact are quite high in that area (Stânişoara Mountains). Though, these species play a very important role in the floristic spectra of that area.

Other species are doubtfull present for our region, though they were cited in here, e. g.: *Rumex arifolius* All. (*R. alpestris* Jacq.) f. *carpaticus* Zapał., which was cited into the Romanian Flora [10] from Stânişoara Mountains, but without an accurate statement localities.

Some of the species are threatened by the human impacts, especially by clearing forests, grazing, fires (e. g. the yew).

On the territory of the Stânişoara Mountains there are three protected area only, namely: 1. Natural Park "Vânători Neamţ"; 2. Nature Reserve "Piatra Pinului" at Gura Humorului; 3. Nature Reserve Pângăraţi.

We shall propose to the local authorities (Suceava county – Regional Environment Protected Agency) an other area, which deserve to be protected in the future. It is situated nearby the Crucea village, at Tarniţa Mare Rocks. Those rocks are situated at a maximum altitude of 1431 m. The importance of this place consists in the existence of a second place of the endemic species *Asperula carpatica* in the Eastern Carpathians.

Conclusions

- The previous floristic data over the Stânişoara Mountains (Eastern Carpathians) has been very poor and entirely unmeaningful, previous of this study.
- Our investigations, during the period of 2005 – 2008, concluded in registering over 900 different vascular plant species.
- Apart of these 145 plants are pretty rare in the field.
- A number of 21 species from the Stânişoara Mountains are registered under the international regulations, as: *Habitat Directive 92/43/EEC* (Dir. Hab.), *Global Red List* (GRL), *World Tree Red List* (WLT, 1998), *Bern Convention* (BC, 1979).
- A number of 31 species are endemic and near Endemic in the flora of Romania, being met in a few places in Stânişoara Mountains, only.
- A number of 93 species from the Stânişoara Mountains are listed into the Romanian Red List of vascular plants.
- Other 55 plant species are very rare in the flora of Romania, being met in various localities in Stânişoara Mountains.

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ASPECTS OF THE FLORISTIC DIVERSITY IN NEAGRA BROŞTENILOR RIVER BASIN (EASTERN CARPATHIANS) (I)

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Abstract: The paper presents aspects of the floristic diversity (*Cormobionta*) from Neagra Broştenilor river basin including approximately 900 taxa. The floristic conspectus includes species identified by us in 2005 – 2008 period and species published by others authors in speciality literature.

Key words: flora, cormophytes, Neagra Broştenilor.

Introduction

The hydrographic basin of Neagra Broştenilor river occupies, in its larger part, the central zone of Bistriţa Mountains, a small part of the eastern side of Călimani Mountains and the Drăgoiasa – Glodu depression (Eastern Carpathians). It is localized on the territory of the Suceava and Harghita counties. Neagra Broştenilor river has 42 km length and its hydrographic basin presents approximately 350 km^2. The average altitude of the reception basin is about 1220 m. The pedological substratum is represented by mountain soils, disposed depending on altitude [17]. The great variety of alpine, subalpine, forests or meadows habitats characterized by diverse substrata types presents a very interesting flora studied by us in 2005-2008 period.

Material and method

The study presents a floristic conspectus of the flora from Neagra Broştenilor river basin. It includes species identified by us in 2005-2008 period and not published before, species identified (and confirmed) both by us and other authors and species identified and published by other authors in this territory but not found by us during field researches (for these are presented the bibliographic references). The identification of cormophytes species has been realized taking into account prestigious works [1], [5], [28], [34], [35]. In this paper, the used classification system is that adopted by V. Ciocârlan [5] and the families are phylogenetic ordered. Within a botanic family the species are presented in alphabetical order.

Results and discussion

PTERIDOPHYTA

Lycopodiaceae: *Lycopodium alpinum* L.: Izvorul Călimanului, Căliman Cerbuc; Budacu; *Lycopodium annotinum* L.: Dârmoxa; Grinţieş, Cristişor; Izvorul Călimanului, Căliman Cerbuc; Glodu; *Lycopodium clavatum* L.: Cristişor peat-bog; Izvorul Călimanului, Căliman Cerbuc; Grinţieş;

* “Anastasie Fătu” Botanic Garden, str. Dumbrava Roşie, no. 7-9, Iassy

Neagra Broşteni; *Lycopodium complanatum* L.: Izvorul Călimanului, Căliman Cerbuc; Izvorul Călimanului; Ortoiţa rivulet; *Lycopodium inundatum* L.: Grinţieş [24]; *Lycopodium selago* L. (*Huperzia selago* (L.) Bernh. ex Schranch et C. P. F. Mart.): Broşteni; Neagra Broşteni; Izvorul Călimanului, Căliman Cerbuc; Cristişor; Budacu; Grinţieş, Păltiniş; Glodu; **Selaginellaceae**: *Selaginella helvetica* (L.) Spring.: Neagra Broşteni; Grinţieş; Budacu; *Selaginella selaginoides* (L.) Beauv. ex Schrank. et C.F.P. Mart.: Broşteni [34], Neagra Broşteni [29]; **Equisetaceae**: *Equisetum arvense* L.: Broşteni; Bradului valley; Cristişor peat-bog; Drăgoiasa; Neagra Broşteni; *Equisetum fluviatile* L.: Broşteni; Păltiniş; mlaştina turboasă de la Cristişor; Drăgoiasa; pârâul Omului; Arsurii rivulet; *Equisetum hyemale* L.: Broşteni; Păltiniş; Cristişor peat-bog; *Equisetum palustre* L.: Cristişor peat-bog; Drăgoiasa; *Equisetum pratense* Ehrh.: Cristişor peat-bog [15]; *Equisetum sylvaticum* L.: Neagra Broşteni; Cristişor peat-bog; Drăgoiasa; Izvorul Călimanului; Căliman Cerbuc; Păltiniş; Glodu; Dârmoxa; *Equisetum telmateia* Ehrh.: Drăgoiasa, Neagra Broşteni; **Ophioglossaceae**: *Botrychium lunaria* (L.) Swartz: Păltiniş; Izvorul Călimanului; Căliman Cerbuc; Neagra Broşteni; Budacu; **Aspleniaceae** (inclusiv Athyriaceae, Dryopteridaceae, Thelypteridaceae, Woodsiaceae): *Asplenium ramosum* L. (*A. viride* Hudson): Neagra Broşteni; Izvorul Călimanului, Căliman Cerbuc; Crişţişor; Budacu; Drăgoiasa; *Asplenium ruta-muraria* L.: Budacu; Neagra Broşteni; *Asplenium scolopendrium* L.: Broşteni; Neagra Broşteni; Cristişor; *Asplenium trichomanes* L. ssp. *trichomanes*: Broşteni; Neagra Broşteni; Cristişor peat-bog; Budacu; *Athyrium filix-femina* (L.) Roth: Broşteni; Neagra Broşteni; Cristişor peat-bog; Budacu; Păltiniş; Drăgoiasa; Glodu; Dârmoxa; *Cystopteris fragilis* (L.) Bernh.: Broşteni; Dârmoxa; Neagra Broşteni; Cristişor peat-bog; Budacu; Căliman Cerbuc; *Cystopteris montana* (Lam.) Desv.: mlaştina turboasă de la Cristişor [15]; Izvorul Călimanului; *Cystopteris sudetica* A. Br. et Milde: Broşteni [23], [33]; Cristişor peat-bog [15]; *Dryopteris carthusiana* (Vill.) Fuchs: Cristişor peat-bog; Broşteni, Neagra Broşteni; Drăgoiasa; *Dryopteris cristata* (L.) A. Gray: Drăgoiasa [21]; *Dryopteris filix-mas* (L.): Broşteni; Dârmoxa; Cristişor peat-bog, Budacu, Neagra Broşteni; Glodu; Păltiniş; Căliman Cerbuc; *Gymnocarpium dryopteris* (L.) Newm.: Broşteni; Cristişor; pârâul Bradului; Drăgoiasa, Neagra Broşteni; Glodu; Păltiniş; *Matteuccia struthiopteris* (L.) Tod.: Broşteni; Neagra Broşteni; Dârmoxa; Cristişor peat-bog; Glodu; Păltiniş; *Phegopteris connectilis* (Michx.) Watt: Cristişor peat-bog [15]; *Polystichum aculeatum* (L.) Roth: Neagra Broşteni; *Polystichum lonchitis* (L.) Roth: Broşteni, Neagra Broşteni; *Polystichum setiferum* (Forssk.) Woyn.: Cristişor peat-bog, Neagra Brosteni; Grinţieş; *Thelypteris palustris* Schott: Cristişor peat-bog, Neagra Broşteni; **Polypodiaceae**: *Polypodium vulgare* L.: Broşteni; Cristişor peat-bog; Căliman Cerbuc; Budacu; Neagra Broşteni; Glodu; **Dennstaedtiaceae**: *Pteridium aquilinum* (L.) Kuhn: Broşteni; Cristişor peat-bog; Budacu; Neagra Broşteni; Păltiniş; Drăgoiasa;

PINOPHYTA

Pinaceae: *Abies alba* Miller: Broşteni; Bradului rivulet; Budacu, Neagra Broşteni; Drăgoiasa; Grinţieş; Căliman Cerbuc; *Picea abies* (L.) Karsten: Broşteni; Cristişor peat-bog; Omului rivulet; Drăgoiasa; Izvorul Călimanului, Căliman Cerbuc; Budacu; Neagra Broşteni; Glodu; Păltiniş; *Pinus mugo* Turra: Budacu [34]; Izvorul Călimanului; Căliman Cerbuc; *Pinus sylvestris* L.: Neagra Broşteni; Negrişoara; Drăgoiasa; Grinţieş; Ortoiţa rivulet; **Cupressaceae**: *Juniperus communis* L.: Broşteni; Izvorul Călimanului, Căliman Cerbuc; Drăgoiasa; Budacu; Grinţieş; Glodu; *Juniperus sibirica* Lodd. in Burgsd.: Broşteni; Izvorul Călimanului; Căliman Cerbuc; **Taxaceae**: *Taxus baccata* L.: Drăgoiasa [7], [34]; Grinţieşul Mic [34];

MAGNOLIOPHYTA

Magnoliatae (Dicotyledonatae)

Aristolochiaceae: *Asarum europaeum* L.: Broşteni; Stânii rivulet, Neagra Broşteni; **Ranunculaceae**: *Aconitum anthora* L.: Izvorul Călimanului, Neagra Broşteni; Glodu; *Aconitum degenii* Gayer (*A. paniculatum* Lam. nom. illeg.): Neagra Broşteni; Izvorul Călimanului, Căliman Cerbuc; Cristişor peat-bog [15]; *Aconitum lasiostomum* Reichenb. ex Besser: Broşteni [34]; *Aconitum moldavicum* Hacq.: Broşteni; Dârmoxa; Neagra Broşteni; *Aconitum variegatum* L.: Broşteni [3]; *Aconitum vulparia* Reichenb.: Broşteni; Neagra Broşteni; Cristişor; *Actaea spicata* L.: Bradului rivulet; Dârmoxa, Neagra Broşteni; Păltiniş; *Anemone narcissifolia* L.: Grinţieş [29]; Căliman Cerbuc [30]; *Anemone nemorosa* L.: muntele Grinţieş, Neagra Broşteni; *Anemone ranunculoides* L.: Neagra Broşteni, Budacu; *Aquilegia nigricans* Baumg. ssp. *nigricans*: Budacu; *Caltha palustris* L.: Broşteni; Păltiniş; Drăgoiasa; Cristişor peat-bog; Izvorul Călimanului, Căliman Cerbuc; Glodu; Arsurii rivulet; *Clematis alpina* (L.) Miller: Broşteni; Păltiniş; Negrişoara; Cristişor peat-bog; Izvorul Călimanului, Căliman Cerbuc; Neagra Broşteni; *Delphinium elatum* L. ssp. *elatum*: Păltiniş [18]; *Hepatica nobilis* Scheber: Neagra Broşteni; *Hepatica transsilvanica* Fuss: Grinties; *Isopyrum thalictroides* L.: Broşteni; Neagra Broşteni; Glodu; *Pulsatilla alba* Reichenb.: Grinţieş; Izvorul Călimanului; Căliman Cerbuc; Budacu; *Pulsatilla grandis* Wenderoth: Cristişor [18]; *Ranunculus acris* L. ssp. *acris*: Broşteni; Drăgoiasa; Păltiniş; Cristişor peat-bog; Neagra Broşteni; ssp. *friesianus* (Jord.) Syme (*R. stevenii* auct.): Drăgoiasa; *Ranunculus auricomus* L.: Cristişor peat-bog; Drăgoiasa; Broşteni; Neagra Broşteni; Glodu; *Ranunculus bulbosus* L.: Broşteni [2]; *Ranunculus ficaria* L.: Cristişor peat-bog; Neagra Broşteni; *Ranunculus flammula* L.: Broşteni; Drăgoiasa; *Ranunculus platanifolius* L.: Păltiniş; Izvorul Călimanului; Căliman Cerbuc; *Ranunculus polyanthemos* L. ssp. *polyanthemoides* (Boreau) Ahlfengren: Broşteni; Neagra Broşteni; *Ranunculus repens* L.: Broşteni; Păltiniş, Neagra Broşteni; Cristişor peat-bog; Drăgoiasa; Budacu; Glodu; Drăgoiasa; *Ranunculus sceleratus* L.: Cristişor peat-bog; Broşteni; *Ranunculus serpens* Schrank ssp. *nemorosus* (DC.) Lopez: Cristişor peat-bog; Neagra Broşteni; Budacu; *Thalictrum alpinum* L.: Păltiniş [29]; *Thalictrum aquilegiifolium* L.: Broşteni; Cristişor peat-bog; Drăgoiasa; Neagra Broşteni; Dârmoxa; Păltiniş; *Thalictrum lucidum* L.: Drăgoiasa; *Trollius europaeus* L.: Broşteni; Păltiniş; Cristişor peat-bog; Drăgoiasa; Izvorul Călimanului; Neagra Broşteni; Glodu; **Papaveraceae**: *Chelidonium majus* L.: Broşteni; Neagra Broşteni; **Fumariaceae**: *Corydalis capnoides* (L.) Pers.: Neagra Broşteni; *Corydalis cava* (L.) Schweigg. et Koerte (*C. bulbosa* auct.): Neagra Broşteni [29]; **Ulmaceae**: *Ulmus glabra* Hudson: Dârmoxa; Neagra Broşteni; Izvorul Călimanului; Căliman Cerbuc; Cristişor; **Cannabaceae**: *Humulus lupulus* L.: Cristişor peat-bog; Neagra Broşteni; **Urticaceae**: *Urtica dioica* L.: Broşteni; Cristişor peat-bog; Budacu, Neagra Broşteni; Glodu; Drăgoiasa; Păltiniş; *Urtica urens* L.: Cristişor peat-bog [15]; **Fagaceae**: *Fagus sylvatica* L.: Stânii rivulet; Cristişor peat-bog; Broşteni, Budacu, Neagra Broşteni; Glodu; Căliman Cerbuc; Păltiniş; *Fagus taurica* Popl.: Neagra Broşteni; **Betulaceae**: *Alnus alnobetula* (Ehrh.) Koch (*A. viridis* (Chaix) DC.): Căliman Cerbuc; Izvorul Călimanului; *Alnus glutinosa* (L.) Gaertn.: Broşteni; Cristişor peat-bog; Drăgoiasa; *Alnus incana* (L.) Moench: Broşteni; Neagra Broşteni; Izvorul Călimanului, Căliman Cerbuc; Omului rivulet; Cristişor peat-bog; Drăgoiasa; Glodu; *Betula alba* L. ssp. *glutinosa* (Berher) Holub (*B. pubescens* Ehrh.): Drăgoiasa; Cristişor peat-bog; *Betula pendula* Roth: Drăgoiasa; Broşteni; Bradului rivulet; Cristişor peat-bog; Neagra Broşteni, Budacu; Păltiniş; **Corylaceae**: *Carpinus betulus* L.: Broşteni; Cristişor peat-bog [15]; *Corylus avellana* L.: Broşteni; Toplicioara, Pinului rivulet; Cristişor peat-bog; Budacu, Neagra Broşteni; Păltiniş; Dârmoxa; **Caryophyllaceae**: *Arenaria serpyllifolia* L.: Cristişor peat-bog [15]; Broşteni; *Cerastium alpinum* L.: Izvorul Călimanului, Căliman Cerbuc [8]; *Cerastium arvense* L. ssp. *arvense*: Păltiniş; Budacu; *Cerastium fontanum* Baumg. ssp. *fontanum*: Budacu, Drăgoiasa; ssp. *lucorum* (Schur) Soó (*C. fontanum ssp. macrocarpum* auct.): Izvorul Călimanului, Căliman Cerbuc; *Cerastium semidecandrum* L.: Neagra Broşteni; *Dianthus armeria* L. ssp. *armeriastrum* (Wolf.) Velen.: Broşteni [11], [23]; Neagra Broşteni [29]; Păltiniş [18]; *Dianthus barbatus* L. ssp. *compactus* (Kit.) Heuffel: Broşteni; Păltiniş; Izvorul Călimanului; *Dianthus deltoides* L.: Broşteni; Budacu; *Dianthus superbus* L.: Broşteni; Cristişor peat-bog; Grinţieş; Căliman Cerbuc; *Dianthus tenuifolius* Schur: Broşteni; Izvorul Călimanului; Ortoiţa rivulet; *Lychnis flos-cuculi* L.: Broşteni; Izvorul Călimanului; Căliman Cerbuc; Păltiniş; Drăgoiasa; Cristişor peat-bog; Glodu; Dârmoxa; *Lychnis viscaria* L. ssp. *viscaria*: Păltiniş; Budacu; *Moehringia muscosa* L.: Budacu; *Moehringia trinervia* (L.) Clairv.: Neagra Broşteni; Cristişor peat-bog; Negrişoara; Broşteni; Dărmoxa; Drăgoiasa; *Myosoton aquaticum* (L.) Moench: Cristişor peat-bog [15]; *Sagina procumbens* L.: Cristişor peat-bog [15]; *Saponaria officinalis* L.: Broşteni; Neagra Broşteni; *Scleranthus annuus* L.: Broşteni; Neagra Broşteni; Păltiniş; *Scleranthus uncinatus* Schur: Păltiniş; Grinţieş; Căliman Cerbuc; Izvorul Căliman; *Silene alba* (Mill.) Krause: Cristişor peat-bog; Broşteni; *Silene dioica* (L.) Clairv.: Broşteni; Păltiniş; Cristişor peat-bog; Căliman Cerbuc, Neagra Broşteni; Glodu; *Silene italica* (L.) Pers. ssp. *nemoralis* (Waldst. et Kit.) Nyman: Păltiniş; Neagra Broşteni; *Silene noctiflora* L.: Broşteni [11]; *Silene nutans* L. ssp. *nutans*: Neagra Broşteni; Păltiniş; ssp. *dubia* (Herbich) Zapal.: Stânii rivulet, Catrinari;

Drăgoiasa; Budacu; Neagra Broşteni; *Spergula arvensis* L.: Broşteni [23]; Drăgoiasa [18]; *Spergularia media* (L.) C. Presl.: Broşteni [18]; *Stellaria graminea* L.: Cristişor peat-bog; Drăgoiasa; Izvorul Călimanului; Căliman Cerbuc; Drăgoiasa; Neagra Broşteni; Dârmoxa; Glodu; Budacu; *Stellaria holostea* L.: Drăgoiasa; Broşteni, Budacu; *Stellaria longifolia* Muhl.: Cristişor peat-bog; Drăgoiasa; *Stellaria media* (L.) Vill.: Broşteni; Cristişor peat-bog; Drăgoiasa, Neagra Broşteni; Glodu; *Stellaria nemorum* L.: Dârmoxa, Bradului rivulet; Cristişor peat-bog; Drăgoiasa; Budacu, Neagra Broşteni; *Stellaria pallida* (Dumort) Piré (*S. media* (L.) Vill. *ssp. pallida* (Dumort) Asch. et Graeb.): Drăgoiasa [18]; *Stellaria palustris* Retz.: Drăgoiasa [18], [29]; *Stellaria uliginosa* Murray (*S. alsine* Grimm. nom. inval.): Cristişor peat-bog; Drăgoiasa; **Chenopodiaceae**: *Chenopodium album* L.: Cristişor peat-bog; Broşteni; Neagra Broşteni; Păltiniş; *Chenopodium bonus henricus* L.: Broşteni; Căliman Cerbuc; Budacu; Grinţieş; **Polygonaceae**: *Polygonum aviculare* L.: Broşteni; Cristişor; Păltiniş; Drăgoiasa; Glodu; *Polygonum bistorta* L.: Broşteni; Cristişor peat-bog; Drăgoiasa; *Polygonum convolvulus* L.: Broşteni; Păltiniş; Crişţişor; Neagra Broşteni; *Polygonum dumetorum* L.: Păltiniş; *Polygonum hydropiper* L.: Broşteni; Neagra Broşteni; Cristişor peat-bog; Drăgoiasa; *Polygonum lapathifolium* L.: Broşteni; *Polygonum mite* Schrank: Broşteni; Neagra Broşteni; *Polygonum persicaria* L.: Broşteni; Grinţieş rivulet; Cristişor peat-bog; Drăgoiasa; Neagra Broşteni; *Rumex acetosa* L.: Păltiniş; Cristişor peat-bog; Neagra Broşteni; Drăgoiasa; *Rumex acetosella* L.: Cristişor peat-bog; Budacu, Drăgoiasa; Glodu; *Rumex alpestris* Jacq. (*R. arifolius* All.): Cristişor peat-bog; Izvorul Călimanului, Căliman Cerbuc; Budacu; *Rumex alpinus* L.: Bradului rivulet; Izvorul Călimanului, Căliman Cerbuc; Budacu; *Rumex crispus* L.: Păltiniş; Cristişor peat-bog; Broşteni; *Rumex obtusifolius* L.: Cristişor peat-bog; *Rumex patientia* L.: Broşteni [14]; Cristişor peat-bog [15]; *Rumex sanguineus* L.: Drăgoiasa, Glodu, Neagra Broşteni; *Rumex stenophyllus* Ledeb.: Cristişor peat-bog [15]; Drăgoiasa [18]; **Grossulariaceae**: *Ribes alpinum* L.: Broşteni [18], [23]; Căliman Cerbuc; *Ribes nigrum* L.: Drăgoiasa; *Ribes petraeum* Wulfen: Izvorul Călimanului, Căliman Cerbuc [4]; Izvorul Călimanului [8]; *Ribes uva crispa* L.: Dârmoxa; Bradului rivulet; Cristişor peat-bog; Drăgoiasa, Neagra Broşteni; Glodu; **Crassulaceae**: *Rhodiola rosea* L. : Izvorul Călimanului; Căliman Cerbuc; *Sedum acre* L.: Neagra Broşteni [29]; *Sedum alpestre* Vill.: Izvorul Călimanului; Căliman Cerbuc; *Sedum annuum* L.: Neagra Broşteni; Broşteni; *Sedum maximum* (L.) Hoffm.: Broşteni; Budacu; Neagra Broşteni; Drăgoiasa; *Sedum vulgare* (Haw.) Link: Izvorul Călimanului [8]; *Sempervivum montanum* L.: Izvorul Călimanului; Grinţieş; *Sempervivum zeleborii* Schott: Budacu; **Saxifragaceae**: *Chrysosplenium alpinum* Schur: Izvorul Călimanului, Căliman Cerbuc [4]; *Chrysosplenium alternifolium* L.: Bradului rivulet; Cristişor peat-bog; Dârmoxa; *Parnassia palustris* L.: Broşteni; Neagra Broşteni; Păltiniş; Drăgoiasa; Cristişor peat-bog; Izvorul Călimanului; Căliman Cerbuc; *Saxifraga paniculata* Miller (*S. aizoon* Jacq.): Broşteni; Izvorul Călimanului; Grinţieş; *Saxifraga stellaris* L.: Izvorul Călimanului; Căliman Cerbuc; **Rosaceae**: *Agrimonia eupatoria* L.: Broşteni; Cristişor peat-bog; Neagra Broşteni; Drăgoiasa; *Agrimonia repens* L. (*A. procera* Wallr.): Broşteni [11], [18], [23], [34]; *Alchemilla glaucescens* Wallr.: Cristişor peat-bog; Budacu; *Alchemilla monticola* Opiz: Cristişor; Budacu; Drăgoiasa; *Alchemilla vulgaris* L. emend. Frohner: Drăgoiasa; Budacu; *Alchemilla xanthochlora* Rothm.: Broşteni; Neagra Broşteni; Paltinis; Cristişor; Căliman Cerbuc; *Aruncus dioicus* (Walter) Fernald: Broşteni; Izvorul Călimanului; Căliman Cerbuc; Cristişor; *Comarum palustre* L. (*Potentilla palustris* (L.) Scop.): Drăgoiasa; Cristişor peat-bog; *Dryas octopetala* L.: Broşteni [18]; *Filipendula ulmaria* (L.) Maxim.: Neagra Broşteni; Păltiniş; Cristişor peat-bog; Drăgoiasa; Glodu; Arsurii rivulet; Izvorul Călimanului; Căliman Cerbuc; var. *denudata* (J. et C. Presl.) Maxim.: Cristişor peat-bog [15]; *Filipendula vulgaris* Moench: Dârmoxa; Neagra Broşteni; Cristişor peat-bog; Broşteni; *Fragaria vesca* L.: Neagra Broşteni; Păltiniş; Cristişor peat-bog; Drăgoiasa; Izvorul Călimanului; Căliman Cerbuc; Budacu; *Fragaria viridis* Weston ssp. *viridis*: Păltiniş [29]; Broşteni [14]; Cristişor peat-bog [15]; *Geum aleppicum* Jacq.: Păltiniş; Cristişor peat-bog; Drăgoiasa; Glodu; *Geum rivale* L.: Păltiniş; Cristişor peat-bog; Drăgoiasa; Izvorul Călimanului; Căliman Cerbuc; Omului rivulet; *Geum urbanum* L.: Bradului rivulet; Neagra Broştenilor; Broşteni; Cristişor peat-bog; Drăgoiasa, Păltiniş; *Potentilla alba* L.: Păltiniş; *Potentilla anserina* L.: Broşteni; Cristişor peat-bog; Drăgoiasa, Neagra Broşteni; Păltiniş; *Potentilla argentea* L.: Broşteni; Cristişor peat-bog; *Potentilla aurea* L.: Cristişor peat-bog [15]; Izvorul Călimanului; Căliman Cerbuc; Grinţieşul Broştenilor; *Potentilla erecta* (L.) Räusch.: Neagra Broşteni; Păltiniş; Cristişor peat-bog; Drăgoiasa; *Potentilla norvegica* L.: Cristişor peat-bog [15]; *Potentilla recta* L.: Drăgoiasa; Neagra

Broşteni; *Potentilla reptans* L.: Cristişor peat-bog; Broşteni; *Potentilla supina* L.: Broşteni; *Potentilla ternata* Koch: Cristişor peat-bog [15]; Căliman Cerbuc; Izvorul Călimanului; *Padus avium* Miller: Păltiniş; Cristişor; Neagra Broşteni; *Pyrus pyraster* (L.) Burgsd.: Neagra Broşteni; *Rosa arvensis* Huds.: Broşteni [2]; *Rosa canina* L.: Negrişoara; Păltiniş; Broşteni; *Rosa corymbifera* Borkh. (*R. dumetorum* Thuill.): Broşteni [2]; *Rosa pendulina* L.: Păltiniş; Bradului rivulet; Cristişor peat-bog; Izvorul Călimanului; Budacu, Neagra Broşteni; *Rosa pimpinellifolia* L.: Broşteni [2]; *Rubus caesius* L.: Neagra Broşteni; Broşteni; Cristişor; *Rubus hirtus* Waldst. et Kit.: Broşteni; Pinului rivulet; Neagra Broşteni; *Rubus idaeus* L.: Broşteni; Neagra Broşteni; Cristişor peat-bog; Izvorul Călimanului; Căliman Cerbuc; Glodu; Păltiniş; Grinţieş; *Sanguisorba officinalis* L.: Cristişor peat-bog; Drăgoiasa; *Sorbus aucuparia* L.: Izvorul Călimanului; Căliman Cerbuc; Broşteni; Neagra Broşteni; Omului rivulet; Cristişor peat-bog; Budacu; Drăgoiasa; Glodu; Păltiniş; *Spiraea chamaedrifolia* L. (*S. ulmifolia* Scop.): Neagra Broşteni; Broşteni; Cristişor peat-bog; Grinţieş; Budacu, Dragoiasa; Glodu; Păltiniş; *Spiraea salicifolia* L.: Drăgoiasa; **Fabaceae**: *Anthyllis vulneraria* L. ssp. *vulneraria* (ssp. *kerneri* (Sag.) Domin): Broşteni; Catrinari; Drăgoiasa; Păltiniş; ssp. *alpestris* (Kit.) Asch. et Graeb.: Izvorul Călimanului, Căliman Cerbuc; *Astragalus glycyphyllos* L.: Păltiniş; *Chamaecytisus hirsutus* (L.) Link ssp. *leucotrichus* (Schur) A. et D. Löve: Neagra Broşteni; Ortoiţa rivulet; *Coronilla varia* L.: Broşteni; *Cytisus nigricans* L.: Broşteni [25]; Neagra Broşteni; Glodu; *Galega officinalis* L.: Broşteni [18]; *Genista tinctoria* L.: Budacu; *Lathyrus laevigatus* (Waldst. et Kit.) Gren.: Neagra Broşteni; *Lathyrus palustris* L.: Păltiniş; Arsurii rivulet; *Lathyrus pannonicus* (Jacq.) Garcke: Neagra Broşteni [29]; *Lathyrus pratensis* L.: Broşteni; Păltiniş; Cristişor peat-bog; Drăgoiasa; Neagra Broşteni; *Lathyrus sylvestris* L.: Neagra Broşteni; Broşteni; Budacu; *Lathyrus vernus* (L.) Bernh.: Neagra Broşteni; Cristişor; *Lotus corniculatus* L.: Păltiniş; Cristişor peat-bog; Budacu; Drăgoiasa; Neagra Broşteni; *Medicago falcata* L.: Păltiniş; Broşteni; *Medicago lupulina* L.: Broşteni; Cristişor peat-bog; Drăgoiasa; *Melilotus albus* Medik.: Neagra Broşteni; Păltiniş; Drăgoiasa; *Melilotus officinalis* Lam.: Broşteni; Neagra Broşteni; *Onobrychis viciifolia* Scop.: Păltiniş; Neagra Broşteni; *Ononis arvensis* L.: Păltiniş; Drăgoiasa; *Trifolium alpestre* L.: Păltiniş; Neagra Broşteni; *Trifolium aureum* Pollich: Broşteni; Cristişor peat-bog; *Trifolium badium* Schreber: Păltiniş [29]; *Trifolium campestre* Schreber: Broşteni; Drăgoiasa; *Trifolium hybridum* L. ssp. *hybridum*: Cristişor peat-bog; Neagra Broşteni; *Trifolium medium* L. ssp. *medium*: Cristişor peat-bog; Neagra Broşteni; *Trifolium montanum* L.: Neagra Broşteni; Cristişor peat-bog; Broşteni; Neagra Broşteni; *Trifolium ochroleucon* Huds.: Broşteni; Neagra Broşteni; *Trifolium pannonicum* Jacq.: Broşteni; Păltiniş; Drăgoiasa; *Trifolium pratense* L.: Broşteni; Păltiniş; Cristişor peat-bog; Drăgoiasa, Neagra Broşteni; *Trifolium repens* L. ssp. *repens*: Broşteni; Păltiniş; Cristişor peat-bog; Drăgoiasa, Neagra Broşteni; Glodu; *Trifolium spadiceum* L.: Păltiniş [113]; Cristişor peat-bog [48]; *Vicia cracca* L.: Cristişor; Drăgoiasa; *Vicia sepium* L.: Cristişor peat-bog; Dârmoxa, Neagra Broşteni; *Vicia sylvatica* L.: Broşteni; Neagra Broşteni; Budacu; **Hippuridaceae**: *Hippuris vulgaris* L.: Broşteni [18]; **Lythraceae**: *Lythrum salicaria* L.: Cristişor peat-bog; Arsurii rivulet; Neagra Broşteni, Drăgoiasa; *Peplis portula* L.: Cristişor peat-bog [15]; **Onagraceae**: *Circaea alpina* L.: Neagra Broşteni; Cristişor peat-bog; Broşteni; Budacu; Păltiniş; *Circaea x intermedia* Ehrh.: Neagra Broşteni; muntele Grinţieş; Drăgoiasa; *Circaea lutetiana* L.: Neagra Broşteni; Cristişor peat-bog; Glodu; *Chamerion angustifolium* (L.) Holub. (*Epilobium angustifolium* L.): Neagra Broşteni; Negrişoara; Cristişor peat-bog; Izvorul Călimanului; Căliman Cerbuc; Păltiniş; Budacu; *Epilobium collinum* C.C. Gmelin: Broşteni; Neagra Broşteni; Cristişor peat-bog; *Epilobium hirsutum* L.: Neagra Broşteni; *Epilobium montanum* L.: Neagra Broşteni; Cristişor peat-bog; Broşteni; Drăgoiasa; *Epilobium obscurum* Schreb.: Cristişor peat-bog [15], [18]; Drăgoiasa [20]; *Epilobium palustre* L.: Neagra Broşteni; Drăgoiasa; Cristişor peat-bog; Arsurii rivulet; *Epilobium parviflorum* Schreber: Broşteni; Cristişor peat-bog; Drăgoiasa; *Epilobium roseum* Schreber: Broşteni; Cristişor peat-bog; **Thymelaeaceae**: *Daphne mezereum* L.: Dârmoxa; Cristişor peat-bog; Păltiniş, Budacu, Neagra Broşteni; Glodu; **Cornaceae**: *Cornus sanguinea* L.: Broşteni; **Santalaceae**: *Thesium alpinum* L.: Broşteni; Izvorul Călimanului; Căliman Cerbuc; Budacu; **Celastraceae**: *Evonymus europaeus* L.: Broşteni; Neagra Broşteni; *Evonymus nanus* Bieb.: Cristişor peat-bog; **Euphorbiaceae**: *Euphorbia amygdaloides* L.: Păltiniş; Izvorul Călimanului; Căliman Cerbuc; Budacu, Neagra Broşteni; Drăgoiasa; *Euphorbia carniolica* Jacq.: Bradului rivulet; Broşteni; Grinţieş; *Euphorbia cyparissias* L.: Broşteni; Neagra Brosteni; Dragoiasa; Păltiniş; *Euphorbia helioscopia* L.: Broşteni [23]; *Euphorbia platyphyllos* L.:

Broşteni; Păltiniş; *Mercurialis perennis* L.: Neagra Broşteni; Bradului rivulet; Cristişor peat-bog; Drăgoiasa; Budacu; **Rhamnaceae**: *Frangula alnus* Mill.: Cristişor peat-bog; Neagra Broşteni.

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FLORISTIC AND PHYTOCOENOTIC BIODIVERSITY OF PROTECTED AREA NEMȚENI (R. MOLDOVA)

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Abstract: Protected area Nemțeni is situated in the bottom-grassland of the river Prut have the area of 20,9 ha and, attributed to the ecosystems which consist of *Salix alba*, *Populus alba*, *Quercus robur*. The investigations done during 2003-2006 periods had the target of study the floristic and phytocoenotic composition, elaborate optimal measures of biosafety and sustainable use. 168 species of vascular plant, classified in 46 fam. and 129 gen. were identified. 9 species of rare plants being on high endangered level were determined. Floristic composition from the biologic, ecologic, geographic, economic, cariologic point of view was analyzed. Vegetal community of 5 associations were attributed to *Salicetum albae-fragilis* Issler 1926; *Populetum albae-Fraxinosum bessarabicum* Borza 1937; *Pruno spinosae-Crataegetum* Soó 1931; *Trifolio repenti-Lolietum* Krippelova 1967; *Lolio-Plantaginetum majoris* (Linkola 1921) Berger 1930.

Key words: biodiversity, protected area, rare species.

Introduction

Protected area Nemțeni represents a value forestry sector extended on the area of 20,9 ha is included in the category of natural forestry reserve. Some literature data about flora and vegetation of forestry reserve Nemțeni is unknown. The target of revealing the floristic biodiversity, elaborating optimal measures and performing scientific investigations during the 2003-2006 periods was achieved.

Material and method

Protected area Nemțeni represents a forestry formation, distinguished by bi-stratified arboretum of *Populus alba*, *Salix alba*, *Quercus robur*, is classified at the category of poplar, willow, oak system extended on the river grassland [7, 8]. In the Forestry Unit Oneşti, the forestry type Lunca, parcel 24, sub-parcel B and D, managed under Forestry Enterprise Hânceşti is emplaced [6]. From the physical and geographical point of view protected area Nemțeni is situated on the bottomland of the river Prut (Republic Moldova), between the villages Bălăurești (north), Ovileni (south) and Nemțeni (east), the coordinates are 46°49'38" north latitude and 28°6'3" east longitude (Fig. 1).

As a coenotaxonomic unit flora and vegetation's protected area Nemțeni during the 2003-2006 periods were studied. Floristic investigations using the itinerary method over all vegetation season were performed. For describing vegetal communities phytocoenologic descriptions according Central-European Phytocoenology School were used [1, 2, 4, 5].

Meantime, for geobotanical description, were revealed and delimited the surfaces, which have following dimensions: forestry vegetation 2500 s. m., shrubs 100 s. m., grasslands 100 s. m. Geobotanical descriptions in the form-type were registered. General information referring to each geobotanical description, it means: locality, description data,

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geographical situation, characteristic station conditions (relief, soil, etc.) was registered. The height and diameter of the phytorepresentatives, also existent stratification in phytocoenosis, general cover, and each cover's layer were registered too. All of the species, indicated in the control surface, according J. Braun-Blanquet phytocoenotic index of abundance-dominance (AD) were noted [2].

Results and discussions

Arboretum diversity

In protected area Nemțeni natural, fundamental and mixed arboretum of poplar (*Populus alba*), willow (*Salix alba*), 70 years old oak (*Quercus robur*) of average productivity, growing on alluvial typical soils between 15-20 m altitude were evidenced. In arboretum an island surface formed by oak, parcel 29, sub-parcel B, varying between 200-250 years old was detected. In arboretum, on the second floor, the species of elm (*Ulmus laevis*), hedge (*Acer campestre*) and pear (*Pyrus pyraster*) were revealed.

Floristic diversity

As a result of floristic investigations in protected area Nemțeni 168 species of vascular plants were identified and registered.

Arboretum numbers 10 trees species: *Acer campestre*, *A. negundo*, *A. tataricum*, *Populus alba*, *P. nigra*, *Pyrus pyraster*, *Quercus robur*, *Salix alba*, *S. triandra*, *Ulmus laevis* and, 2 liana species: *Humulus lupulus*, *Vitis sylvestris*.

Fruticant (bushy) layer is well expressed and is represented by 11 trees species: *Corylus avellana*, *Cornus mas*, *Crataegus monogyna*, *Euonymus europaea*, *E. verrucosa*, *Prunus spinosa*, *Rosa canina*, *Swida sanguinea*, *Sambucus nigra*, *Viburnum lantana*, *V. opulus*.

Herbaceous cover is represented by 145 species of vascular plants: *Aegopodium podagraria*, *Agrimonia eupatoria*, *Agrostis stolonifera*, *Ajuga reptans*, *Althaea offiinalis*, *Anchusa ochroleuca*, *Anemone ranunculoides*, *Angelica sylvestris*, *Anthriscus sylvestris*, *Arctium lappa*, *A. tomentosum*, *Arenaria serpyllifolia*, *Aristolochia clematites*, *Artemisia annua*, *A. vulgaris*, *Asarum europaeum*, *Asparagus officinalis*, *A. tenuifolius*, *Atriplex rosea*, *A. tatarica*, *Ballota nigra*, *Brachyopodium sylvaticum*, *Brassica nigra*, *Bromus hordeaceus*, *Bromus sterilis*, *Calamagrostis canascens*, *Campanula persicifolia*, *C. trachelium*, *Capsella bursa-pastoris*, *Cardamine impatiens*, *Cardaria draba*, *Carduus acanthoides*, *C. nutans*, *Carex hirta*, *Cerastium holosteoides*, *Cerinthe minor*, *Chelidonium majus*, *Chenopodium album*, *C. urbicum*, *Cichorium inthybus*, *Cirsium arvense*, *Conium maculatum*, *Consolida regalis*, *Convollaria majalis*, *Convolvulus arvensis*, *Corydalis cava*, *C. solida*, *Crepis foetida*, *Cynoglossum officinale*, *Dactylis glomerata*, *Datura stramonium*, *Daucus carota*, *Descurania sophia*, *Dipsacus laciniatus*, *Epipactis helleborine*, *E. palustris*, *Equisetum arvense*, *Erysimum virgatum*, *Euphorbia helioscopia*, *E. villosa*, *Filipendula ulmaria*, *Fragaria vesca*, *Fumaria schleicheri*, *Gagea lutea*, *G. pusilla*, *Galanthus nivalis*, *Galeopsis speciosa*, *Galium aparine*, *G. boreale*, *G. odoratum*, *Geum urbanum*, *Glaucium corniculatum*, *Glechoma hederacea*, *G. hirsuta*, *Hordeum murinum*, *Isopyrum thalicroides*, *Iva xanthiifolia*, *Lamium maculatum*, *L. purpureum*, *Lapsana communis*, *Lapulla squarosa*, *Lathraea squamaria*, *Lathyrus niger*, *L. sylvestris*, *Leonurus cardiaca*, *Linaria vulgaris*, *Lolium perenne, Lotus corniculatus*, *Lycopus europaeus*, *Lygustrum vulgare*, *Lysimachia nummularia*, *L. vulgaris*, *Malva pusilla*, *Matricaria discoidea*, *M. perforata*, *Melilotus officinalis*, *Mercurialis perennis*, *Orobanche cernua*, *Paris quadrifolia*, *Phlomis pungens*, *Physalis alkekengi*, *Plantago major*, *Poa angustifolia*, *P. annua*, *P. nemoralis*, *Polygonatum multiflorum*, *Polygonum aviculare*, *P. dumetorum*, *P. hydropiper*, *P.*

lapathifolium, *Potentilla anserina*, *P. reptans*, *P. supina*, *Prunella vulgaris*, *Pulmonaria officinalis*, *Ranunculus ficaria*, *Rorippa austriaca*, *Rubus caesius*, *Sambucus ebulus*, *Saponaria officinalis*, *Scilla bifolia*, *Scutellaria altissima*, *Silene alba*, *Sisymbrium altissimum*, *S. loeselii*, *S. officinale*, *S. strictissimum*, *Sonchus arvensis*, *Stachys sylvatica*, *Stellaria holostea*, *Symphytum officinale*, *Taraxacum officinale*, *Torilis arvensis*, *Tragopogon dubius*, *Trifolium hybridum*, *T. pratense*, *T. repens*, *Tussilago farfara*, *Urtica dioica*, *Verbena officinalis*, *Veronica chamaedrys*, *Vicia angustifolia*, *V. cracca*, *Viola elatior*, *V. reichenbachiana*, *Xanthium italicum*, *X. spinosum*.

Taxonomic Analysis revealed the plant species of the protected area Nemțeni, which were attributed to 129 genuses and 46 families. During the study 8 most representative genus, it means: *Polygonum*, *Sisymbrium* (4 sp.), *Acer*, *Galium*, *Euphorbia*, *Poa*, *Potentilla*, *Trifolium* where each genus is represented by 3 species were identified. Other genuses by 1-2 species constituting 85% from the flora of above-mentioned protected area are represented. The families which include the most species are: *Asteraceae* (19 sp.), *Lamiaceae* (13 sp.), *Brassicaceae* (11 sp.), *Poaceae* (10 sp.). Families which possess less than 10 species constitute 70% from the floristic fund of the protected area Nemțeni (**Fig. 2**).

Analysis of Bioform of flora's protected area Nemțeni create the possibility of evidencing the numerical value of the hemicryptophyte (37%), terophytes (32%), phanerophytes (15%) and geophytes (14%), other categories registered less percentage (**Fig. 3**).

Analysis of Geoelements. From the geographical point of view, in flora of protected area Nemțeni predominate north elements – 82%, from which euriasiatic – 54% and european – 16% geoelements were evidenced, regarding to another floristic elements its forms an inconsiderable part (**Fig. 4**).

Analysis of Ecologic Index. Concerning the exigencies to the soil humidity in flora of protected area Nemțeni the species manifested different percentage: mesophytes – 50%, xeromesophytes – 36%, mesohygrophytes – 13%. Referring to the air temperature attitude in the ecological spectrum of flora's protected area Nemțeni the species remarked following percentage: micromesotherm – 68%, moderate-thermophyle – 18%, euriterm – 15%. According to the soil reaction here predominate the species slightly acid-neutrophyle (37%), euryionic (36%) and acid-neutrophyle (31%) (**Fig. 5**).

Economical Analysis of Flora Inventory from protected area Nemțeni, conform the modality and possibility of using the considerable value of medicinal (52%), ornamental (34%), melliferous (36%), alimentary (26%), industrial (24%) were revealed. For appreciating anthropeic influence in the zone where is emplaced protected area Nemțeni, as a studying subject, the altitudinal index **Ka** was calculated (Pop et Drăgulescu, 1983) [4], the value of which varies into 51-90% that denotes the anthropeic impact in zone (**Fig. 6**).

Caryologic Analysis points out a considerable participation of 35% polyploid and diploid-polyploid species into the constitution of floristic gene pool (fund) of protected area Nemțeni, the diploids registering 29%. Diploid index (DI) is 0,8 that indicates on the pioneer and instable character of vegetal formations of above-mentioned area, reflecting completely station conditions of the grassland (**Fig. 7**).

Rare plants species. In flora of protected area Nemțeni 9 rare plants species, representing 5, 2% of floristic fund of named area, with following classification according UICN was revealed (**Fig. 1**).

Endangered (EN) – 5 species: *Asparagus officinalis*, *Epipactis palustris*, *Vitis sylvestris*, *Paris quadrifolia*.

Vulnerable (VU) – 1 species: *Galanthus nivalis*.

Lower risk (LR) – 3 species: *Astragalus pseudoscaber*, *Epipactis helleborine*, *Viburnum opulus*.

Phytocoenotic diversity: In the protected area Nemţeni limits 3 types of vegetation were revealed: forestry, pratal, ruderal, including 5 vegetal associations, 4 classes, 4 orders, and 4 alliances.

Conspectus of vegetal associations*:*

Forestry vegetation

QUERCO-FAGETEA Br.-Bl. et Vlieger 1937
PRUNETALIA Tx. 1952
Prunion spinosae Soó 1931
1. *Pruno spinosae-Crataegetum* Soó 1931
II. SLICETEA PURPUREAE Moor 1958
SALICETALIA PURPUREAE Moor 1958
Salicion albae Tx. 1955
2. *Salicetum albae-fragilis* Issler 1926
3. *Populetum albae-fraxinosum bessarabicum* Borza 1937

Vegetation of mesophyle grassland

III.MOLINIO-ARRHENATHERETEA Tx. 1937
ARRHENATHERETALIA Pawl. 1928
Cynosurion Tx. 1947
4. *Trifolio repenti-Lolietum* Krippelova 1967

Synantropic vegetation

VI. PLANTAGINETEA MAJORIS Tx. et Prsg. 1950
PLANTAGINETALIA Tx. 1950
Lolio-Plantaginion Siss. 1969
5. *Lolio-Plantaginetum majoris* (Linkola 1921) Berger. 1930

Natural and anthropeic impact

In the past, protected area Nemţeni frequently was flood. Such natural impact had a decisive character in the development of all vital processes in above-mentioned protected area. Concomitantly, the constructions, in 1975, of Costeşti-Stînca artificially dam upstream the protected area, the hydrologic regime of the river was regularized and, in such manner being stopped the inundations. Dam's construction unfavorable influenced reducing surfaces occupied with aquatic and paludal vegetation. Ecosystem's vulnerability in such conditions favored the installing of adventives and ruderal species in the protected area's phytocoenosis.

Biodiversity conservation

Protected area Nemţeni is a representative forestry area, with willow and poplar, characteristic for the grassland's forests river Prut. According to floristic composition of protected area Nemţeni it is a valuable forest which includes a gene pool (fund) constituted from 168 vascular plant, from which 10 trees, 11 shrub, 2 liana and, 145 herbaceous plant species. 9 rare species was registered, 3 of which are included in Red Book of Republic Moldova [3]. Protected area Nemţeni, in February 25, 1998, conform the Decision of R. Moldova Parliament, nr. 1539, received the Statute of Natural Forestry Reserve (Annex 4) [9].

Conclusions

- Protected area Nemţeni represents an area (20,9 ha) of valuable forestry. Floristic gene fund includes 168 species of vascular plants, from which 10 trees species, 11 shrub species, 2 liana species and, 145 herbaceous plants species, appertaining to 129 genus and, 46 families.
- Nine species of rare plants were registered, three of which are included in Red Book of Republic Moldova. Five vegetal associations were revealed: *Salicetum albae-fragilis* Issler 1926; *Populetum albae-Fraxinosum bessarabicum* Borza 1937; *Pruno spinosae-Crataegetum* Soó 1931; *Trifolio repenti-Lolietum* Krippelova 1967; *Lolio-Plantaginetum majoris* (Linkola 1921) Berger 1930.
- For optimizing the biodiversity conservation and sustainable use it is necessary performing works on ecological reconstruction, with the target of ameliorating the composition and structures of vegetal community.

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Fig. 1 – Map of protected area Nemţeni

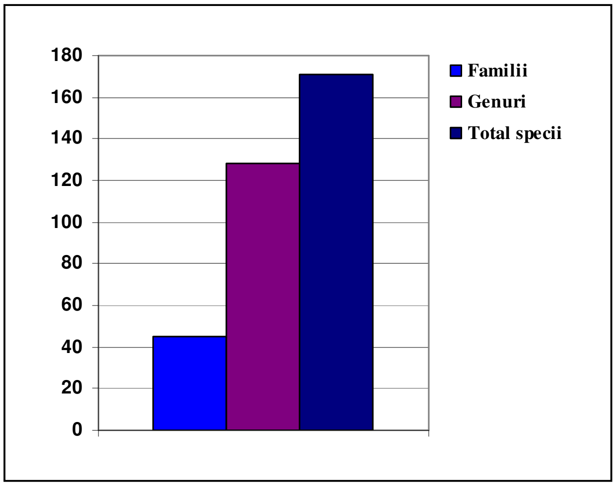

Fig. 2. Taxonomic analysis of flora's protected area Nemțeni

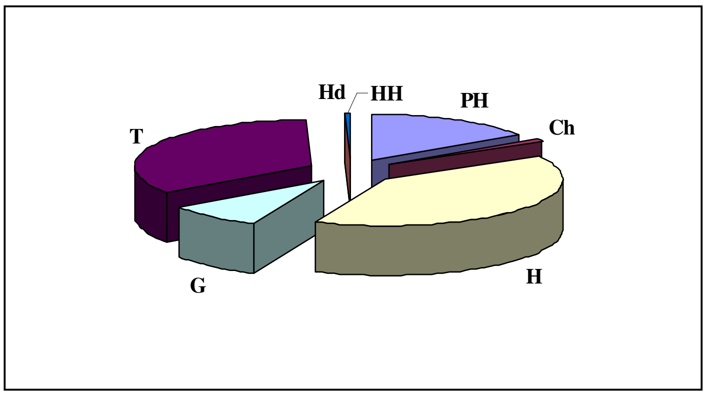

Fig. 3. Analysis of bioform of flora's protected area Nemțeni

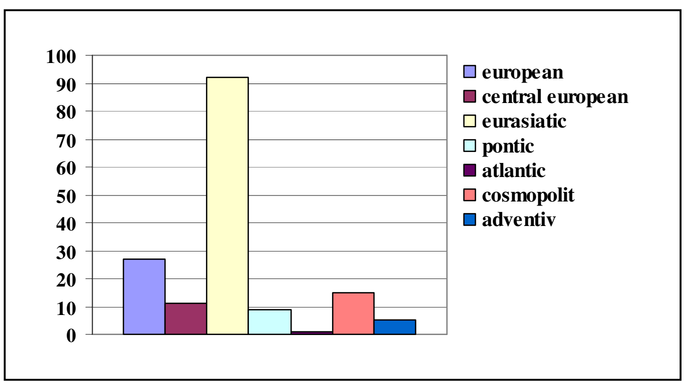

Fig. 4. Geoelement analysis of flora's protected area Nemțeni

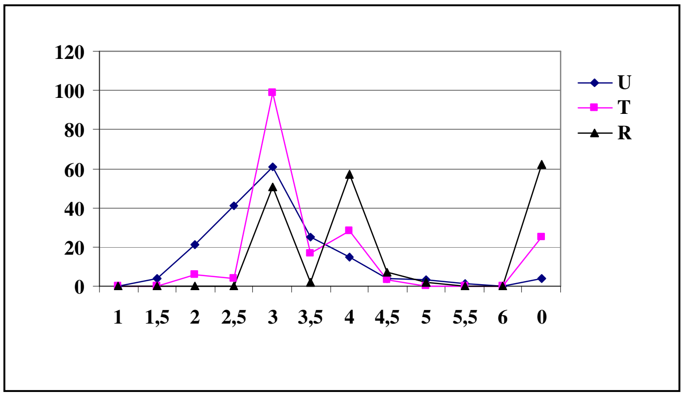

Fig. 5. Ecological index's analysis of flora's protected area Nemțeni

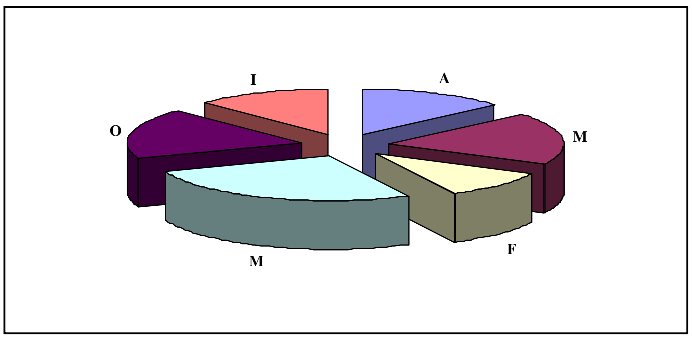

Fig. 6. Economical analysis of flora's protected area Nemțeni

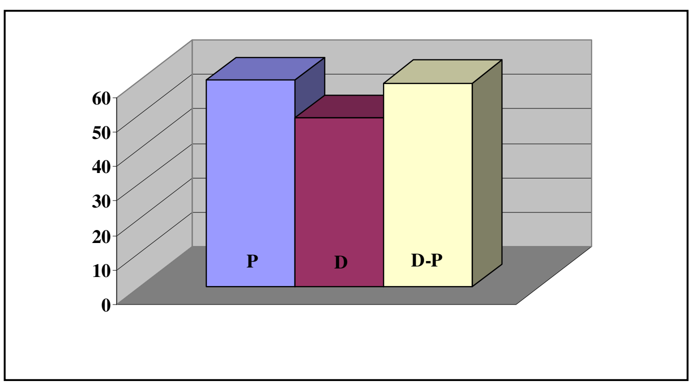

Fig. 7. Caryological analysis of flora's protected area Nemțeni

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FLORA AND VEGETATION OF GRASSLANDS FROM NÂRNOVA RIVER'S BOTTOMLAND

MIRON ALIONA*

Abstract: The paper represents a synthesis of the investigation issues performed in Nârnova River's grassland during the 2006-2007 vegetation periods. Floristic and phytocoenotic composition of vegetation's grassland was established. Floristic Inventory of Nârnova River's grassland includes 193 species, appertaining to 112 genus and 38 families. Flora was analyzed from taxonomic, bioform, geoelement, ecological index, economical importance points of view. 11 species with different endangered level were identified. Studied phytocoenosis appertain to 15 associations included into 10 alliances, 10 orders and 4 classes.

Key words: Nîrnova river's grassland, floristic and phytocoenotic composition.

Introduction

Nîrnova river's springs out in the south part of the villages Vânători and Nisporeni, have 49 ha length, is closer village Leuşeni. The basin is situated in the vest part of Codrii highland. Height average of reception basin is of 160 m, area - 358 km. River Nârnova has 40 affluent, majority of which don't exceed 10 km length. The most part of basin area is ploughed, in the superior part of the river are extended the forests. Valleys affluent are narrows, with abrupt versants, exposed to erosion. The bottomland is bilateral, length is 150-400 m; maximal – 600 m (4 km upstream of the village Leuşeni) and minimal – 60 m at the spring. In the grassland persists alluvial and halomorphic soils. The cauce is instable, predominantly drought, have 1-7 m width. Closer the river mouth the cauce is canalized [10], where 8 lacks are built [9].

Some literature data about flora and vegetation of Nîrnova river grassland is unknown. Our investigations had the target of evidencing floristic and phytocoenotic composition of vegetation for elaborate biosafety measures and sustainable use of Nîrnova river grasslands' flora and vegetation.

Material and method

Floristic and phytocoenotic investigations according Central–European Phytocoenologic School [1, 2, 4 and 5], during 2006-2007 periods of vegetation, were performed. Flora and Vegetation of the grassland, beginning from the spring, till its flowing into river Prut, conform itinerary method were studied. For studying the phytocoenosis, the phytocoenologic description, as basic method, was used. Identification of the associations, according characteristic and dominant species, comparatively to synthetic similar tables from the special, national and occidental literature works was done. Coenotaxonomic Conspectus of the associations was compound on the base of the scientific works [3, 7, 8].

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Results and discussions

A. Floristic diversity

Taxonomic analysis

In the grassland spontaneous flora 193 species, appertaining to 112 genus and 38 families were evidenced. Taxonomic analysis the number of species of families was established: *Asteraceae* (30 sp.-15,5%), *Poaceae* (23 sp.-11,9%), *Fabaceae* (17 sp.-8,8%), *Cyperaceae* (15 sp.-7,7%), *Brassicaceae* and *Polygonaceae* (11 sp.-5,7% each). 6 fam. includes 107 sp. (55,4%) of vascular plant, others 32 fam. summarize 44,6%.

The most representative genuses are *Carex* (11 sp.-5,7%), *Rumex* (7 sp.-3,6%), *Plantago* (6 sp.-3,1%), *Juncus*, *Trifolium*, *Polygonum* (4 sp. each). The List of the vascular plant species evidenced in grassland flora's is presented: *Achillea collina, A. nobilis, A. setacea, Agrostis stolonifera, A. tenuis, Alisma lanceolatum, A. plantago-aquatica, Allium rotundum, Alopecurus arundinaceus, A. pratensis, Althaea officinalis, Ambrosia artemisiifolia, Anchusa gmelinii, Arctium minus, Arrhenatherum elatius, Artemisia absinthium, A. austriaca, A. vulgaris, Atriplex littoralis, A. micrantha, A. nitens, Bassia sedoides, Batrachium rionii, Beckmannia eruciformis, Berteroa incana, Bolboschoenus maritimus, Borago officinalis, Bromus arvensis, B. japonicus, B. squarrosus, Bryonia alba, Butomus umbellatus, Capsella bursa-pastoris, Caragana scythica, Cardaria draba, Carex acutiformis, C. distans, C. extensa, C. hirta, C. hordeistichos, C. melanostachya, C. muricata, C. otrubae, C. riparia, C. secalina, C. vulpina, Cerastium perfoliatum, Ceratophyllum demersum, C. submersum, Chenopodium album, C. glaucum, Cichorium intybus, Cirsium arvense, Conium maculatum, Consolida regalis, Convolvulus arvensis, Cynodon dactylon, Cynoglossum officinale, Daucus carota, Descurainia sophia, Echinops ritro, Elaeagnus angustifolia, Eleocharis palustris, Elytrigia intermedia, E. repens, Equisetum arvense, E. telmateia, Erigeron acris, Festuca arundinacea, F. pratensis, Fragaria vesca, Frankenia pulverulenta, Galega officinalis, Galium aparine, G. mollugo, G. verum, Geranium collinum, Glyceria fluitans, G. nemoralis, Hieracium caespitosum, Inula germanica, Iris germanica, I. halophila, I. pseudacorus, Juncus bufonius, J. compressus, J. gerardii, J. inflexus, Lactuca quercina, Lathyrus tuberosus, Lemna minor, Leonurus quinquelobatus, Lepidium latifolium, L. ruderale, Leucanthemum vulgare, Linaria ruthenica, Lolium perenne, Lotus corniculatus, L. tenuis, Lycopus europaeus, L. exaltatus, Lysimachia nummularia, Lythrum salicaria, L. virgatum, Malva neglecta, Matricaria perforata, M. recutita, Medicago falcata, M. lupulina, M. sativa, Melampyrum arvense, Melilotus alba, M. officinalis, Mentha arvensis, Myosotis arvensis, Papaver rhoeas, Phragmites australis, Picris hieracioides, Plantago cornuti, P. lanceolata, P. major, P. maritima, P. media, P. urvillei, Poa angustifolia, P. pratensis, Polygonum amphibium, P. aviculare, P. lapathifolium, P. scabrum, Potentilla argentea, P. recta, P. reptans, Prunella vulgaris, Prunus spinosa, Puccinellia distans, P. gigantea, P. limosa, Ranunculus acris, R. repens, R. sceleratus, Raphanus raphanistrum, Rorippa austriaca, R. palustris, R. sylvestris, Rubus caesius, Rumex confertus, R. conglomeratus, R. crispus, R. maritimus, R. palustris, R. sanguineus, R. stenophyllus, Salicornia europaea, Salix alba, S. pentandra, Salvia nemorosa, Sambucus ebulus, Scirpus sylvaticus, S. tabernaemontani, Scorzonera parviflora, Sonchus arvensis, S. palustris, Spergularia marina, S. maritima, S. rubra, Suaeda maritima, S. prostrata, Symphytum officinale, Tamarix ramosissima, Tanacetum vulgare, Taraxacum bessarabicum, T. officinale, T. palustre, Teucrium* *chamaedrys, Thymus ucrainicus, Torilis arvensis, Tragopogon orientalis, Trifolium fragiferum, T. patens, T. pratense, T. repens, Tripolium vulgare, Tussilago farfara, Typha angustifolia, Urtica dioica, Verbascum phlomoides, Veronica anagallis-aquatica, V. scutellata, Vicia angustifolia, V. hirsuta, V. sylvatica, Xanthium spinosum, X. strumarium.*

Bioform Analysis

In the grassland predominate the hemicryptophytes - 47,7%, terophytes - 27,5%, geophytes - 12,4%, hydro-helophytes - 5,2%, phanerophytes – 3,1%, chamaephytes - 1,6%. Altitudinal index (**Ka**) for grassland flora is equal with 58%, which denote a slow climate and severe anthropeic influence [4]. Vital duration analysis evidenced the predominance of perennial herbaceous (68,4%), annual (21,2%), biennial (5,7%) plants.

Analysis of Floristic Elements

In flora species of euriasiatic element predominate (55%), considerable role have the cosmopolite (13,5%), circumpolar (9,8%), european (9,3%), pontic (7,3%) and mediterranean (2,6%) by less percentage.

Analysis of the Ecological Indexes

Analysis of the humidity indexes shows that the mesophytes (24,4%), xeromesophytes (23,6%), mesohygrophytes (23,6%) hygrophytes (7,8%), hydrophytes (6,2%), euriphytes (5,7%), xerophytes (3,6%) react differently. Referring to the exigencies of species to the thermic factor the greater part remains for micromesoterme (54,4%), amphitolerant (19,7%), temperate-thermophile (16,6%), microtherm only 3,6%. According soil reaction the most of species are slightly acid-neutrophilious (39,9%), euryionics (34,2%), acid-neutrophile (10,4%) and, neutrobasiphile (8,8%). Trophic soil reaction is represented by eutrophic (35,8%), mesotrophic (28%), oligotrophic and euritrophic with 6,7% and 2,1%, respectively. In the floristic composition persists 17,8% of species as indicators of the azotes soil fixing level. The most numerous, ensured with nutritive elements, are the plant of medium soil (N3-6,8%) and poor soil (N2-5,2%). In the grassland 39 halophyte species (20,4%) from the total number of species were identified.

Economical Plant Importance

Analyses of plant from wild flora show that the number achieves more than 120 species (65% from the total number of species). The most numerous are the medicinal (31,4%), industrial (26,2%), technical (23,6%), melliferous and alimentary plant have equal percentage (16,2%), toxic and decorative have less values (5,2%).

Rare Plant Species

Conform to the International Classification (IUCN, 1994) of endangered species 11 rare plant species (5,7%) were identified which are grouped in 3 categories [6]:

1. **Endangered** (EN) – *Carex extensa*, *Cerastium perfoliatum*;
2. **Vulnerable** (VU) – *Frankenia pulverulenta*, *Spergularia rubra*, *Tamarix ramosissima*, *Veronica scutellata*;
3. **Rare** (R) – *Agrostis tenuis*, *Anchusa gmelinii*, *Carex secalina*, *Equisetum telmateia*, *Iris haplophila*.

B. Phytocoenotic diversity

There are 3 types of vegetation: paludal and pratal (**Fig. 1**).

The conspectus of paludal vegetation

PHRAGMITI – MAGNOCARICETEA Klika in Klika et Novak 1941.
Phragmitetalia Koch 1926.
Phragmition communis Koch 1926.
Scirpo-Phragmitetum Koch 1926 (art. 36).
Corology: village Vânători (district Nisporeni), town Nisporeni.
Typhetum angustifoliae Pignatti 1953.
Corology: Leuşeni (Hînceşti).
Magnocaricetalia elatae Pignatti 1953.
Magnocaricion elatae Koch 1926.
Caricenion gracilis (Neuhaus 1959) Oberd. et al. 1967.
Caricetum vulpinae Soo 1927.
Corology: Leuşeni (Hânceşti).
Eleocharitetum palustris Ubrizsy 1948.
Corology: Nisporeni.
Caricetum ripariae Soo 1928 (art. 2b).
Corology: Vărzăreşti (Nisporeni).
Bolboschoenotalia maritime Eggler 1933.
Cirsio brachycephali – Bolboschoenion (Passarge 1978) Mucina in Grabherr et Mucina 1993.
Bolboschoenetum maritimi Eggler 1933.
Corology: Nisporeni; Ivanovca, Leuşeni (Hînceşti).
Schoenoplectetum tabernaemontani Soo 1947.
Corology: Vânători (Nisporeni), Nisporeni.

The conspectus of pratal vegetation

MOLINIO – ARRHENANTHERETEA R. Tx. 1937.
Molinietalia caeruleae Koch 1926.
Alopecurion pratensis Passarge 1964.
Ranunculo repenti – Alopecuretum pratensis Ellmauer et Mucina in Mucina et al. 1993.
Corology: Vânători (Nisporeni), Nisporeni; Ivanovca (Hâncesti).
Arrhenatheretalia R. Tx. 1931.
Arrhenatherion Koch 1926.
Pastinaco - Arrhenatheretum Passarge 1964.
Corology: Vînători (Nisporeni).
Potentillo – Polygonetalia R. Tx. 1947.
Potentillion anserinae R. Tx. 1947.
Agrostietum stoloniferae Burduja et al. 1956.
Corology: Vărzăreşti (Nisporeni), Nisporeni.
Rorippo austriacae - Agropyretum repentis (Timar 1947) R. Tx. 1950.
Corology: Vînători (Nisporeni), Nisporeni; Ivanovca (Hânceşti).
THERO – SALICORNIETEA (Pignatti 1953) R. Tx. in R. Tx. et Oberd. 1958.
Thero – Salicornietalia (Pignatti 1953) R. Tx. in R. Tx. et Oberd. 1958.
(Thero -) Salicornion strictae Br.-Bl. 1933 em. R. Tx. 1950.
Salicornietum europaeae Wendelbg. 1953.
Corology: Nisporeni; Ivanovca (Hânceşti).
PUCCINELLIO – SALICORNIETEA Țopa 1939.

Crypsidetalia aculeatae Vicherek 1973.

Cypero – Spergularion Slavnic 1948.

Spergularietum mediae (Şerbănescu 1965) Popescu et al. 1992.

Corology: Ivanovca (Hânceşti).

Puccinellietalia Soo 1940.

Puccinellion peisonis (Wendelbg. 1943) Soo 1957.

Puccinellietum distantis Soo 1937; Knapp 1948.

Corology: Vînători (Nisporeni); Ivanovca (Hânceşti).

Scorzonero – Juncetalia gerardii Vicherek 1973.

Scorzonero – Juncion gerardii Vicherek 1973.

Astero tripoli - Juncetum gerardii Smarda 1953.

Corology: Vânători (Nisporeni), Nisporeni; Ivanovca, Leuşeni (Hânceşti).

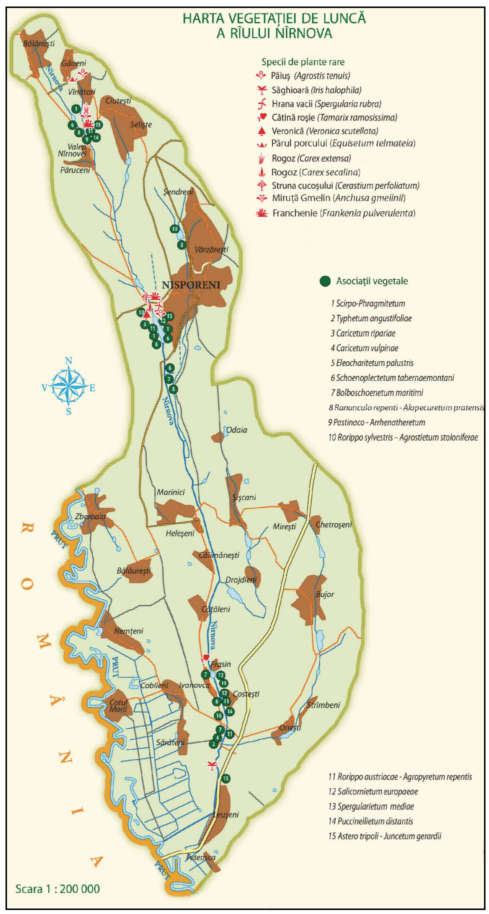

Fig. 1. The map of vegetation's Nârnova River

Conclusions

- Bioform Analysis evidenced the predominance of hemicryptophytes (47,7%), meantime, the Analysis of Floristic Elements reflects the predominance of euriasiatic element (55%).
- Ecological Analysis established that from the humidity exigencies, thermal and soil reaction point of view, numerically predominate the mesophytes (24,4%), micromesoterme (54,4%), slightly acid-neutrophile (39,9%).
- Conform International Classification (IUCN, 1994) in spontaneous flora 11 sp. by different endangered level were evidenced.
- Coenotaxonomic Conspectus includes 15 associations vegetable from 10 alliances, 10 orders and, 4 classes of vegetation.

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CONTRIBUTIONS TO THE STUDY OF THE CLASS *MOLINIO-ARRHENATHERETEA* R. TX. 1937 IN THE UPPER BASIN OF THE RIVER DORNA (DISTRICT OF SUCEAVA) (II)

DANU MIHAELA AURELIA*, CHIFU TOADER*, IRIMIA IRINA*

Abstract: The paper presents two hygrophilic associations in the upper basin of the river Dorna (district of Suceava): *Epilobio-Juncetum effusi* Oberd 1957 and *Scirpetum sylvatici* Ralski 1931, associations classified from the coenotaxonomic point of view in the class *Molinio-Arrhenatheretea* R. Tx. 1937.

Key words: phytocoenology, hygrophilic vegetation.

Introduction

The upper basin of the river Dorna is located in the north of Romania, in the south-west part of the district of Suceava, being integrated in the central-northem part of the Oriental Carpathians.

The association *Epilobio-Juncetum effusi* Oberd 1957 was also noticed on the territory of the upper basin of Dorna (in the village Poiana Stampei) by Guşuleac M. in 1930 [5] under the name of *Juncetum effusae*, but it was mentioned without phytocoenological relevées. The association was also noticed without phytocoenological relevées by Mititelu D., Chifu T. and Pascal P. in 1989 [6] at Poiana Stampei. The second association was not mentioned so far in the territory of the upper basin of the river Dorna.

Material and method

The names of the species were chosen according to *Flora Europaea* [10] and *Flora ilustrată a României – Pteridophyta et Spermatophyta* [3], and for the study of the vegetation it was used the phytosociological method of Braun-Blanquet.

On taking into consideration several papers in the specialty literature [1, 2, 7, 8, 9], the two vegetal associations were classified in the following coenosystem:

MOLINIO-ARRHENATHERETEA R. Tx. 1937
MOLINIETALIA CAERULEAE Koch 1926
CALTHION PALUSTRIS R. Tx. 1937

Epilobio-Juncetum effusi Oberd 1957
Scirpetum sylvatici Ralski 1931

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Results and discussions

Ass. ***Epilobio-Juncetum effusi*** Oberd 1957

Corology. The association has an insular spread, being identified lengthways of axial path Dorna, between Dornişoara and forest path Bărăcii and lengthways of forest paths Borcut Muncelu, Muncelu Mare, Podu Vărăriei and Rizu-Dosu Arşiţei, near Tinovul Mare, between Dorna river and the axial path Dorna.

Ecology. The hygrophilic phytocoenoses of *Juncus effusus* are usually developed in the valleys of the rivers, on alluvial soils, pseudogleic or gleic, with reduced content in nutritive substances. In the upper basin of Dorna, the phytocoenoses of this association are developed on surfaces generally plane, with a surplus of soil humidity.

The floristic and phytocoenological characterisation. The floristic composition of the association is rich (43 species) and varied. The dominant species *Juncus effusus* realizes a covering of vegetation with values between 50 and 75%, while the characteristic species *Epilobium palustre* has a high constancy in the frame of the association. These two species, besides the species in the alliance *Calthion* and in the order *Molinietalia* underlines the high humidity in the soil where these phytocoenoses develop. The species characteristic to the class *Molinio-Arrhenatheretea*, as well as the species in the inferior coenotaxons of this class give a mesophilic touch to this association (**Tab. 1**).

As for the **bioforms**, the hemicryptophytes are clearly dominant (H-76.74%), being followed at big distance by geophytes (G-13.95%). Equal percentages realize the terrophytes (T), hemiterrophytes (Ht), camephytes (Ch) and fanerophytes (Ph): 2.33% each (**Fig. 1 a**).

The element of flora dominant is the Euro-Asian one (Euras.-46.51%), followed by the circumpolar one (Circ.-23.26%) and cosmopolite (Cosm.-13.95%) (**Fig. 1 b**).

The hygrophilic touch of this association is reflected also in the high percentage of species with high index of humidity (almost 55% of the species). Over 90% of the total number of species are plants that prefer the light. As for the temperature, 60% are species tolerant to water, and almost 31% are plants preferring a climate with moderate values. The **spectre of ecological indices** shows also the high percentage (61.9%) of the amphitolerant species to the pH of the soil, and the preference for the low content in mineral nitrogen is reflected by the percentage of 35.2%.

Ass. ***Scirpetum sylvatici*** Ralski 1931

Corology. The association was identified between Dornişoara and the forest path Bărăcii, axial path Dorna (near Dornişoara), forest path Zgârciu, forest path Rizu-Dosu Arşiţei, forest path Mâţei, forest path Podu Vărăriei.

Ecology. The phytocoenoses identified by *Scirpus sylvaticus* are met on alluvial soils, gleic and pseudogleic, having a large distribution in altitude. The association was identified on plane surfaces, with soils with excessive humidity almost throughout the year.

The floristic and phytocoenological characterisation. The floristic composition is rich (42 species). The dominant species and characteristic to the association, *Scirpus sylvaticus*, realizes coverings between 80 and 100%. Besides it, numerous mesophilic and meso-hygrophilic species develop, characteristic for the alliance *Calthion* and the class *Molinio-Arrhenatheretea*. The excess of humidity favours also the appearance of species in the classes *Phragmiti-Magnocaricetea*, *Scheuchzeri-Caricetea fuscae* etc (**Tab. 2**).

Hemicryptophytes (H) dominate the **spectre of bioforms** (76.19%), being followed at big distance by geophytes (G-16.67%). Reduced percentages realize the camephytes (Ch-2.38%) and the terrophytes (T-4.76%) (**Fig. 2 a**).

The Euro-Asian element represents the biggest percentage (Euras.-54.76%) in the **spectre of floristic elements**; the circumpolar element (Circ.) comes next (23.81%), being followed by the European element (Eur.) with 9.52% (**Fig. 2 b**).

The spectre of ecological indices confirms the data in the specialty literature, reflecting the high percentage of hygrophilic species (over 50%). As for the temperature, over 70% of the species are amphitolerant. Almost 62% of the species in these phytocoenoses are amphitolerant to the reaction of the soil, and over 55% prefer the soils with low to moderate content of nitrogen.

Conclusions

- The installation and development of this kind of hygrophilic phytocoenoses is favorised by the stational conditions on plane surfaces, with a surplus of soil humidity almost throughout the year (alluvial soils, gleic and pseudogleic);
- The floristic and phytocoenological composition of these two associations is rich and varied;
- The analysis results of the 12 relevées realised for the two associations, in that concerning the bioforms, floristic elements and ecological indices, shows that our results are according with specialty literature.

Table 1

Ass. *Epilobio-Juncetum effusi* Oberd 1957

Number of relevées	1	2	3	4	5	6	
Altitude (m)	1095	1020	915	902	975	1096	
Covering of vegetation (%)	90	85	90	95	95	80	
Surface of relevée (m²)	10	25	100	50	50	50	
Number of species	16	15	16	15	20	18	K
Association's characteristics							
Epilobium palustre	+	+	-	+	+	-	IV
Calthion palustris							
Carex ovalis	-	-	+	-	-	-	I
Epilobium parviflorum	-	-	+	-	-	+	II
Geum rivale	-	+	-	-	+	+	III
Juncus articulatus	-	-	+	-	+	+	III
Myosotis scorpioides	-	+	+	+	+	+	V
Scirpus sylvaticus	1	-	1	+	-	1	IV
Trifolium hybridum ssp. hybridum	-	-	-	+	-	-	I
Molinietalia caeruleae							
Deschampsia caespitosa ssp. caespitosa	-	+	-	-	-	-	I
Equisetum palustre	-	-	-	-	+	+	II
Filipendula ulmaria	-	1	+	+	-	-	III
Galium palustre ssp. palustre	+	-	-	-	+	+	III
Juncus effusus	4	4	4	4	4	4	V
Lychnis flos-cuculi	-	-	-	-	-	+	I
Vicia sepium	-	-	-	-	-	+	I
Cynosurion							
Cynosurus cristatus	-	-	+	-	-	-	I
Trifolium repens ssp. repens	+	-	-	1	+	-	III

Arrhenatherion et Arrhenatheretalia							
Achillea millefolium ssp. millefolium	-	-	-	+	-	-	I
Bellis perennis	-	-	-	+	+	-	II
Campanula patula	-	-	+	-	-	-	I
Taraxacum officinale	+	-	-	+	-	-	II
Poo alpinae-Trisetetalia							
Phleum alpinum ssp. alpinum	-	-	-	-	+	-	I
Potentillion anserinae et Potentillo-Polygonetalia							
Agrostis stolonifera	-	-	-	-	-	+	I
Carex hirta	-	+	-	-	-	-	I
Potentilla anserina	-	+	-	+	+	-	III
Ranunculus repens	-	+	+	1	+	+	V
Molinio-Arrhenatheretea							
Alchemilla vulgaris	+	-	+	-	1	+	IV
Cerastium holosteoides	-	-	-	-	+	-	I
Lotus corniculatus	-	-	+	+	+	-	III
Prunella vulgaris	+	+	+	+	+	+	V
Ranunculus acris ssp. acris	+	+	1	+	-	-	IV
Trifolium pratense ssp. pratense	+	+	-	-	+	+	IV
Variae syntaxa							
Cirsium arvense	+	+	+	-	+	+	V
Cruciata glabra	-	+	-	-	-	+	II
Eleocharis austriaca	+	-	-	-	-	-	I
Epilobium montanum	-	-	-	-	1	-	I
Juncus buffonius	+	-	-	-	-	-	I
Mentha arvensis ssp. arvensis	+	-	-	-	-	-	I
Potentilla erecta	-	-	-	-	+	-	I
Salix caprea (juv.)	-	+	-	-	-	-	I
Senecio ovatus	-	-	+	-	-	-	I
Tussilago farfara	1	-	-	-	-	+	II
Veronica officinalis	+	-	-	-	-	-	I

Place and date of relevées:

1 – axial path Dorna, between Dornişoara and forest path Bărăcii (27.07.2006); 2 – forest path Borcut Muncelu (22.08.2006); 3 – forest path Muncelu Mare (24.08.2006); 4 – near Tinovul Mare, between Dorna and the axial path Dorna (24.08.2006); 5 – forest path Podu Vărăriei (2.09.2006); 6 – forest path Rizu-Dosu Arşiţei (3.09.2006).

Table 2

Ass. *Scirpetum sylvatici* Ralski 1931

Number of relevées	1	2	3	4	5	6	
Altitude (m)	1095	1050	1150	1096	1012	970	
Covering of vegetation (%)	95	80	90	95	100	90	
Surface of relevée (m²)	25	10	100	100	20	50	
Number of species	21	21	19	16	13	15	K
Association's characteristics							
Scirpus sylvaticus	4	5	5	5	5	5	V
Calthion palustris							
Caltha palustris	-	+	+	-	+	-	III
Epilobium parviflorum	+	-	+	-	-	-	II
Geum rivale	-	-	+	+	+	-	III
Juncus articulatus	-	-	+	+	-	+	III
Myosotis scorpioides	+	+	+	+	+	-	V
Poa palustris	-	+	-	-	-	-	I
Alopecurion pratensis							
Festuca pratensis ssp. pratensis	+	-	-	-	-	+	II
Phleum pratense	+	-	+	-	-	-	II

Deschampsion caespitosae							
Carex ovalis	+	-	-	-	-	-	I
Deschampsia caespitosa ssp. caespitosa	-	+	-	-	-	-	I
Arrhenatherion							
Equisetum arvense	+	-	-	-	+	+	III
Taraxacum officinale	-	-	-	+	-	-	I
Cynosurion							
Cynosurus cristatus	+	-	-	+	-	-	II
Trifolium repens ssp. repens	+	-	+	-	-	+	III
Arrhenatheretalia							
Achillea millefolium ssp. millefolium	-	+	-	-	-	-	I
Leucanthemum vulgare ssp. vulgare	-	+	-	+	-	-	II
Molinietalia caeruleae							
Filipendula ulmaria	-	+	+	-	+	+	IV
Galium palustre ssp. palustre	-	+	-	+	+	+	IV
Juncus effusus	1	+	+	+	+	+	V
Lychnis flos-cuculi	+	-	+	-	+	-	III
Molinio-Arrhenatheretea							
Alchemilla vulgaris	+	+	+	+	+	-	V
Anthoxanthum odoratum	+	-	-	+	-	-	II
Cerastium holosteoides	-	+	-	-	-	+	II
Euphrasia officinalis ssp. pratensis	+	-	+	+	-	-	III
Lotus corniculatus	+	-	-	-	-	-	I
Plantago lanceolata ssp. lanceolata	-	+	-	-	+	-	II
Prunella vulgaris	+	+	+	-	-	+	IV
Trifolium pratense ssp. pratense	+	+	+	-	-	-	III
Phragmiti-Magnocaricetea							
Carex acutiformis	+	+	-	-	-	+	III
Eleocharis palustris	-	+	-	-	-	-	I
Scheuchzerio-Caricetea fuscae							
Triglochin palustre	+	-	-	-	-	-	I
Juncetea trifidi							
Hieracium aurantiacum	-	-	+	-	-	-	I
Potentilla erecta	-	+	+	-	+	-	III
Epilobietea angustifolii							
Rumex acetosella ssp. acetosella	-	+	-	+	-	-	II
Stellarietea mediae							
Mentha arvensis ssp. arvensis	+	-	-	+	-	+	III
Artemisietea vulgaris							
Cirsium arvense	-	+	+	-	-	+	III
Tussilago farfara	-	-	-	+	-	+	II
Querco-Fagetea							
Epilobium montanum	+	-	-	+	-	-	II
Equisetum sylvaticum	-	-	+	-	-	-	I
Impatiens noli-tangere	-	-	-	-	-	+	I
Vaccinio-Piceetea							
Veronica officinalis	-	+	-	-	+	-	II

Place and date of relevées:
1 – between Dornişoara and the forest path Bărăcii (27.07.2006); 2 – axial path Dorna (near Dornişoara) (21.08.2006); 3 – forest path Zgârciu (02.09.2006); 4 – forest path Rizu – Dosu Arşiței (03.09.2006); 5 – forest path Mâței (20.08.2006); 6 – forest path Podu Vărăriei (03.09.2006).

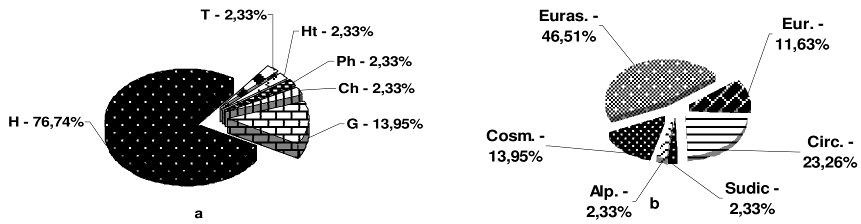

Fig. 1. a) The bioforms spectrum; **b)** The floristic elements spectrum – ass. *Epilobio-Juncetum effusi* Oberd 1957

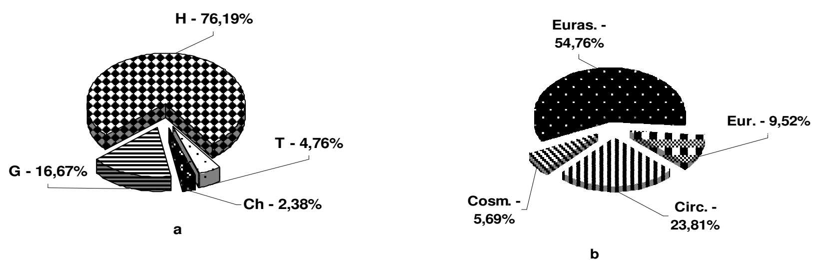

Fig. 2. a) The bioforms spectrum; **b)** The floristic elements spectrum – ass. *Scirpetum sylvatici* Ralski 1931

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CONTRIBUTIONS TO THE STUDY OF VEGETATION FROM THE NATURAL PARK VANATORI NEAMT

DARABAN MIHAELA *

Sumary: As a result of the researches carried out between 2005-2007 in The Natural Park Vanatori Neamt, we identified two association: *Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995 and *Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu et Sârbu 2001. This article describes these associations by taking into consideration main aspects of chorology, ecology, physiognomy and floristic composition, biological forms, floristic elements, ecological indexes.

Key words: chorology, ecology, physiognomy and floristic composition, biological forms, floristic elements, ecological indexes.

Introduction

The results of the investigation developed between the years 2005-2007, as well as the existing literature data in the field, put into evidence the presence of two association *Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995 and *Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu et Sârbu 2001.

Material and method

The aspects of chorology, ecology, physiognomy and floristic composition, was made on the *Vademecum ceno-structural privind covorul vegetal din România* by V. Sanda (2002). [9] The establishment of the bioforms and floristical elements was made on the basis of *Flora ilustrată a României. Pteridophyta et Spermatophyta*, by V. Ciocârlan (2000). [1] The ecological indices were noted by H. Ellenberg (1974) *Indicator values of vascular plants in Central Europe.* [8]

Results and discussions

QUERCETEA ROBORI – PETRAEAE Br. – Bl. et R. Tx. 1943
Quercetalia roboris R. Tx. 1931
Genisto germanicae – Quercion Neuhäusel et Neuhäslova – Novotna 1967
***Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995**

Chorology: We can find this vegetal association in Neamt Mountains (Chifu T., Ştefan N., 1973) and in the reserve „Brass Wood" (Mititelu D.,1992, 1993).

We identified sub-association *quercetosum dalechampii*, that covers a large area from Neamt Natural Park, never been found before.

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Ecology: The association *Cytiso nigricantis–Quercetum petraeae* Paucă 1941, met in hillock level is known as ,,durmast forests level". This association met on slightly or strongly inclined surfaces and acid soils. *Quercus dalechampii* is a mediterranean element characteristic to oak tree forests submesophiles – thermophiles.

Table 1

Ass. *Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995

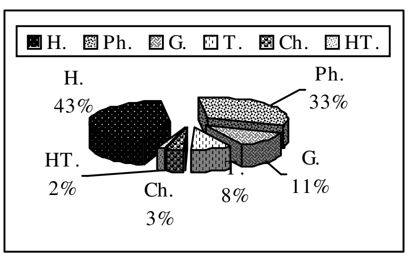
No. of survey	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**K**
Altitude (m.s.m.)	600	650	600	600	650	650	600	600	600	
Exposition	E	SE	E	E	S	NE	E	E	SE	
Angle of slope (degrees)	25	20	25	20	20	40	25	40	30	
Covering – the layer (%)	90	90	95	80	95	85	80	60	80	
Covering – shrubs + sapling (%)	10	15	5	10	10	10	5	5	20	
Covering – herbaceous layer (%)	5	10	5	5	5	20	5	10	5	
Surface (m^2)	400	400	400	400	400	400	400	400	400	
Charact. ass.										
Cytisus nigricans	-	-	+	-	-	+	+	+	-	III
Dif. subassoc										
Quercus dalechampii	4	5	5	4	5	4	4	3	4	V
Genisto germanicae - Quercion										
Trifolium medium ssp. medium	+	+	-	+	-	-	+	+	+	IV
Veronica chamaedrys	-	-	+	+	-	-	+	+	-	III
Lathyrus niger	+	+	+	-	-	-	-	-	-	III
Genista tinctoria	+	-	+	-	-	-	-	-	-	II
Pino - Quercion										
Vaccinium myrtillus	-	-	+	-	-	+	-	-	-	I
Quercetalia roboris										
Rosa canina	+	+	+	-	+	+	+	-	-	IV
Calamagrostis arudinacea	-	-	+	-	+	+	-	+	-	III
Luzula luzuloides	-	+	+	-	-	-	+	-	-	III
Pteridium aquilinum	-	-	+	-	-	+	-	-	+	III
Hieracium umbellatum	-	-	+	-	-	-	-	-	-	I
Symphyto - Fagion										
Acer pseudoplatanus	+	+	+	-	+	+	+	+	-	V
Acer pseudoplatanus (juv.)	-	+	+	+	-	1	+	+	+	V
Campanula persicifolia	+	+	+	-	-	+	-	-	-	III
Lathyro hallersteinii - Carpinion										
Galium schultesii	-	+	+	+	+	-	+	+	+	V
Carpinus betulus (juv.)	-	-	-	1	-	+	+	+	+	III
Cerasus avium	+	+	+	-	+	-	-	+	+	III
Carpinus betulus	-	+	-	-	-	+	+	-	-	II
Dactylis polygama	+	-	-	+	-	+	-	-	-	II
Lathyrus venetus	+	-	-	+	-	-	-	-	-	II
Lathyrus vernus	+	+	-	-	-	-	+	-	-	II
Tilia cordata	+	-	-	+	-	-	+	-	+	II
Fagus taurica	+	-	+	-	-	-	-	-	-	I

Fagetalia sylvaticae										
Galium odoratum	+	+	+	+	+	-	+	+	+	V
Geranium robertianum	+	+	+	-	+	1	+	1	+	V
Rubus hirtus	+	1	+	+	1	+	+	+	-	V
Sanicula europaea	+	-	-	+	+	+	+	-	+	IV
Campanula rapunculoides	-	+	-	+	-	+	-	-	-	III
Hieracium murorum	-	-	+	+	-	+	+	+	-	III
Scrophularia nodosa	+	+	+	-	+	-	-	-	-	III
Carex sylvatica	+	-	-	-	+	-	+	-	-	II
Alnion incanae et Alno - Fraxinetalia										
Circaea lutetiana	-	+	+	+	+	-	+	-	-	III
Stachys sylvatica	-	+	-	+	+	-	-	-	-	II
Pyrus pyraster	+	-	-	-	+	-	-	-	+	II
Querco - Fagetea										
Dryopteris filix-mas	+	+	+	-	+	+	+	+	+	V
Acer campestre	-	+	+	+	+	+	+	+	-	IV
Mycelis muralis	-	-	+	+	+	+	+	-	+	IV
Viola reichenbachiana	+	+	-	+	+	+	+	+	-	IV
Geum urbanum	+	-	+	-	+	+	-	+	-	III
Quercus petraea (juv.)	-	+	+	-	-	+	+	+	-	III
Sedum maximum	+	+	+	-	-	+	+	-	-	III
Poa nemoralis	+	+	+	-	-	+	+	-	-	III
Quercus petraea	-	-	-	-	-	1	1	+	+	II
Cruciata glabra	-	+	-	-	-	+	-	+	-	II
Quercetea pubescentis										
Cornus mas	-	-	+	+	-	+	-	-	1	II
Polygonatum odoratum	+	+	+	-	-	-	-	+	-	II
Vaccinio - Piceetea										
Juniperus communis	-	-	+	-	-	-	-	-	-	I
Rhamno - Prunetea										
Crataegus monogyna	+	-	+	+	+	+	+	+	1	V
Evonymus europaeus	+	-	-	+	+	-	-	+	-	III
Rubus sylvaticus	1	1	+	+	+	+	-	-	-	III
Clematis vitalba	-	+	-	+	+	-	-	-	+	II
Rubus idaeus	-	+	-	+	-	-	+	-	-	II
Epilobietea angustifolii										
Fragaria vesca	+	-	+	-	+	+	+	+	+	V
Galio - Urticetea										
Urtica dioica	-	+	-	+	+	1	+	+	+	V
Lapsana communis	+	+	+	-	+	-	+	-	-	III
Variae syntaxa										
Clinopodium vulgare	+	+	+	-	-	+	-	-	-	III
Galeopsis tetrahit	-	+	+	-	-	+	+	-	+	III
Galeopsis speciosa	-	-	+	-	-	+	+	-	-	II
Trifolium alpestre	-	-	-	-	-	+	+	-	+	II
Alliaria petiolata	-	-	-	-	-	-	-	+	+	I

Pinus sylvestris (juv.)	-	-	-	-	-	-	-	-	+	I
Torilis arvensis	+	-	-	+	-	-	-	-	-	I
Vincetoxicum hirudinaria	-	+	+	-	-	-	-	-	-	I

Localization and date of surveys:
Neamt Mountain: 1, 2, 3, 4, 5 – (21-08-2005); „Brass Wood": 6, 7 - (28-08-2005); 8, 9 - (14-05-2006)

Physiognomy and floristic composition: The vegetation is relatively unitary from the viewpoint of physiognomy, *Quercus dalechampii* being the dominant specie. The analysis of the fitocenological table (Tab. I) reveals the species belongs to Class *Querco – Fagetea*, such as: *Quercus petraea*, *Acer pseudoplatanus*, *Viola reichenbachiana*, *Dryopteris filix-mas*, etc. Because the reserve is situated at 550-650 m high, (the upper limit of hillock), we can observe the beginning of an infiltration of typical mountain species: *Rubus idaeus*, *Fagus taurica*, *Trifolium alpestre*, *Vaccinium myrtillus* etc. The spectrum of the bioforms (**Fig. 1**) is outnumbered by the hemicryptophyte species (43%), followed by the phanerophyte species (33%). Geophyte species (11%) are represented by numerous vernal and estival species. We can notice in the analysis of the floristic elements distribution (**Fig. 2**) the dominance of the elements with a northern character: the Euroasian elements (35%), the European element (20%) and the Central-European elements (18%), resulting 73% of the total of species. Relatively well represented are the circumpolar elements (13%).



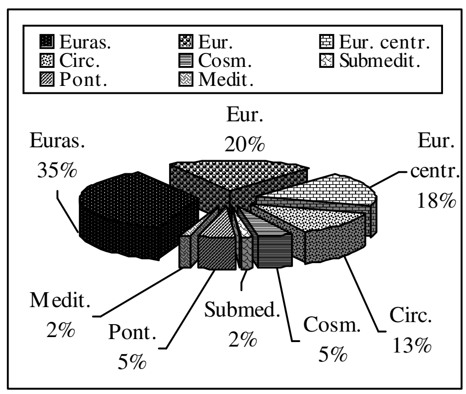


Fig. 1 – The spectrum of the bioforms **Fig. 2** – The spectrum of floristic elements of the association *As. Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995

The analysis of the distribution of species according to the six ecological indexes (H.Ellenberg – L, T, K, F, R, N) [8], related the preferences of the species for different factors. Thus, we can draw the following conclusions: as far as the analysis of the preferences of the species for light, the best represented are the ombrophile and semiombrophile species; the greatest proportion belongs to the thermophyles species; as far as the continentalism of the species who propagate in entire Central Europe; regarding the moisture content, the greatest proportion belongs to the category of mezoxerophile species; from the distribution of the species according to their reaction to the soil, we deduce that the majority are euriphytes; regarding the distribution of the species in relation to the amount of nitrogen available in the soil, most of the species prefer soil pour of mineral nitrogen and the same percent are amfitolerantes (**Fig. 3**). [1, 2, 3, 4, 5, 6, 7, 9]

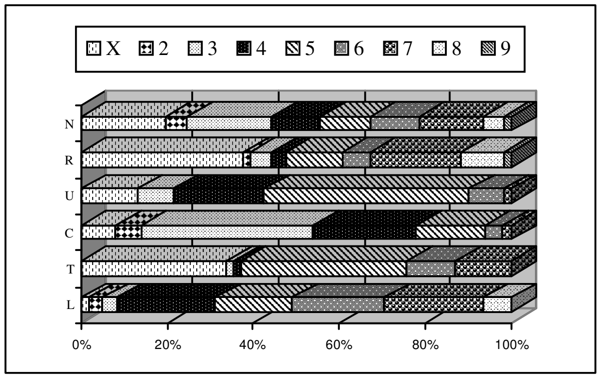


Fig. 3 – Distribution of the species in relation to the six ecological indexes (H. Ellenberg) of the association *As. Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995

QUERCO – FAGETEA Br. – Bl. et Vlieger in Vlieger 1937
Fagetalia sylvaticae (Pawlovski in Pawlovski 1928)
Lathyro hallersteinii – Carpinion
Galio schultesii – Carpinenion Tauber 1692
***Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu et Sârbu 2001**

Chorology*:* In the studied area, the association *Corylo avellanae – Carpinetum* Chifu 1997 was known by different names: *Querco robori – Carpinetum* Soó et Pócs 1957; *Evonymo nanae – Carpinetum aegopodietosum podagrariae* Chifu 1995. This association was identified by Chifu T., Ştefan N. (1973), on Brăilenei Hill, Valea Ozanei and ,,Dumbrava Forest". Later, was found by some authors in ,,Dumbrava Forest" (Burduja C., Chifu T., 1974), (Chifu T., 1995) şi (Mititelu D., 1992). On the occasion of vegetation research made in Vanatori Neamt Park, we found a new sub association: *quercetosum pedunculiflora.*

Ecology: This association met on plain or slightly inclined surfaces. *Quercus pedunculiflora* is rarely met in south and north forests of Moldova. This specie likes warm weather, presents resistance of drought, soil and atmosphere dryness. In Moldova, *Coryllus avellana* is a habitual shrub element of forests belongs to hillock and mountain lower level.

Physiognomy and floristic composition: The layer is represented by *Quercus pedunculiflora*, *Carpinus betulus*, *Pirus pyraster*. The shrubs and sapling is composed by *Cornus sanguinea*, *Crataegus monogyna* etc, the herbaceous layer being represented by forest species like: *Polygonatum latifolium*, *Brachypodium sylvaticum, Mycelis muralis, Sanicula europaea* etc. (**Tab. 2**)

The spectrum of the bioforms (**Fig. 4**) is outnumbered by the hemicryptophyte species (47%), followed by the phanerophyte species (28%). Geophyte species (16%) are well represented. The analysis of the distribution of the floristic elements (**Fig. 5**), the dominance of the elements with a northern character: the Euroasian elements (45%), the European element (25%) and the Central-European elements.The analysis of the distribution of species according to the six ecological indexes [8], we can draw the following conclusions: as far as the analysis of the preferences of the species for light, the best represented are semiombrophile species; the greatest proportion belongs to the thermophyles species; as far as the continentalism of the species who propagates in entire Central Europe; the greatest proportion belongs to the category of mezoxerophile species; from the distribution of the species according to their reaction to the soil, we deduce that the majority are neutrophile species; regarding the distribution of the species in relation to the amount of nitrogen available in the soil, the category of the nitrophile species has the greatest proportion, and the same percent are amfitolerantes (**Fig. 6**). [1, 2, 3, 4, 5, 6, 7, 9]

Table 2

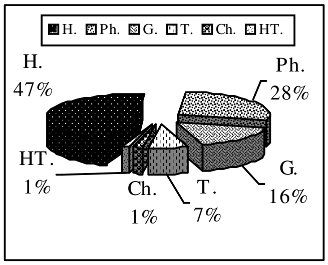
As. *Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu 1997

No. of survey	1	2	3	4	5	6	7	8	9	10	11	12	K
Altitude (m.s.m.)	450	500	550	500	450	450	450	500	500	500	500	500	
Exposition	S	S	S	S	NE	S	SE	E	NE	E	NV	V	
Angle of slope (degrees)	-	-	5	5	5	-	-	-	-	-	-	-	
Covering – the layer (%)	60	85	50	60	60	50	50	50	60	55	55	60	
Covering – shrubs + sapling (%)	20	25	35	35	20	10	5	25	10	10	5	20	
Covering – herbaceous layer (%)	40	25	10	10	20	35	55	80	65	45	50	20	
Surface (m^2)	400	400	400	400	400	400	400	400	400	400	400	400	
Charact ass.													
Coryllus avelana	1	+	-	1	1	1	+	2	1	+	+	+	V
Dif. subassoc.													
Quercus pedunculiflora	3	3	2	3	3	1	2	1	3	2	1	+	V
Alno - Fraxinetalia													
Aegopodium podagraria	1	+	+	-	+	-	-	-	+	1	+	+	V
Sambucus nigra	+	+	+	+	-	1	+	1	+	+	+	+	V
Geranium phaeum	+	-	+	+	-	+	-	-	+	+	+	+	V
Stachys sylvatica	+	+	+	+	+	-	-	-	+	+	+	+	V
Impatiens noli-tangere	-	-	+	+	+	-	-	-	+	+	+	+	IV
Circaea lutetiana	-	-	+	+	+	-	-	-	+	+	+	-	IV
Glechoma hederacea	1	+	+	-	+	+	-	-	+	+	+	+	
Galio schultesii - Carpinenion													
Carpinus betulus	1	2	2	1	1	1	1	2	1	1	2	3	V
Carpinus betulus (juv.)	1	2	2	2	1	+	+	+	+	+	+	1	V
Glechoma hirsuta	-	-	+	-	+	+	+	-	+	+	+	+	IV
Galium schultesii	-	-	+	+	+	-	-	-	+	+	+	+	IV
Cerasus avium	+	-	-	+	-	-	-	-	+	+	+	-	III

Campanula trachelium	-	-	+	-	+	-	-	-	+	+	-	+	III
Ranunculus cassubicus	-	+	-	+	-	-	-	-	+	-	-	-	I
Symphyto cordati - Fagion													
Acer pseudoplatanus	+	-	+	+	+	+	+	-	+	+	+	+	V
Abies alba	+	-	+	-	+	+	+	-	+	+	-	-	IV
Abies alba (juv.)	+	+	-	-	-	-	+	-	-	-	+	-	III
Epipactis helleborine	-	-	-	+	-	-	-	-	-	-	-	-	I
Fagetalia								**-**					
Sanicula europaea	+	+	-	+	+	+	+	+	+	+	+	+	V
Galium odoratum	+	+	-	+	+	+	-	-	+	1	+	+	V
Mercurialis perennis	2	2	-	1	+	2	+	2	3	+	3	1	V
Carex sylvatica	+	+	+	+	+	-	-	-	+	+	-	-	IV
Salvia glutinosa	+	-	+	-	+	-	-	-	+	+	+	+	IV
Fagus sylvatica	+	1	+	-	-	+	+	-	+	+	-	-	III
Asarum europaeum	+	+	-	-	-	-	-	-	+	+	+	+	III
Arum orientale	+	-	-	-	-	+	+	+	-	-	-	-	II
Rubus hirtus	-	-	-	+	+	-	-	-	+	+	-	-	II
Anemone ranunculoides	-	-	-	-	-	+	+	2	-	-	-	-	I
Corydalis solida	-	-	-	-	-	+	1	1	-	-	-	-	I
Querco - Fagetea													
Geum urbanum	+	+	-	+	1	+	+	-	+	+	+	+	V
Viola reichenbachiana	+	+	+	+	1	-	-	-	+	1	+	+	V
Acer campestre	+	+	+	+	+	+	+	1	-	-	+	1	V
Acer campestre (juv.)	+	+	+	-	-	+	+	+	+	+	-	1	V
Fraxinus excelsior	+	+	+	+	-	+	-	-	-	+	+	-	IV
Geranium robertianum	+	-	+	+	+	-	-	-	+	+	+	+	IV
Dryopteris filix-mas	-	+	+	+	+	+	-	-	+	-	-	+	IV
Ajuga reptans	+	-	+	+	+	-	-	-	+	+	+	+	IV
Brachypodium sylvaticum	-	-	+	+	+	-	-	-	+	+	+	+	IV
Polygonatum latifolium	+	+	-	-	-	+	+	+	+	-	-	-	III
Mycelis muralis	-	-	-	+	+	-	-	-	+	+	+	+	III
Lapsana communis	-	-	-	+	+	+	-	-	+	+	-	-	III
Fragaria vesca	-	-		+	+	-	-	-	+	+	+	-	III
Cornus mas	+	-	-	-	+	+	-	-	+	+	+	-	III
Quercus robur	+	-	+	+	-	+	-	-	+	+	-	-	III

Scrophularia nodosa	-	-	-	+	+	-	-	-	+	+	-	-	II
Acer platanoides	+	-	-	-	+	+	-	-	+	-	-	-	II
Convallaria majalis	-	+	-	-	-	-	-	-	-	-	-	-	I
Cruciata glabra	-	-	+	-	-	-	-	-	+	+	-	-	I
Ranunculus ficaria ssp.*bulbifer*	-	-	-	-	-	+	3	2	-	-	-	-	I
Paris quadrifolia	-	-	-	-	-	+	+	+	-	-	-	-	I
Rhamno - Prunetea													
Cornus sanguinea	-	+	-	+	+	+	-	-	+	+	+	+	IV
Crataegus monogyna	-	+	-	+	+	+	-	-	+	1	-	-	III
Rubus silvaticus	-	-	1	+	-	-	-	-	-	-	-	-	I
Pyrus pyraster	+	-	-	+	-	-	-	-	-	-	-	-	I
Ribes uva-crispa	-	+	-	-	-	-	-	-	-	-	-	-	I
Variae syntaxa													
Urtica dioica	+	+	1	+	+	+	+	+	2	2	+	1	V
Alliaria petiolata	+	+	+	+	-	+	+	+	+	-	-	-	IV
Galeopsis speciosa	+	-	+	-	+	-	-	-	+	+	+	+	III
Polygonatum verticillatum	-	-	-	+	-	+	+	+	-	-	-	-	II
Ajuga genevensis	-	-	-	-	-	+	+	+	-	-	-	-	I

Localization and date of surveys: Dumbrava Forest: 1, 2, 3, 4, 5 - (21-08-2005); 6, 7, 8 - (22-04-2006); 9, 10, 11, 12 - (29-07-2006).



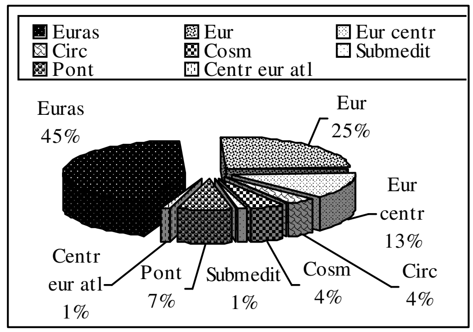


Fig. 4 – The spectrum of the bioforms **Fig. 5** – The spectrum of floristic elements of the association *As. Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu 1997

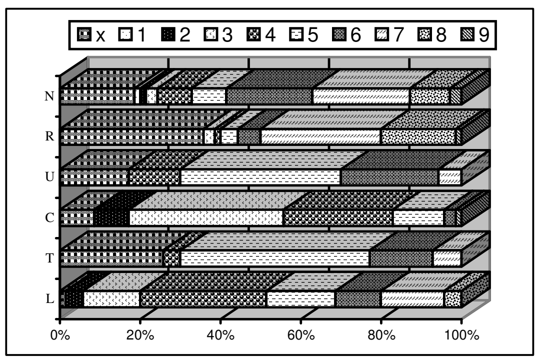


Fig. 6 – Distribution of the species in relation to the six ecological indexes (H. Ellenberg) of the association *As. Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu 1997

Conclusions

- On the occasion of vegetation research made in Vanatori Neamt Park, we identified two association *Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995 in Neamt Mountains and „Brass Wood" and *Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu et Sârbu 2001, in „Dumbrava Forest".
- Most of bioforms are represented by hemicryptophytes (H)-
- The Eurasiatic elements are majoritary among floristic elements.
- The analysis of the distribution of species according to the six ecological indexes Ellenberg – L, T, K, F, R, N) we can draw the following conclusions: In As. *Cytiso – Quercetum petraeae* Paucă 1941 *quercetosum dalechampii* Chifu et al. 1995 the best represented are the ombrophile and semiombrophile species, thermophyles who propagate in entire Central Europe, mezoxerophile and most of the species prefer soil pour of mineral nitrogen and the same percent are amfitolerantes. In *ass. Corylo avellanae – Carpinetum quercetosum pedunculiflorae* Chifu 1997, the best represented are semiombrophile species, the greatest proportion belongs to the thermophyles

species who propagates in entire Central Europe, mezoxerophile, neutrophile and nitrophiles.

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CONTRIBUTIONS TO THE VEGETATION STUDY FROM THE VASLUI RIVER BASIN (I)

IRIMIA IRINA[*]

Summary: This paper presents two associations from the *Rhamno - Prunetea* Rivas Goday et Borja Carbonell 1961 class and the *Salicetea purpureae* Moor 1958 class.

Key words: phytocoenology, bioforms, floristic elements, ecological indices.

Introduction

The Vaslui River Basin is located in the central area of the Moldavian Plateau, between Iaşi in the North and Vaslui in the South. The territory being characterized by a hilly relief of a plateau, interrupted by several valleys. It is characterised by a temperate continental climate, with dry and cold winters and hot or even very hot and dry summers. The prevailing soils here are chernozems, on the plateaus and slopes, and alluvial soils, along the meadows and narrow valleys.

Material and methods

For the identification of plant associations, we used phytosociological research methods according to the Central–European school. The establishment of the bioforms and floristic elements was made on the basis of *Flora ilustrată a României – Pteridophyta et Spermatophyta*, by V. Ciocârlan (2000) [2]. The ecological indices were noted having in mind the works of H. Ellenberg [4].

After analysing some recent papers on phytosociological nomenclature and classification [1, 5, 8], the associations presented in this work have been included in the following phytocoeno-system:

RHAMNO – PRUNETEA Rivas Goday et Borja Carbonell 1961
PRUNETALIA SPINOSAE R. Tx. 1952
PRUNION SPINOSAE Soó 1951
Pruno spinosae – Crataegetum Hueck 1931
SALICETEA PURPUREAE Moor 1958
SALICETALIA PURPUREAE Moor 1958
SALICION ALBAE Soó 1930
Salicetum albae Issler 1926

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Results and discutions

Ass. ***Pruno spinosae – Crataegetum*** Hueck 1931
(Syn.: *Pruno spinosae – Crataegetum* Soó 1931)

Chorology: Chirceşti (Mititelu D., 1975), Emil Racoviţă, Dăneşti, Poieni, Pripoare hill, Dobrovăţ

Ecology: The *Prunus spinosa* and *Crataegus monogyna* bushes are encountered at the edge of woods and glades, on cleared sites or sunny coasts.

The phytocoenological characterisation: Besides these two edifying species we also encounter: *Rosa canina*, *Rubus caesius*, but also a large number of herbaceous species in the classes *Festuco-Brometea* conferring the association a xerophile character, alternating with the mesophile character, *Molinio-Arrhenatheretea*. The species characteristic to the classes *Artemisietea vulgaris* and *Stellarietea mediae* show the effect of the anthropozoogenous actions (**Tab. 1**).

After the analysis of the surveys we noticed the following: the **bioforms spectrum** shows us the dominance of hemicryptophytes (73.22%), followed by terophytes (7.14%) and hemiterophytes (10.71%) which underlines the presence of the anthropic factor in the area. The presence of the phanerophytes amounts to a percentage of 8.93%. The **phytogeographical spectrum** indicates the dominance of the Eurasian elements (64.27%), followed by European (19.64%) and Pontic (8.94%), reflecting thus the temperate character of the area and also the presence of the species from the Southern area. Besides circumpolar elements (3.57%), cosmopolite (1.79%) and adventive (1.79%) participate. The **spectrum of ecological indices** indicate the presence of heliophilous species (45.65%), amphitolerant to temperature (39.14%) with spreading area in Central Europe (39.13%) which develop on dry up to moderate-humid soils (39.13%), amphitolerant with regard to soil reaction (50%) and the amount of mineral nitrogen in the soil (19.56%).

Observations: The association has been recorded in this area within a study, but without presenting a table of floristic surveys.

Table 1. Ass. *Pruno spinosae – Crataegetum* Hueck 1931

Number of survey	1	2	3	4	5	6	
Altitude (m.s.m.)	320	328	245	310	245	270	
Exposition	-	NV	-	E	-	S	
Slope (º)	-	2	-	8-9	-	20	
Coverage of the shrub layer (%)	90	70	65	50	85	60	
Coverage of the herbaceous layer (%)	20	6	5	10	15	5	
Surface of survey (m²)	50	25	25	25	50	50	
Number of species	30	14	13	14	24	38	K
Association's characteristics							
Prunus spinosa	+	4	3	1	4	2	V
Prunion spinosae et Prunetalia							
Crataegus monogyna	5	1	2	3	2	3	V
Rubus caesius	-	+	-	-	-	-	I
Origanum vulgare	-	-	-	-	+	-	I
Rhamno-Prunetea							
Evonymus europaeus	+	-	+	+	-	+	IV

Rosa canina	-	+	+	-	1	+	IV
Clematis vitalba	+	-	-	+	+	-	III
Cornus sanguinea	-	+	+	-	-	+	III
Acer campestre	-	-	-	-	-	+	I
Querco-Fagetea							
Salvia glutinosa	-	-	-	-	+	-	I
Campanula rapunculoides	-	-	-	-	-	+	I
Carpinus betulus	-	-	-	-	-	+	I
Geum urbanum	-	-	-	-	-	+	I
Dryopteris filix-mas	-	-	-	-	-	+	I
Festuco-Brometea							
Achillea setacea	+	-	-	+	-	+	III
Fragaria viridis	+	-	-	-	+	+	III
Koeleria macrantha	+	-	-	-	+	-	II
Euphorbia glareosa ssp. glareosa	+	-	-	-	+	-	II
Eryngium campestre	+	-	-	+	-	-	II
Dichanthium ischaemum	+	-	-	-	+	-	II
Galium verum	+	-	-	-	-	+	II
Galium humifusum	+	-	-	-	-	-	I
Potentilla argentea	+	-	-	-	-	-	I
Echium vulgare	+	-	-	-	-	-	I
Salvia nemorosa	+	-	-	-	-	-	I
Inula germanica	-	-	+	-	-	-	I
Polygala major	-	-	+	-	-	-	I
Dianthus membranaceus	-	-	-	+	-	-	I
Hieracium bauhinii	-	-	-	-	-	+	I
Stachys germanica	-	-	-	-	-	+	I
Cerinthe minor	-	-	-	-	-	+	I
Medicago falcata	-	-	-	-	-	+	I
Potentilla recta	-	-	-	-	-	+	I
Plantago media	-	-	-	-	-	+	I
Molinio-Arrhenatheretea							
Trifolium repens	+	-	-	+	+	+	IV
Plantago lanceolata	+	+	-	-	+	+	IV
Cichorium intybus	+	-	+	+	-	-	III
Lotus corniculatus	1	-	-	+	-	+	III
Trifolium pratense	+	-	-	-	+	+	III
Centaurea jacea	+	+	-	-	+	-	III
Lolium perenne	+	+	-	-	+	-	III
Veronica chamaedrys	-	+	-	-	+	+	III
Achillea millefolium	-	+	+	-	+	-	III
Taraxacum officinale	+	-	-	+	-	-	II
Leucanthemum vulgare	-	+	-	-	+	-	II
Dactylis glomerata	-	-	+	-	-	+	II
Ranunculus acris	-	-	-	+	-	+	II
Medicago lupulina	+	-	-	-	-	-	I
Leontodon autumnalis	+	-	-	-	-	-	I
Stachys officinalis	-	-	+	-	-	-	I

Daucus carota	-	-	-	+	-	-	I
Rumex crispus	-	-	-	-	-	+	I
Ajuga reptans	-	-	-	-	-	+	I
Poa pratensis	-	-	-	-	-	+	I
Equisetum arvense	-	-	-	-	-	+	I
Artemisietea vulgaris							
Verbascum phlomoides	+	+	-	+	-	-	III
Echinops sphaerocephalus	+	-	-	-	-	-	I
Carduus nutans	+	-	-	-	-	-	I
Artemisia absinthium	+	-	-	-	-	-	I
Linaria vulgaris	-	+	-	-	-	-	I
Sambucus ebulus	-	-	-	+	-	-	I
Erigeron acris ssp. acris	-	-	-	-	+	-	I
Carduus acanthoides	-	-	-	-	+	-	I
Ballota nigra ssp. nigra	-	-	-	-	+	-	I
Berteroa incana	-	-	-	-	-	+	I
Elymus repens	-	-	-	-	-	+	I
Stellarietea mediae							
Erigeron annuus	-	+	-	-	-	+	II
Artemisia annua	-	-	-	+	-	+	II
Lathyrus tuberosus	-	-	+	-	-	-	I
Conyza canadensis	-	-	+	-	-	-	I
Torilis arvensis	-	-	-	-	-	+	I
Variae syntaxa							
Agrimonia eupatoria	+	-	-	-	+	+	III
Galium album	+	-	-	-	+	-	II
Hypericum perforatum	-	-	+	-	+	-	II
Torilis japonica	-	+	-	-	-	-	I
Tanacetum corymbosum	-	-	+	-	-	-	I
Silene vulgaris	-	-	-	-	+	-	I
Dianthus armeria	-	-	-	-	-	+	I
Galium mollugo	-	-	-	-	-	+	I

Place and date of the surveys: 1. Emil Racoviţă, 6.08.2003; 2. Dăneşti, 5.08.2002; 3, 5. Poieni, 27.07.2003, 06.2001; 4. Pripoare hill, 06.2001; 6. Dobrovăţ, 1.07.2004

Ass. ***Salicetum albae*** Issler 1926
(Syn.: *Salicetum albae-fragilis* R. Tx. 1937)

Chorology: Bârnova (Mititelu D. and collab., 1995), Dobrovăţ, Pocreaca, Dăneşti, Codăeşti

Ecology: The association was encountered in few places in the Vaslui River Basin and it occupies the major river bed and the brooks and riversides. It also shows in the form of narrow band accompanying the water courses and it rarely form dense riverside coppices.

The phytocoenological characterisation: The arborescent layer ensures a reduced covering and it is dominated by *Salix alba*, besides which *Salix fragilis* and *Populus alba* develop (**Tab. 2**). The bushes layer is poorly represented, we remind here *Rubus caesius*. With regard to the herbaceous layer, this is made of various hygrophilous species which withstand the floods or water stagnation for a long period of time, among which we mention: *Urtica dioica, Phragmites australis, Glechoma hederacea, Bidens tripartita*, *Lythrum salicaria, Lycopus europaeus* etc.

After the analysis of the surveys we noticed the following: from the **bioforms spectrum**, the hemicryptophytes (51.72%) dominate, followed by geophytes (13.78%), phanerophytes (17.25%), terophytes (10.35 %), hemiterophytes (3.45%) and hydrophytes (3.45%); from the **phytogeographical spectrum**, we observe dominance of the Eurasian elements (51.72%), followed by the cosmopolite (20.68%) and circumpolar (13.80%). Besides, the European elements (6.90%) also participate, the Central European (3.45%) and the adeventive (3.45%). The **spectrum of ecological indices** shows us the presence of the species developing in full light (50%), mesothermal (42.86%), with spreading area in Central Europe (35.71%), growing on damp-moist up to wet soils (8-25%, 10-17.85%), amphitolerant to the soil reaction (46.42%) with high content of mineral nitrogen (7-25%, 8-28.57%).

Observations: The association has been recorded in this area within a study, but without presenting a table of floristic surveys.

Table 2. Ass. *Salicetum albae* Issler 1926

Number of survey	1	2	3	4	5	
Altitude (m.s.m.)	270	270	150	240	85	
Coverage of the arborescent layer (%)	75	90	80	60	70	
Coverage of the herbaceous layer (%)	2	7	10	8	7	
Surface of survey (m²)	25	25	20	20	20	
Number of species	8	12	7	9	6	K
Association's characteristics						
Salix alba	4	5	5	4	4	V
Salicion, Salicetalia et Salicetea purpureae						
Salix fragilis	1	-	-	+	1	III
Populus alba	+	-	-	+	-	II
Calamagrostis epigejos	-	+	-	-	-	I
Phragmiti-Magnocaricetea						
Phragmites australis	+	1	+	+	+	V
Typha latifolia	+	-	+	+	+	IV
Lycopus europaeus	+	+	-	-	-	II

Glyceria maxima	-	+	-	-	-	I
Eleocharis palustris	-	+	-	-	-	I
Alisma plantago-aquatica	-	-	+	-	-	I
Polygonum hydropiper	-	-	-	+	-	I
Mentha aquatica	-	-	-	+	-	I
Molinio-Arrhenatheretea						
Lythrum salicaria	+	-	-	-	+	II
Mentha pulegium	-	-	+	-	-	I
Inula britannica	-	+	-	-	-	I
Mentha longifolia	-	+	-	-	-	I
Verbena officinalis	-	+	-	-	-	I
Vicia cracca	-	-	-	-	+	I
Variae syntaxa						
Echynocystis lobata	-	-	1	1	-	II
Clematis vitalba	-	-	1	+	-	II
Eupatorium cannabinum	+	-	-	-	-	I
Lamium maculatum	-	+	-	-	-	I
Bidens tripartita	-	+	-	-	-	I
Lemna minor	-	+	-	-	-	I

Place and date of the surveys: 1, 2. Dobrovăţ, 23.08.2003; 3. Pocreaca, 23.08.2003; 4. Dăneşti, 5.08.2002; 5. Codăeşti, 24.08.2003

Conclusions

- The spectrum of bioforms, of floristic elements and of ecological indices shows us that our results are according with specialty literature.
- These associations were noticed in the area undergoing study, but without presenting a table with of floristic surveys.

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VEGETAL ASSOCIATIONS EDIFIED BY *PINUS SYLVESTRIS* L. IN NEAGRA BROŞTENILOR HYDROGRAPHIC BASIN

MARDARI CONSTANTIN [*]

Abstract: The diversity of the natural habitats specific to Neagra Broşteni hydrographical basin have favoured installation of two different types of pine phytocoenoses. Although both of these plants communities are characteristic to acid substrata, one is specific to oligotrophic peat - bogs (*Oxycocco – Sphagnetea*) and the other to mountain versants presenting acidophilous soils and accentuated slopes (*Vaccinio – Piceetea*). These vegetal associations are presented in phytosociological tables and analysed in this paper from the bioforms, floristic elements and ecological requests perspectives.

Key words: vegetal associations, Pinus sylvestris, Neagra Broştenilor.

Introduction

Plant communities edified by Pinus sylvestris are recognized for their high conservative value, their floristic composition including a lot of relict species. Due to the fact that speciality literature [5], [7], [11] presented few information about the natural distribution of this species in our research territory we have realized an phytosociological study in 2007 summer that had as result the identification of two types of pine phytocoenoses in Neagra Broşteni river basin: *Vaccinio – Pinetum sylvestris* Kleist 1929 (*Erioporo vaginati – Pinetum sylvestris* Hueck 1931) in Drăgoiasa village and *Leucobryo – Pinetum sylvestris* Matuszkiewicz 1962 *betuletosum pendulae* (Burduja et Stefan 1982) Coldea 1991 in Ortoaia and Negrişoara valleys.

Material and method

The phytosociological study has been made using the classic methods specific to Central Europe Phytosociological School. The pine phytocoenoses have been characterized through phytocoenological relevées used as sampling method in field. Each vegetal species has been quantified using Braun – Blanquet scale (presenting the abundance – dominance indices from + to 5). Phytosociological relevées have been ordered and grouped in vegetal associations on the basis of characteristic, differential and dominant species [1], [4], [9], [10]. The biological forms and floristic elements for each species are those that have been given by V. Ciocarlan [2] and the values for ecological indices (L–light, T–temperature, U–humidity, R–soil pH) have been established by H. Ellenberg [6].

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Results and discussion

According to speciality literature [1], [3], [4], [7], [8] these two plant communities are subordinated to the next superior coenotaxa:

OXYCOCCO – SPHAGNETEA Br.-Bl. et R. Tx. ex Westhoff et al. 1946

SPHAGNETALIA MEDII Kästner et Flössner 1933

Sphagnion medii Kästner et Flössner 1933

Vaccinio – Pinetum sylvestris Kleist 1929 (*Erioporo vaginati – Pinetum sylvestris* Hueck 1931)

VACCINIO – PICEETEA Br.-Bl. in Br.-Bl. et al. 1939

PICEETALIA EXCELSAE Pawlowski in Pawlowski et al. 1928

Dicrano – Pinion (Libbert 1932) Matuszkiewicz 1962

Leucobryo – Pinetum sylvestris Matuszkiewicz 1962 *betuletosum pendulae* (Burduja et Stefan 1982) Coldea 1991

1. Ass. *Vaccinio – Pinetum sylvestris* Kleist 1929 (*Erioporo vaginati – Pinetum sylvestris* Hueck 1931) association (**Table 1**) has been identified only in Dragoiasa village on a limited area (approximate 1,5 ha). It includes pine phytocoenoses vegetating in oligotrophic peat bogs at 1060 m altitude, presenting *Pinus sylvestris* as arboreal edifying species and *Eriophorum vaginatum* as herbaceous characteristic species. The trees stratum is dominated by *Pinus sylvestris* that is accompanied by *Picea abies*, *Sorbus aucuparia*, *Betula alba* ssp. *glutinosa* or *Betula pendula*, species realizing an average covering degree between 50% and 70%. The shrubs stratum covering varies from 10 to 40%, significant abundance – dominance indices presenting *Vaccinium myrtillus* and *Vaccinium vitis-idaea* species while in the herbs stratum *Eriophorum vaginatum* dominates (up to 60%). Besides the characteristic species to the association, to *Sphagnion* and *Sphagnetalia* alliance and order (*Drosera rotundifolia*) and *Oxycocco-Sphagnetea* vegetation class (*Andromeda polifolia*, *Oxycoccus palustris*), in the studied area are also present species from Vaccinio-Piceetea (*Sorbus aucuparia*, *Vaccinium myrtillus*, *Picea abies*). The floristic elements spectrum (**Fig. 2**) presents the preponderance of the circumpolar (44%) and Eurasiatic (31%) elements followed by the central European (13%), cosmopolite (6%) and endemic (6%) elements. The bio-forms spectrum (**Fig. 1**) reveals the prevalence of the hemicryptophytes species (44%) followed by the phanerophytes species (31%) and chamaephytes species (25%). Ecological indices spectrum (**Fig. 3**) points out the fact that in this vegetal association structure prevails the indifferent species to humidity (44%), temperature (69%) and soil reaction (56%) followed by the species preferring wet (25%) and very acid (19%) soils and characteristic to cold mountains areas (19%).

Table 1

Floristic element	Bioform	No. of relevé	1	2	3	4	5	K
		Plot area (m^2)	400	400	400	400	400	
		Altitude (m)	1060	1060	1060	1060	1060	
		Aspect	-	-	-	-	-	
		Slope (°)	-	-	-	-	-	
		Tree stratum covering (%)	60	65	50	60	70	
		Shrubs and regeneration stratum covering (%)	30	35	40	30	10	
		Herbs stratum covering (%)	25	30	60	25	10	
Car. ass.								

Euras.	Ph.	Pinus sylvestris	3	4	3	3	4	V
Euras.	Ph.	Pinus sylvestris juv.	+	+	1	-	-	III
Circ.	H.	Eriophorum vaginatum	2	3	4	2	1	V
Sphagnion et Sphagnetalia medii								
Circ.	H.	Drosera rotundifolia	+	-	-	-	-	I
Oxycocco – Sphagnetea								
Circ.	Ch.	Andromeda polifolia	+	+	-	+	-	III
Circ.	Ch.	Oxycoccus palustris	1	+	+	+	+	V
Vaccinio – Piceetea								
Eur. centr.	Ph.	Picea abies	1	+	+	1	-	IV
Eur. centr.	Ph.	Picea abies juv.	+	-	+	+	-	III
Circ.	Ch.	Vaccinium myrtillus	2	3	3	2	1	V
Circ.	Ch.	Vaccinium vitis-idaea	+	+	1	+	1	V
Eur. centr.	Ph.	Sorbus aucuparia	-	-	-	-	+	I
Aliae								
Euras.	H.	Potentilla erecta	+	-	+	+	-	III
End. carp.	Ph.	Betula alba ssp. glutinosa	+	+	-	+	-	III
End. carp.	Ph.	Betula alba ssp. glutinosa juv.	-	+	-	-	-	I
Euras.	Ph.	Betula pendula	-	-	+	-	-	I
Cosm.	H.	Deschampsia caespitosa	-	-	-	+	-	I
Euras.	H.	Molinia caerulea	-	-	-	+	-	I
Circ.	H.	Stellaria longifolia	-	-	-	+	-	I
Euras.	H.	Succisa pratensis	-	-	-	-	+	I

Place and date of relevées: rel. 1-5: Drăgoiasa (29. 07.2007)

2. Ass. *Leucobryo – Pinetum sylvestris Matuszkiewicz* 1962 *betuletosum pendulae* (Burduja et Stefan 1982) Coldea 1991 sub-association (**Table 2**) includes pine phytocoenoses, sporadically spread in the researched area, covering mountains versants presenting generally northern aspects and accentuate slopes (up to 50°), between 850 and 1020 m altitude, on siliceous rocks. The trees stratum is dominated by *Pinus sylvestris*, species that realize an average covering degree of 50-65% and *Betula pendula*, species characterized by an average covering degree up to 20%. In some phytocoenosis, *Picea abies* (spruce fir) is present (without becoming co-dominant or sub-dominant) and also *Fagus sylvatica, Sorbus aucuparia, Acer pseudoplatanus* can be present. Shrubs stratum flora is rich in plants species, significant abundance – dominance indices presenting *Vaccinium myrtillus, Vaccinium vitis - idaea* etc, while in the herbs stratum *Oxalis acetosella, Hieracium transsilvanicum, Campanula abietina, Orthilia secunda* and other species are present. Besides the characteristic species to the association, to *Dicrano – Pinion* alliance (*Chamaecytisus hirsutus, Veronica officinalis* etc.), *Piceetalia* order (*Luzula luzuloides, Calamagrostis arundinacea*) and *Vaccinio – Piceetea* vegetation class (*Oxalis acetosella, Campanula abietina, Sorbus aucuparia* etc.), in the studied areas are also present representative species to *Asplenietea trichomanis* (*Sedum maximum, Polypodium vulgare, Silene nutans* ssp. *dubia*, *Valeriana tripteris*) and *Querco – Fagetea* classes (*Spiraea chamaedryfolia, Fagus sylvatica*, *Maianthemum bifolium, Euphorbia amygdaloides, Veronica urticifolia, Lonicera xylosteum* etc.). The bio-forms spectrum (**Fig. 4**) is dominated by hemicryptophyte species (49%) followed by phanerohyte (31%), chamaephyte (14%) and geophyte (6%) species. Floristic elements spectrum (**Fig. 5**) presents the preponderance of the eurasiatic (33%), central European (29%) and circumpolar (26%) species. Reduced proportions presents the European (3%), Carpathian – Balkan (3%) and endemic elements (6%). Ecological indices spectrum (**Fig. 6**) reveals that in this vegetal association composition prevails the species preferring moderate moist (42%), and acid or moderate acid soils (22%). Most of the component species are eurythermic (62%).

Fig. 1. Bioforms spectrum ass. Vaccinio – Pinetum sylvestris

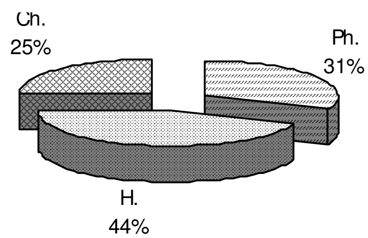


Fig. 2. Floristic elements spectrum ass. Vaccinio – Pinetum sylvestris

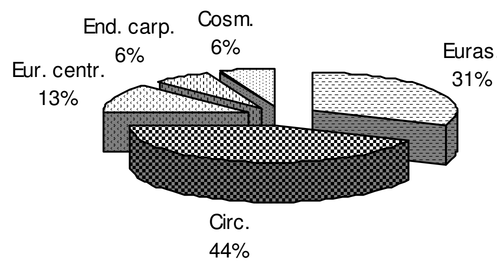


Fig. 3. Ecological indices spectrum – ass. Vaccinio – Pinetum sylvestris

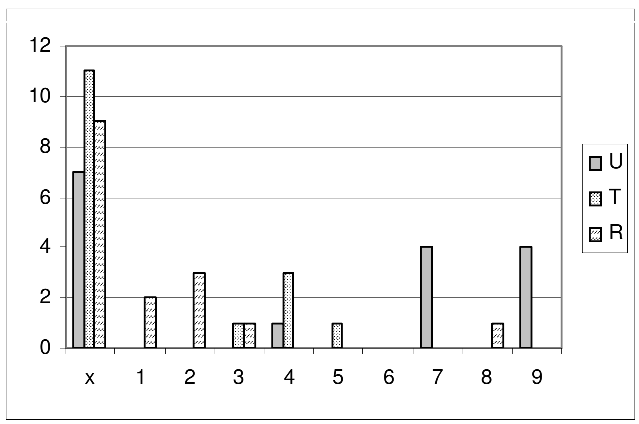


Table 2

Floristic element	Bioform	No. of relevé	1	2	3	4	5	K
		Plot area (m^2)	1000	1000	1000	1000	1000	
		Altitude (m)	850	900	800	950	1020	
		Aspect	NV	N	N	NE	SE	
		Slope (º)	40	35	45	25	40	
		Tree stratum covering (%)	60	65	55	60	65	K
		Shrubs and regeneration stratum covering (%)	45	30	50	20	15	
		Herbs stratum covering (%)	10	15	15	10	20	
		Car. ass.						
Euras.	Ph.	Pinus sylvestris	3	4	3	3	4	V
		Dif. subass.						
Euras.	Ph.	Betula pendula	1	+	+	1	1	V
Euras.	Ph.	Betula pendula juv.	+	+	-	-	+	III
Dicrano – Pinion								
Eur. centr.	Ph.	Chamaecytisus hirsutus	1	+	+	-	+	IV
Euras.	Ch.	Veronica officinalis	+	+	+	+	-	IV
Euras.	H.	Pyrola media	-	+	-	-	-	I

Piceetalia excelsae								
Eur. centr.	H.	Luzula luzuloides	+	+	-	+	-	III
Euras.	H.	Calamagrostis arundinacea	+	+	+	-	+	IV
Vaccinio – Piceetea								
Circ.	Ch.	Vaccinium myrtillus	3	2	3	1	1	V
Circ.	Ch.	Vaccinium vitis-idaea	+	+	+	+	1	V
Eur. centr.	Ph.	Sorbus aucuparia	+	+	-	+	+	IV
Eur. centr.	Ph.	Picea abies	+	-	+	+	-	III
Circ.	H.	Oxalis acetosella	+	+	+	+	1	V
Eur. centr.	H.	Abies alba	-	+	+	-	-	II
Circ.	Ch.	Orthilia secunda	-	+	-	+	-	II
Carp.-balc.	H.	Campanula abietina	-	+	-	-	+	II
Asplenietea trichomanis								
Eur.	H.	Sedum maximum	+	+	-	+	+	IV
Circ.	G.	Polypodium vulgare	+	-	+	+	-	III
End. carp.	H.	Silene nutans ssp. dubia	+	-	+	-	-	II
Eur. centr.	H.	Valeriana tripteris	-	+	+	-	+	III
Querco – Fagetea								
Euras.	Ph.	Spiraea chamaedryfolia	+	+	-	-	+	III
Eur. centr.	Ph.	Fagus sylvatica	+	+	+	-	-	III
Euras.	G.	Maianthemum bifolium	+	+	-	-	+	III
Circ.	H.	Poa nemoralis	-	+	+	+	+	IV
Eur. centr.	H.	Veronica urticifolia	-	-	+	+	+	III
Eur. centr.	Ch.	Euphorbia amygdaloides	-	-	+	+	-	II
Euras.	Ph.	Lonicera xylosteum	-	-	-	-	+	I
Aliae								
End. carp.	H.	Dianthus tenuifolius	+	-	+	+	-	III
Circ.	H.	Solidago virgaurea	+	-	+	-	-	II
Euras.	H.	Salvia glutinosa	+	+	+	-	+	IV
Eur. centr.	H.	Gentiana asclepiadea	-	+	+	-	+	III
Euras.	H.	Fragaria vesca	-	+	-	-	+	II
Circ.	Ph.	Rubus idaeus	-	-	+	-	+	II
Euras.	H.	Origanum vulgare	-	-	-	+	-	I
Circ.	Ph.	Sambucus racemosa	-	-	+	-	+	II
Euras.	H.	Senecio ovatus	-	-	-	-	+	I
Eur. centr.	H.	Cirsium erisithales	-	-	-	-	+	I

Place and date of relevées: rel. 1,2: Neagra Brosteni (3.07.2007); rel. 3,4: Capraria rivulet (4.07.2007); rel. 5: Negrisoara rivulet (4.07.2007)

Fig. 4. Bioforms spectrum subass. Leucobryo – Pinetum sylvestris betuletosum pendulae

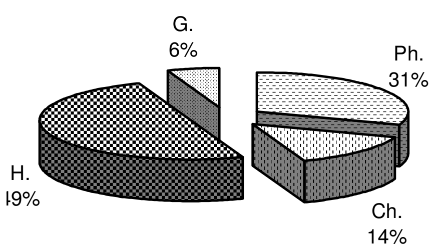


Fig. 5. Floristic elements spectrum subass. Leucobryo – Pinetum sylvestris betuletosum pendulae

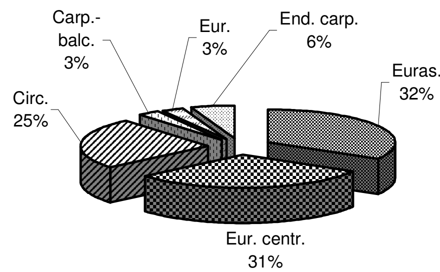
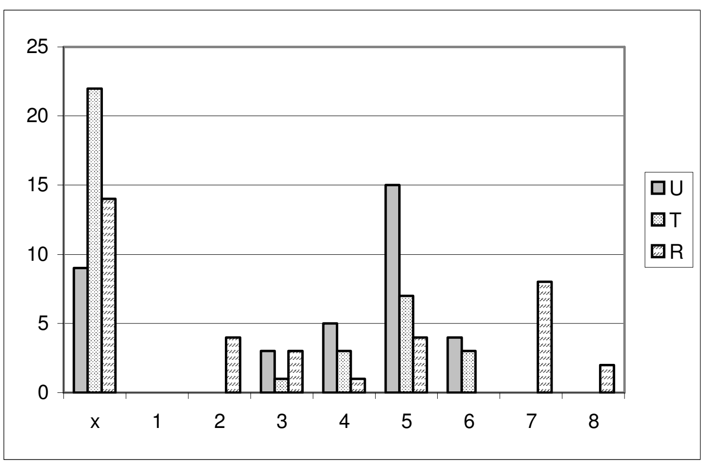


Fig. 6. Ecological indices spectrum – subass. Leucobryo – Pinetum sylvestris betuletosum pendulae



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ASSOCIATIONS OF THE JUNCETEA TRIFIDI KLIKA ET HADAČ 1944 CLASS FROM LEAOTA MASSIF

NEBLEA MONICA [*]

Abstract: The Leaota Mountains are well individualized, with special pastoral activities. Ecopedological conditions and the vegetation arrangement in tiers of the massif permitted the systematization of the types of meadows, on belts of vegetation: the superior mountain belt, subalpine and alpine one. After the phytocoenological investigations that have been done in this region of the Meridional Carpathians we discovered three vegetal associations from *Juncetea trifidi* class: *Potentillo chrysocraspedae – Festucetum airoidis* Boşcaiu 1971, *Oreochloo – Juncetum trifidi* Szafer et al. 1927 and *Cetrario – Loiseleurietum procumbentis* Br. - Bl. et al. 1939.

Key words: plant associations, Leaota Massif, Romania.

Introduction

The Leaota Massif is situated in the North-Western of the Bucegi, being delimitated by the Brătei Valley. The uniform crystalline geological constitution of the massif gives it, a distinct morphological aspect, compared to the massives nearly. Leaota Mountains represents an uniform zone made by cloritical schists with porfiroblastes of albit, amphibolical schists and albiticals with clorit, from the geological point of view.

In the alpine belt the dominant meadows are affiliated in the association *Potentillo chrysocraspedae–Festucetum airoidis*, that vegetates on oligotrophical soils, characterized by a very high acidity and strongly desaturated in the bases. The meadows belonging to the association *Oreochloo–Juncetum trifidi* have reduced surfaces on the montaneous peaks of the Leaota, where they populate the peaks exposed all the time to winds. On the high plateaus of Leaota Mountains are instalated groups, with aspect of short bushes belonging to the association *Cetrario–Loiseleurietum procumbentis.*

Materials and methods

The research method follows the Central-European School of Zürich-Montpellier methodology, elaborated by J. Braun-Blanquet and adapted by Al. Borza [5] to the particularities of the vegetation in our country. The plant association has been the basical syntaxonomical unity adopted. The name of the plant associations has been adopted according to the syntaxonomical foresighs established in the Code of Phytosociological Nomenclature [2]. We realized a synthetic phytocoenological table for all studied associations.

For the classification of the plant associations have been used works of synthesis of some authors and collectives of authors [7, 8, 10, 11].

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Results and discussions

The research done on the terrain put into light three plant associations of *Juncetea trifidi* class, grouping in two alliances, one order and one class. The relevés done are 17, being grouped in one synthetic phytocoenological table.

The coenoses of *Potentillo chrysocraspedae – Festucetum airoidis* Boşcaiu 1971 cover great surfaces of the alpine belt of Leaota Mountain and vegetate on the peaks and little inclined slopes.

The Dacian-Balkanic species, *Potentilla aurea* ssp. *chrysocraspeda* presents in the structure of this phytocoenoses a maximal presence, having a coverage between 5 and 20%. Beside the species that edificate this grouping, in the floriferous composition one can notice, the presence of the specifical taxons of *Potentillo-Nardion* alliance (*Geum montanum, Ligusticum mutellina, Campanula serrata, Viola declinata, Phleum alpinum*). The presence of this species put into the light, the direction of evolution of these coenoses to nardets, by intensive pastoral activities.

Meadows with *Festuca airoides* have a secondary origin, from the furrow-slice lands on which grubbed up *Pinus mugo, Rhododendron myrtifolium* and *Vaccinium myrtillus*. During the stage of furrow-slice are installed *Deschampsia flexuosa, Agrostis rupestris*, and later, *Festuca airoides*. A great number of species to the *Juncetea trifidi* class present a representative coverage: *Agrostis rupestris, Juncus trifidus, Carex curvula.* (**Tab. 1**) In the alpine belt, the herbaceous vegetation of this association evoluates to the *Rhododendro-Vaccinietum*, and further to bushes of *Pinus mugo*.

The meadows of *Juncus trifidus* (*Oreochloo – Juncetum trifidi* Szafer et al. 1927) occupy reduced surfaces in the South-West of the Leaota Massif, where vegetates on the slopes with podzolic, humico-silicate soils and high acid reaction. In the phytocoenoses identified (Tâncava Mt., Vaca, Leaota Peak), *Juncus trifidus* dominates the western expositions, while *Oreochloa disticha* is sporadically met. The intensive pastoral activities in this region caused the extension of these coenoses, as proof being the presence of some species as: *Homogyne alpina, Vaccinium myrtillus, Vaccinium vitis-idaea, Rhododendron myrtifolium,* that have a high constancy in the floriferous composition. The representative species are accompanied by the specifical taxons to the *Caricion curvulae* alliance, *Caricetalia curvulae* order (*Agrostis rupestris, Armeria alpina, Festuca airoides*) and *Potentillo-Nardion* alliance. (**Tab. 1**)

In the alpine belt of the Leaota Mountains, in shaded sites exposed to cold winds, on large surfaces the coenoses of *Loiseleuria procumbens* are developed.

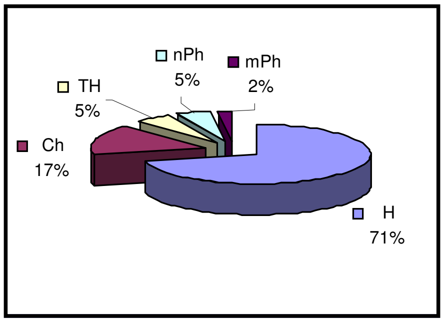
The association is remarkable by the domination of *Loiseleuria procumbens*, accompanied by a lot of ericaceous such as: *Rhododendron myrtifolium, Vaccinium myrtillus, Vaccinium vitis-idaea.* The species of the alliance *Loiseleurio–Vaccinion* (*Thamnolia vermicularis, Vaccinium gaultherioides*) have a high frequency in these coenoses. *Loiseleuria procumbens* vegetates on the plateaus where are denuded meadows with *Festuca airoides*. Also, following the destruction of bushes with *Rhododendron myrtifolium*, because of frost or intensive grazing is installed also, *Loiseleuria procumbens*.

This grouping has a pioneer character in reconstruction of vegetal layer which had been removed by the wind erosion. The fodder value of this grouping is unsignificant, but the alpine azalea is a good species, for fixation of the depreciated lands, especially through intensive grazing and wind erosion. So, the groups edificated by *Loiseleuria procumbens* must be protected against the anthropozoogenic factor.

Table 1

			Plant associations	**1**	**2**	**3**
			Number of relevés	**7**	**5**	**5**
			Altitude (mx10)	**160-180**	**180-213**	**213**
			Char.ass.			
H	Carp-Balc	-	*Potentilla aurea* ssp. *chrysocraspeda*	V	V	V
H	Eua (Arct.Alp)	P	*Festuca airoides*	V	V	IV
H	Alp-Carp	D	*Oreochloa disticha*	-	II	-
H	Cp(Arct.Alp)	D	*Juncus trifidus*	III	V	IV
Ch	Cp(Arct.Alp)	D	*Loiseleuria procumbens*	-	III	V
-	-	-	*Cetraria islandica*	-	-	V
			Potentillo-Nardion			
H	E(Alp)	P	*Geum montanum*	III	III	-
H	Alp-Carp	D	*Ligusticum mutellina*	III	V	II
H	End(Carp)	D	*Campanula serrata*	III	III	I
H	Carp-Balc	P	*Viola declinata*	III	III	III
H	E	D	*Nardus stricta*	III	III	III
H	Cp(Arct.Alp)	P	*Phleum alpinum*	III	-	II
H	Eua	P	*Antennaria dioica*	III	III	II
TH	Carp-Balc	P	*Campanula patula* ssp. *abietina*	III	II	-
H	E(Alp)	P	*Homogyne alpina*	II	II	III
H	Alp-E	D	*Poa alpina*	-	IV	IV
			Genistion			
Ch	Cp	D	*Vaccinium vitis-idaea*	III	III	II
Ch	Cp	D	*Vaccinium myrtillus*	II	III	II
			Loiseleurio-Vaccinion			
Ch	Cp(Arct.Alp)	D	*Vaccinium gaultherioides*	-	-	V
-	-	-	*Thamnolia vermicularis*	-	-	III
			Caricetalia et Juncetea trifidi			
Ch	Ec(Alp)	P	*Primula minima*	III	-	II
H	Alp(E)	P	*Agrostis rupestris*	III	V	IV
H	Alp-Carp	D	*Campanula alpina*	II	-	-
H	Alp-Carp	P	*Armeria alpina*	II	I	II
Ch	E(Alp)	D	*Minuartia sedoides*	III	-	III
			Variae syntaxa			
H	Cp	P	*Deschampsia flexuosa*	IV	IV	IV
H	Cp(Arct.Alp)	D	*Pedicularis verticillata*	III	-	-
nPh	Carp-Balc	P	*Bruckenthalia spiculifolia*	III	-	-
H	Alp-E	D	*Centaurea nervosa*	III	II	I
H	Eua	P	*Trifolium repens*	III	-	-
H	Cp(Arct.Alp)	P	*Cerastium cerastoides*	II	-	-
mPh	Arct. Alp	D	*Juniperus communis* ssp. *alpina*	I	III	-
H	Cp(Arct.Alp)	P	*Polygonum viviparum*	I	-	-
H	Alp-Carp	D	*Pulsatilla alba*	I	-	-
nPh	Carp-Balc	-	*Rhododendron myrtifolium*	-	V	V
TH	Carp-Balc	P	*Gentianella lutescens*	-	IV	-
H	Cp(Arct.Alp)	P	*Carex atrata*	-	III	II
H	E	P	*Luzula luzuloides*	-	III	-
Ch	Carp-Balc	P	*Thymus balcanus*	-	III	-
H	Eua(Mont)	D	*Rumex arifolius*	-	II	-
H	E(Alp)	P	*Soldanella pusilla*	-	I	-
H	Cp(Arct.Alp)	P	*Hieracium alpinum*	-	I	-
H	Eua	D	*Leontodon hispidus*	-	-	I

1 - ***Potentillo chrysocraspedae – Festucetum airoidis*** Boşcaiu 1971
(Place of the relevés - Românescu Mt., Albescu Mt., Vaca Mt., Tâncava Mt.)
2 - ***Oreochloo-Juncetum trifidi*** Szafer et al. 1927
(Place of the relevés - Vaca Mt., Tâncava Mt., Leaota Peak)
3 - ***Cetrario-Loiseleurietum*** *procumbentis* Br.-Bl. et al. 1939
(Place of the relevés - Leaota Peak)



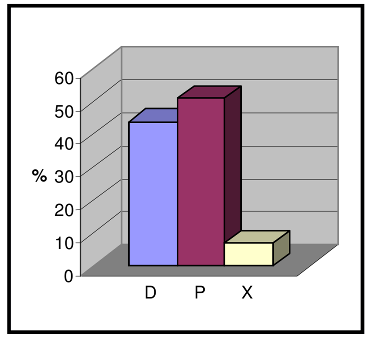


Fig. 1. Bioforms of the plant associations from *Juncetea trifidi* class

Fig. 2. Caryological index of the plant associations from *Juncetea trifidi* class

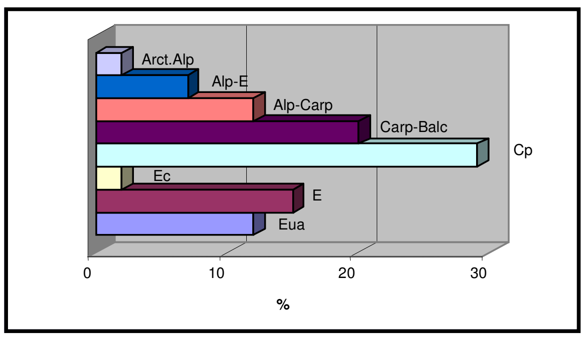


Fig. 3. Geoelements of the plant associations from *Juncetea trifidi* class

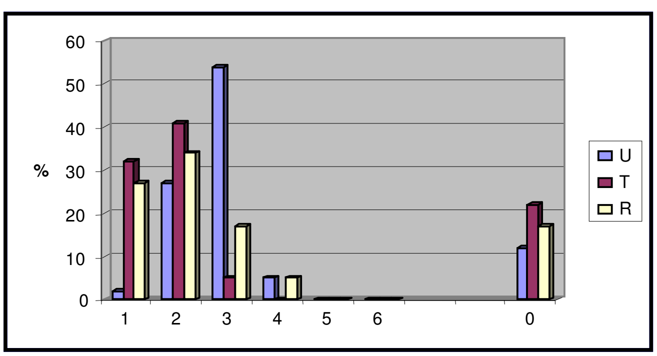


Fig. 4. Ecological index of the plant associations from *Juncetea trifidi* class

The bioforms of the plant associations from *Juncetea trifidi* class indicates besides the major hemicryptophytes (70,73%), a significant percentage of camephytes (17%); the terophytes and nanophanerophytes are presented in a considerable number (4,87%). (**Fig.1**)

The caryological study reveals a high number of polyploid species (51,21%). The diploid species represent 43,90% and the index of ratio is 0,85. (**Fig.2**)

Concerning the phytogeographical elements, the principal components of the studied phytocoenoses are Circumpolar (29,26%) and Carpathian-Balkan (20,50%) species, followed by the European (14,63%), Eurasian (12,19 %) and Alpic-European (12,19%). The Carpathian-Balkan elements are represented by taxons such as: *Rhododendron myrtifolium, Potentilla aurea* ssp. *chrysocraspeda, Viola declinata, Campanula serrata*, *Campanula patula* ssp. *abietina, Bruckenthalia spiculifolia, Thymus balcanus, Gentianella lutescens*. (**Fig. 3**)

In the researched sites the phytocoenoses are mesophilous ($U_{3\text{-}3,5}$=53,65%) and xero-mesophilous (26,82%). Depending on their needs against temperature most of the species are microthermophytes ($T_{2\text{-}2,5}$=41,46%) and cryophytes ($T_{1\text{-}1,5}$=31,70%). (**Fig. 4**)

Conclusions

- In the alpine belt the dominated meadows belong to the *Potentillo chrysocraspedae – Festucetum airoidis* association, that vegetate on soils characterized by a very high acidity and strongly desaturated in basis.
- The meadows of *Juncus trifidus* occupy reduced surfaces in Leaota Mountains, where populate the peaks permanently exposed to the winds. They vegetate on podzolic, humic-silicate soils, where the edifying species for the association are dominant (*Juncus trifidus, Oreochloa disticha*).
- On the high plateaus are installed grouping with aspect of short bushes, which beloging to the *Cetrario-Loiseleurietum procumbentis* association. The floriferous composition is dominated by *Loiseleuria procumbens*, that forms a grouping, poor in species, accompanied by: *Vaccinium gaultherioides, Vaccinium vitis-idaea, Vaccinium myrtillus, Rhododendron myrtifolium, Thamnolia vermicularis.*

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COENOTAXONOMICAL CHARACTERIZATION OF THE MEGAFORBS FROM HOROABA VALLEY (BUCEGI MOUNTAINS)

CHIRIȚOIU MAGDALENA*

Abstract: In this paper are presented two associations of megaforbs of *Adenostylo-Doronicetum austriaci* Horv. 1956 and *Cirsio waldsteinii-Heracleetum transsilvanici* Pawl. et Walas 1949, which were identified in the area of the Natural Reserve Peştera-Cocora-Valea Horoabei (Bucegi Natural Parc). There are also presented the species of plants found here and which are included in the Red List of the superior plants from Romania.

Key words: megaforbs, Horoaba Canyon.

Introduction

Geographical characterization: the Bucegi Massif is situated in the Eastern side of the Meridional Carpathians. It is bordered by Prahova Valley in the East, Cerbul Valley and Glăjăria Valley in the North, the Rucăr-Bran Passage in the West, the Sub-Carpathians and Gurguiatu Massif.

Geological Structure: **t**he geological foundation of the Massif is represented by crystalline rocks belonging to the Gaetic Layer of the Meridional Carpathians. They are prevalent in the Western side and rarely on Ialomiţa Valley or on the southern slope. Above them supplementary deposits from the Jurassic and Cretaceous alternating with limestone and marl-limestone and gritstone and conglomerate are found. During the Quaternary the glacial valleys (ex. Cerbul Valley, Mălăieşti, Gaura, Ialomiţa) and the deposits which represent the frontal moraines in the majority of the valleys appeared. Because of the penetration of the rivers in this limestone 10 gorges succeed in this valley: Cheile Urşilor, Cheile Peşterii, Cheile Vărariei, Cheile Coteanu, Cheile Tătarului, Zănoaga Mică, Zănoaga Mare, Orzei, Dobreşti, Galma. Specific for the Bucegi Massif are the "Horoabe" type valleys [9].

Hidrographical net: the Bucegi Massif has a flowing waters net which has a rich and permanent flow. They are supplied by rainfall and snow melting and underground waters. This net is formed by the upper flow of the Prahova River, the upper side of Prahova Valley and Glăjăria, and the two artificial lakes situated in the central and in the southern side of the National Park Bucegi: Zănoaga and Scropoasa.

Climate: the climate is typically a mountain one, the variations of temperature being directly proportional with the altitude. The annual average temperature: -10^{o}C and -4^{o}C in winter and 5,4^{o}C and 12^{o}C in summer. The quantity of rainfall varies from one altitude to another. July is the most rainy month and October and November are the driest [1, 4].

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Material and methods

The outline of taxa of the two phytocoenoses associations was drawn considering the individual field researches as well as the study of the scientific references. On Horoaba Valley the following associations were identified: *Adenostylo-Doronicetum austriaci* Horv. 1956 and *Cirsio waldsteinii-Heracleetum transsilvanici* Pawł. et Walas 1949.

The syntaxonomical nomenclature is conformable to the stipulations of the International Code of the Phytosociological Nomenclature elaborated by H. E. Weber, J. Moraveç, J.-P. Theurillat [10].

Results and discussions

The natural reserve Peştera-Cocora-Valley Horoaba**,** which belongs to the 4th IUCN category, is part of the Bucegi Natural Parc.

The Reserve includes Ialomiţa Cave, Urşilor Gorges, Peşterii Gorges, and Horoaba Valley. The valley is a distinct protected area included on the list of the Romanian Academy as "Canyonul Horoabei" (Horoaba Canyon). It is situated on an altitude 1500-1600 m, lat. 45^0 27', long. 25^0 26', the surface is about 6 ha.

The Reserve is very important from a botanic viewpoint because many species included on the Red Lists of the superior plants from Romanian are found here [6]. Among them: *Pinus cembra* L., *Dianthus glacialis* Haenke subsp. *gelidus* (Schott, Nyman & Kotschy) Tutin, *Doronicum carpaticum* (Griseb. & Schenk) Nyman, *Ligularia sibirica* (L.) Cass., *Silene nutans* L. subsp. *dubia* (Herbich) Zapal*, Festuca pratensis* Huds. subsp. *apennina* (De Not.) Hegi*, Secale montanum* Guss. (R), *Angelica archangelica* L*., Aquilegia nigricans* Baumg. (V), *Leontopodium alpinum* Cass., *Gentiana lutea* L. (V şi R) etc [2].

Among the endangered species we mention:

- *Campanula patula* L. subsp. *abietina* (Griseb.) Simonk. (endangered European taxon)
- *Dianthus spiculifolius* Schur (endangered subendemic taxon)
- *Dianthus tenuifolius* Schur (endangered subendemic taxon)
- *Hesperis matronalis* L. subsp**.** *candida* (Kit.) Hegi & Em.Schmid (endangered endemic taxon)
- *Larix decidua* Mill. (globaly endangered taxon)
- *Linum perenne* L. subsp. *extraaxillare* (Kit.) Nyman (endangered subendemic taxon)
- *Sesleria rigida* Heuff. ex Rchb. (endangered subendemic taxon)
- *Thymus comosus* Heuff. ex Griseb. (endangered endemic taxon)
- *Trisetum macrotrichum* Hack. (endangered endemic taxon) [8, 2].

Because of the favorable conditions phytocoenoses belonging to the high mountain weeds frequently appear. Two associations of megaforbs were identified within this type of vegetation: *Adenostylo-Doronicetum austriaci* Horv. 1956 and *Cirsio waldsteinii-Heracleetum transsilvanici* Pawl. et Walas 1949.

The two coenoses could be found along the steep valleys from the mountain and subalpine near the rivers. They vegetate on colluvial moist and cold, nutrients rich soils [3, 7].

MULGEDIO-ACONITETEA Hadač et Klika 1944
ADENOSTYLETALIA ALLIARIAE Br.-Bl. 1930
Adenostylion aliariae Br.-Bl. 1926
Adenostylo-Doronicetum austriaci Horv. 1956

The *Adenostylo-Doronicetum austriaci* association Horv. 1956 has some

Carpathians elements in its floristic structure (*Cirsium waldsteinii, Leucanthemum waldsteinii, Dentaria glandulosa*). This association is a Carpathian-Balkan variant of the *Adenostylo-Cicerbicetum* association Br.-Bl. 1950 from Alps [3].

The whole coenotic structure is dominated by species belonging to the *Adenostylion aliariae* alliance Br.-Bl. 1926, *Adenostyletalia alliariae* order Br.-Bl. 1930 (*Leucanthemum waldsteinii, Rumex alpinus, Senecio germanicus, Chaerophyllum hirsutum, Cirsium waldsteinii, Aconitum toxicum*) and to the *Mulgedio-Aconitetea* class Hadač et Klika 1944 (*Athyrium distentifolium, Ranunculus platanifolius, Cicerbita alpina, Valeriana sambucifolia*) [5, 3].

The hemicryptophytes are the prevalent bioforms (68%). They are followed by therophytes (3%) and other categories (**Fig. 1**).

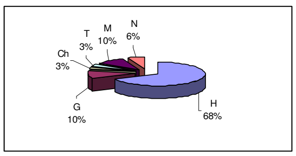

Fig. 1. The spectrum of the bioforms of the *Adenostylo-Doronicetum austriaci* association

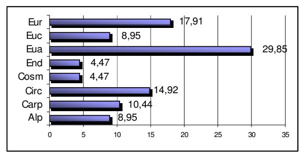

Fig. 2. The spectrum of the floristic elements of the *Adenostylo-Doronicetum austriaci* association

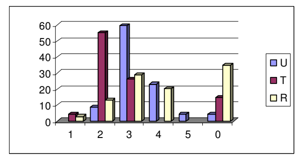

Fig. 3. The spectrum of the ecological indexes of the *Adenostylo-Doronicetum austriaci* association

The prevalent floristic elements are the Eurasian (29,85%) and the European ones (17,91%), followed by the Carpathians species (10,44%) and the Circumpolar ones (14,92%) (**Fig. 2**) .

Analyzing the ecological indexes we find out the following:

-regarding the humidity (U) that the most of the studied megforbs are mesophilous (U_3=59,42%) and meso-hygrophilous (U_4=23,18%), indicating a constantly moist but not swampy soil

-regarding the temperature (T), the micro-termophilous (T_2=55,07 %) and micro-meso-termophilous (T_3=26,08%) are better represented, indicating a cold climate, characterized by low temperatures of the water and of the soil during the entire vegetative season, specific to the upper mountain and sub alpine stand

- the index regarding the soil reaction (R) shows the existence of the acid-neutrophilous (R_3=28,98%) and low-acid-neutrophilous (R_4=20,28%) species, together with the ***euryionics*** ones (R_0=34,74%). In a high percentage (R_2=13,04%) exist the acidophilous species (**Fig. 3**). The quick humification and the mineralization of the organic material leads to a proper mineral nourishing, which lead to the forming of a big volume of the aerial organs as well as to the accumulation of a big quantity of substances for supply in the underground organs in few weeks.

MULGEDIO-ACONITETEA Hadač et Klika 1944

ADENOSTYLETALIA ALLIARIAE Br.-Bl. 1930

Adenostylion aliariae Br.-Bl. 1926

Cirsio waldsteinii-Heracleetum transsilvanici Pawl. et Walas 1949

The characteristic species of the association *Cirsio waldsteinii-Heracleetum transsilvanici* Pawl. et Walas 1949 (syn.: *Cardueto-Heracleetum palmati* Beldie 1967, *Heracleetum palmati* auct. rom.) are *Heracleum palmatum* and *Cirsium waldsteinii*. In the composition of the phytocoenoses from the Romanian Carpathians the specific species of the *Adenostylion aliariae* alliance Br.-Bl. 1926, *Adenostyletalia alliariae* order Br.-Bl. 1930

(*Carduus personatus, Senecio germanicus, Rumex arifolius, Leucanthemum waldsteinii, Doronicum austriacum*) and *Mulgedio-Aconitetea* class Hadač et Klika 1944 (*Ranunculus platanifolius, Milium effusum, Valeriana sambucifolia, Athyrium distentifolium*) are found. There are a lot of species belonging to the forests of the upper mountain stand. Because the snow layer lasts a long period of time in the resorts in which these coenoses are present lead their evolution toward the groups having *Salix silesiaca* and *Alnus viridis* [5, 3], (**Tab. 1**).

The hemicryptophytes are the prevalent bioforms (73%). They are followed by therophytes (3%) and other categories (**Fig. 4**).

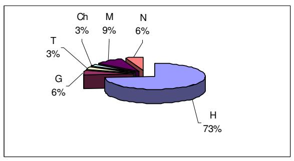

Fig. 4. The spectrum of the bioforms of the *Cirsio waldsteinii-Heracleetum transsilvanici* association

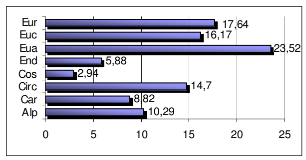

Fig. 5. The spectrum of the floristic elements of the *Cirsio waldsteinii-Heracleetum transsilvanici* association

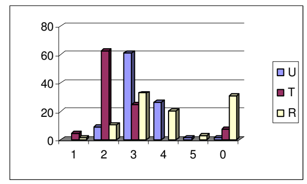

Fig. 6. The spectrum of the ecological indexes of the *Cirsio waldsteinii-Heracleetum transsilvanici* association

The prevalent floristic elements are the Eurasian (23,52%) and the European (17,64%) ones, followed by the Central-European species (16,17%) and the Carpathians species (8,82%) and the circumpolar ones (14,7%) (**Fig. 5**) .

Analyzing the ecological indexes we find out the following:

- regarding the humidity (U) that the most of the studied megforbs are mesophilous (U_3=60,93%) and meso-hydrophilous (U_4=26,56%), indicating a constantly moist but not swampy soil; the xero-mesophilous (U_2=9,37%), hydrophilous (U_5=1,56%) are poorly represented. The late melting of the snow, at the beginning of summer provides a good irrigation of the soil. The maintaining of a high hygrometric level (which does not permit the evaporation) is favorised by the low temperatures and the high degree of humidity and the poor solar action on the megaforbs
- regarding the temperature (T), the micro-thermophilous (T_2=62,5%) and micro-meso-termophilous (T_3=25%) are well represented, indicating a cold climate, characterized by low temperatures of the water and of the soil during the entire vegetative season, specific to the upper mountain and subalpine stand. Cryophilous (T_1=4,68%) and eury-thermophilous (T_0=7,81%) are poorly represented while the moderate-thermophilous (T_4) and thermophilous (T_5) are absent.
- the index regarding the soil reaction (R) shows the existence of the acid-neutrophilous (R_3=33,38%) and low-acid-neutrophilous (R_4=22,03%) species, together with the ***euryionics*** ones (R_0=28,81%). In a high percentage (R_2=13,55%) exist the acidophilous species, while the strong-acidophilous are poorly represented (R_1=1,69%) (Fig. 6). The quick humification and the mineralization of the organic material leads to a proper mineral nourishing, which lead to the forming of a big volume of the aerial organs as well as to the accumulation of a big quantity of substances for supply in the underground organs in few weeks.

Table 1. 1-5 Ass. *Cirsio waldsteinii-Heracleetum transsilvanici* Pawł. et Walas 1949, 6-9 Ass. *Adenostylo-Doronicetum austriaci* Horv. 1956

	Cirsio waldsteinii-Heracleetum transsilvanici					*Adenostylo-Doronicetum austriaci*			
Number of relevee	1	2	3	4	5	6	7	8	9
Exposition	SE	NE	N	N	NV	N	NV	NE	N
Altitude (m x 10)	160	165	170	180	121	145	150	155	160
Slope (^{0})	20	70	80	30	45	80	80	45	45
Surface (m^2)	100	100	100	100	100	100	100	100	100
Char. ass.									
Cirsium waldsteinii	1	+	1	1	+	2	2	+	+
Heracleum palmatum	2	1	-	+	3	-	-	2	-
Doronicum austriacum	-	-	+	2	+	1	1	1	1
Adenostyles alliariae	+	-	+	-	-	+	+	+	3
Adenostylion **et *Adenostyletalia***									
Stellaria nemorum	-	-	+	+	+	+	+	+	+
Aconitum paniculatum	+	+	+	-	-	+	+	+	+
Leucanthemum waldsteinii	+	+	+	+	+	+	+	-	+
Alnus viridis	-	-	+	+	-	-	-	-	-
Delphinium elatum	-	+	+	-	-	-	-	-	-
Cortusa matthioli	-	+	+	+	-	-	-	-	-
Rumex alpinus	-	-	+	-	-	+	-	-	-
Geranium phaeum	+	+	-	-	-	-	+	-	-
Senecio germanicus	+	+	+	-	+	+	1	+	-
Rumex arifolius	+	-	-	-	-	-	-	-	-
Angelica archangelica	1	+	+	+	-	+	1	+	-
Valeriana montana	-	+	+	-	-	-	-	-	-
Rosa pendulina	-	+	-	-	-	-	-	-	-
Mulgedio-Aconitetea									
Cicerbita alpina	-	-	+	-	1	-	-	1	+
Geranium sylvaticum	+	-	+	+	-	-	+	+	+
Ranunculus platanifolius	+	-	-	-	-	-	-	-	-
Athyrium distentifolium	-	-	+	+	1	+	+	+	2
Myosotis sylvatica	+	+	+	+	+	+	+	+	+
Oxalis acetosella	+	+	+	+	+	-	+	+	+
Aliae									
Geum rivale	-	+	-	+	+	-	+	+	+
Caltha laeta	-	+	-	+	-	-	-	+	-
Thalictrum aquilegiifolium	-	-	-	+	+	-	-	-	-
Rubus idaeus	-	-	-	-	+	+	+	+	+
Pulmonaria rubra	+	-	-	+	-	+	+	+	+
Anthriscus sylvestris	-	+	-	+	+	+	+	+	-
Salix silesiaca	+	+	-	+	+	-	+	+	-
Urtica dioica	+	-	+	-	-	+	+	-	+
Lamium maculatum	-	-	+	-	-	-	+	-	+
Sorbus aucuparia	+	-	-	-	-	-	+	+	+
Sambucus racemosa	-	+	+	-	-	+	+	-	+
Picea abies	+	+	+	-	+	+	+	+	+
Soldanella hungarica	+	+	-	+	-	+	-	+	+
Chaerophyllum hirsutum	+	+	+	-	-	+	+	+	+
*Campanula * abietina*	+	+	+	-	-	+	+	-	-
Dentaria glandulosa	+	-	-	-	-	+	-	-	-
Fragaria vesca	-	+	-	-	-	-	-	-	-
Doronicum carpaticum	+	+	+	+	-	-	-	+	+
Valeriana tripteris	+	-	-	-	-	-	-	-	-
Milium effusum	+	-	+	+	-	-	+	-	+
Silene pusilla	+	+	+	+	-	+	-	-	-
Veronica urticifolia	+	+	+	-	+	-	-	+	-
Hieracium transsylvanicum	+	-	-	-	-	-	-	+	-

Spiraea ulmifolia	+	-	-	-	+	-	+	+	+
Clematis alpina	+	-	-	-	-	-	+	-	-
Poa nemoralis	+	-	-	-	-	-	-	-	-
Luzula sylvatica	+	+	-	+	-	-	+	-	+
Astrantia major	-	+	-	-	-	-	-	-	-
Cystopteris fragilis	-	+	+	-	-	-	-	-	+
Asplenium viride	-	+	-	-	-	-	-	-	-
Primula veris	-	+	-	-	-	-	-	-	-
Alchemilla xanthochlora	-	+	+	+	-	+	-	-	-
Dianthus spiculifolius	-	-	+	-	-	-	-	-	-
Aconitum anthora	-	-	+	-	-	-	-	-	-
Ligularia sibirica	-	-	1	-	-	-	-	-	-
Gentiana lutea	-	-	+	-	-	-	-	-	-
Polystichum lonchitis	-	-	+	-	-	-	-	-	-
Scrophularia heterophylla	-	-	+	-	-	-	+	-	-
Galium album	-	-	+	-	-	-	-	-	-
Cirsium erisithales	-	-	+	-	-	-	-	-	-
Daphne mezereum	-	-	+	+	-	-	-	-	-
Aquilegia nigricans	-	-	+	-	-	-	-	-	-
Dentaria bulbifera	-	-	+	-	-	-	-	-	-
Saxifraga cuneifolia	-	-	-	+	-	-	-	-	-

Place and data of record: 1-5 Horoaba Valley (04.08.2007), 6-9 Horoaba Valley (05.08.2007).

Conclusions

The following aspects are revealed after studying the the megaforbs from the natural reserve Peştera-Cocora Horoaba Valley:

- The floristic composition shows the specific ecological conditions of the steep rivers valleys from the mountain and subalpine stands.
- The prevalence of the hemicryptophytes within this type of vegetation,
- The high percentage of European, Eurasian and Central-European species shows the affiliation to the Central-European area,
- The Circumpolar, Alps and Carpathians elements underline the mountain character of the flora.
- The existence of the endemic species suggests the ecologic conservatism of the resorts they vegetate in.
- The high mountain weeds are generally represented by meso- and meso-hydrophilous, micro-termophilous and micro-meso-termophilous, and acid-neutrophilous and low-acid-neutrophilous.

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A NEW VARIETY OF *ORIGANUM VULGARE* L. – DENIS, CREATED AT VRDS BACĂU IN ECOLOGIC AGRICULTURE CONDITION, CERTIFIED IN 2007 YEAR

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Abstract: Oregano is a perennial plant of 0,6 – 0,8m high. The flowers are small, coloured in red till lilac-lavender. It blossom from July till September, being pollinated by bees. The utility rate of plants is 3 : 5.
In the literature is mentioned as a plants with multiple uses: *culinary* (as a condiment plant or for the preparation of a aromatised tea, the leaves can be consumed fresh or cooked); *ornamental* (is decorative through port, bush and flowers: often is cultivated in pots); m*edicinal* (is has an antiseptically and expectorant effects, being used also in affections of respiratory systems, indigestions, arthritis, aromatherapy etc); melliferous (is a good melliferous plant); *in biologic agriculture* (with repellent effect for insects, is recommended for association with many vegetable species, also because the plants cover very well the soil, thus providing an herbicide effect); *cosmetics* (perfume, soap, spay industry).

Key words: *Origanum vulgare* L., common name oregano, origami, arigan, marjoram belongs to *Lamiaceae* family and its origin habitat is Europe.

Introduction

The researches aimed toward the creation of new varieties at perennial plants with multiple uses that correspond with the actual trends, able to be cultivated also after the techniques and principles of biologic agriculture.

The study of germ-plasma resources, the creation of new initial breeding material, selection and multiplication of valuable lines, were accomplished in „bio" cultivation conditions, in the experimental polygon ecologically certified, from V. R. D. S. Bacău.

The objectives of the present study were focused toward the introduction in open field cultivation systems of varieties of utile perennial plants, through the creation of new germ-plasma resources, the selection of a valuable biological material with genetic stability, the improvement of decorative qualities, the production of multiplication material with biological and phyto-sanitary qualities that correspond with the international quality standards and that are well adapted in the pedo-climatic conditions from our country.

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Materials and methods

The researches were accomplished at V. R. D. S. Bacău, during 2001- 2005 years, on a local population of *Origanum vulgare* L. with a large genetic variability, from which, through individual and on families repeated selections, the main selection criteria being the decorative character, adapted for pot cultivations, a line was obtained. This line is characterised through uniformity, stability, authenticity and was forwarded to ISTIS Bucharest for the accomplishment of DHS test and then certified in 2008 under the name of ″Denis″.

For the decorative characters the following quantitative and qualitative characteristics have been screened: plant's height; bush diameter; the port; the ratio height/diameter, the number of floral cane per plant; the inflorescence diameter; the colour of flowers; the blossom period; the blossom precocity; the resistance to low temperatures during the winter, the degree of plant's branching. The cultivation was conducted according with the biologic agriculture regulations (low inputs): two phasial fertilisations with Cropmax 0,2 %, in the vegetation period and before blossom; four manual weeding on row and three with machines between the rows.

The dry matter and water contain was determined through the drying of plants at 105°C.

The minerals were determined through the calcinations of plants at 560°C, followed by the solubilisation in HNO3 concentrated and in solution of 1%, being analysed through an inductor spectrometer coupled with plasma (ICP-ES) IRIS INTREPRID.

The extraction of the volatile oil was achieved through hydro-distillation in an equipment type Neoclevenger. The separation of the volatile compounds was realised through a chromatograph with gas Agilent, utilising an capillary column DB-5 of 25 m long. The utilised gas was helium.

The identification of the compounds was achieved through a spectrometric detector (Agilen), and the verification of the results was made based on Kovats indices.

Results and discussions

At the *Origanum vulgare* specie, the biologic material from the germplasm collection is extremely valuable for its utilisation in the breeding program for the creation and promotion of new cultivars.

The studies regarding the quantitative characteristics, the main criteria for the initial breeding material creation and selection, through which the decorative characters are underlined, are presented in **Table 1**.

The studies concerning the qualitative characters are focused toward the plant's port, the colour of flowers, blossom period, earliness at blossom, resistance to low temperatures during the winter; the degree of plant's branching. The results are presented in **Table 2**.

Due to the high variability degree of the initial biologic material, the individual selection was made on mother plants (vegetative), followed by the selection on families obtained after the generative multiplication (with seeds from elite plants that produced seeds in the same year of vegetation). Thus, we tried to shorten the selection period, the stabilisation of the selected line and the achievement of the objectives established from decorative point of view. Another goal was the achievement of the selected material uniformity.

Due to the fact that *Origanum vulgare* L. is specie recognised first of all as a spicy, aromatic and medicinal plant the studies were focused also on the determination of the mineral content and the essential volatile oil components.

The studies accomplished at ″Denis″ variety concerning the mineral content from mature stems, young stems, leaves, flowers and roots, expressed in mg/100 g f.w. (Table 3) shows that, in all parts of plants the quantities of calcium and potassium are the highest: the calcium vary from 562, 36 mg/100 g f.w. (leaves) to 116,79 mg/100 g f.w (roots); the determined potassium shows the fact that the highest accumulations are in leaves (1970 mg/100 g f.w) and flowers (557,64 mg/100 g f.w). High values were recorded for magnesium in flowers (132,37 mg/100 g f.w), young stems (101,66 mg/100 g f.w) and roots (98,61 mg/100 g f.w).

In the young stems the highest content is in: Ca (522,34 mg/100 g f.w), K (216,33 mg/100 g f.w) and Mg (101,66mg/100 g f.w).

In the mature stems the highest content is in: K (227,49 mg/100 g f.w) and Ca (211,54 mg/100 g f.w).

In leaves, the highest content is in: K (1970,35 mg/100 g f.w), Ca (562,36 mg/100 g f.w) and Ba (129,68 mg/100 g f.w). Tracks of Mg, Al and Na minerals can be also noted.

In flowers, the highest content is in: K (557,64 mg/100 g f.w), Ca (163,77 mg/100 g f.w), Ba (116,74 mg/100 g f.w) and Al (116,41 mg/100 g f.w).

In roots, the highest content is in: K (331,06 mg/100 g f.w), Ca (116,79 mg/100 g f.w), Al (98,98 mg/100 g f.w) and Mg (98,61 mg/100 g f.w). Tracks of Fe and Na minerals can be also noted.

The compounds of the volatile oils that were identified (un number of 33 compounds) through the correlation between the spectrum and the retention time (Table 4 and Figure 1), shows that, the most important compounds are: gama-terpinen (18,58 %), p-cimen (15,07 %), beta-cariofilen (13,46 %), cariofilen oxid (5,42 %), sabinen (5,12 %), trans-beta-ocimen (4,31%), cis-beta-terpineol (4,19 %).

The important compounds are registered between 1 % to 3 %: terpinen-4-ol (2,72 %), borneol (2,69 %), germacren D-4-ol (2,53 %), alfa-farnesen (2,46 %), m cis-beta-ocimen (2,34 %), alfa-cadinol (2,14 %), alfa-terpinen (2,05 %), camfen (1,7 %), alfa-pinen (1,3 %), alfa-himacalen (1,45 %), tau-muurolol (1,02 %) and alloaromadendren (1,01 %).

Except the number of 6 compounds (under 0,50 %), the rest of them (8 compounds) are registered below 0,5% to 1 %: mircen (0,98 %), silvestren (0,94 %), terpinolen (0,76 %), Thujen (0,69 %), alfa-cariofilen (0,64 %), Elixen (0,63 %), beta-pinen (0,61 %) and longifolen aldehidç (0,5 %).

The chromatogram of the essential oils is presented in **Graphic 2**.

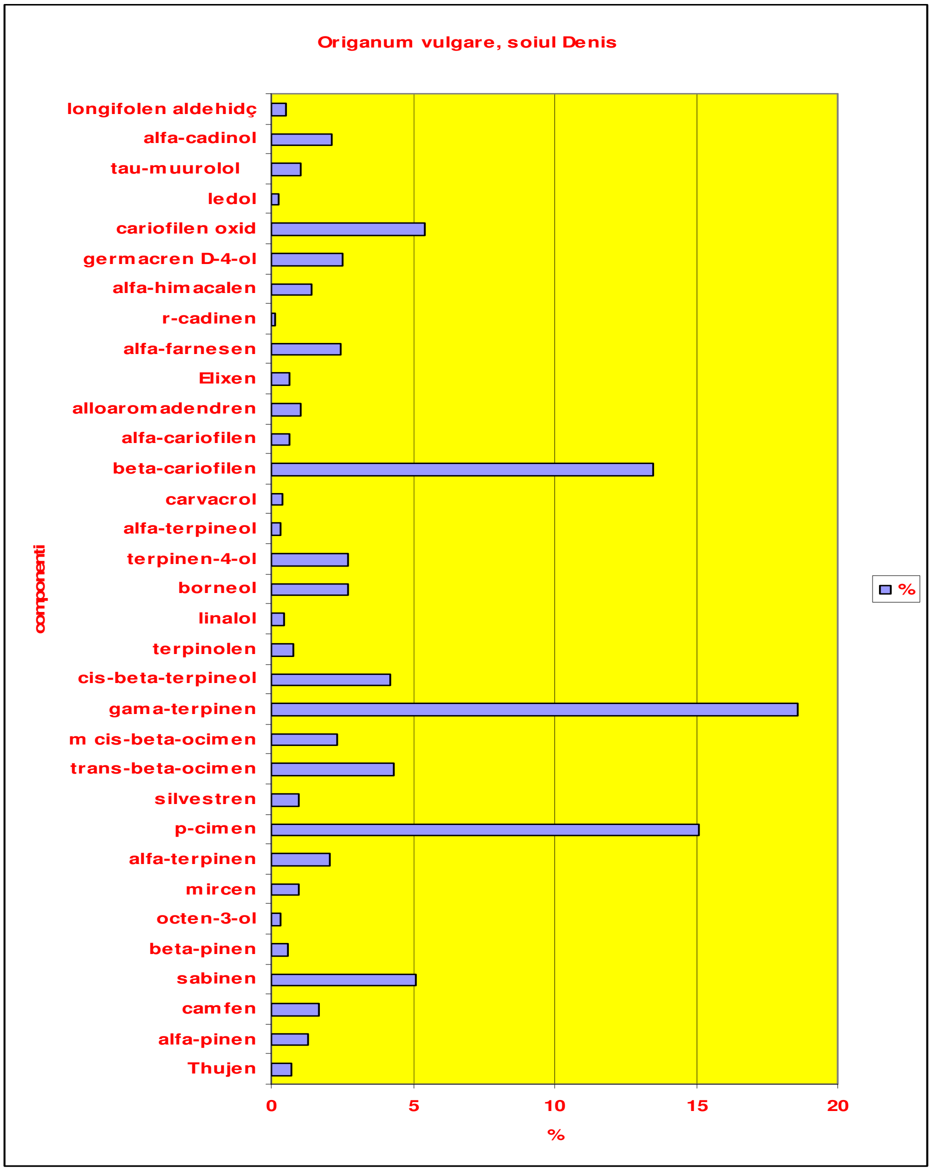

Fig. 1. Graphical representation of the essential oils at Origanum vulgare L., variety "Denis"

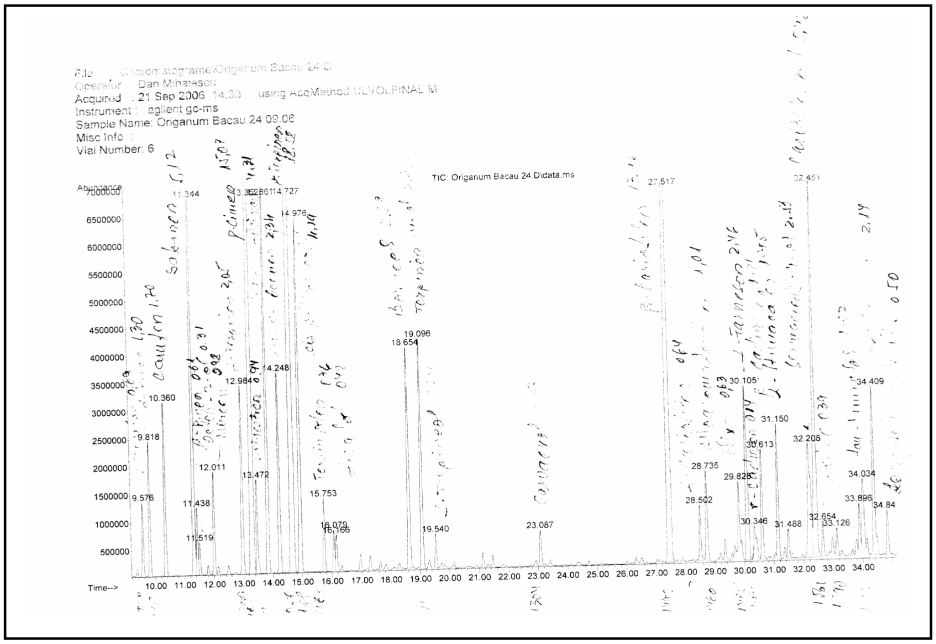

Fig. 2. The chromatogram of the essential oils at *Origanum vulgare* L.*,* variety "Denis"

Conclusions

- The accomplished studies underline the value of the biologic material that was created, selected and multiplied at V. R. D. S. Bacău at *Origanum vulgare* L. species, during 2002-2006 years.
- The utility as a decorative specie is emphasized by the quantitative and qualitative characteristics, followed and accomplished through selection and propagation, both for the creation of the initial material and for the breeding program.
- The studies concerning the content in minerals, on mature stems, young stems, leaves, flowers and roots expressed in mg/100 g f.w., shows the fact that in all plant's parts the calcium and magnesium content is the highest; the determined potassium shows the biggest accumulations in leaves. Magnesium has high values in flowers, young stems and roots. The highest content of the mature stems is in K and Ca.
- The study of the volatile oil content through the identification of a number of 33 compounds, confirms the multiple utility of the plant (especially as a spicy, aromatic and medicinal plant).
- The cultivation in unconventional conditions, in the perimeter of the biologic farm from V. R. D. S. Bacău, through the application of the low input technologies, assures the quality of the selected and propagated biologic material.

Table 1. The quantitative characteristics of the new cultivar ″Denis″, comparing with its original population

Cultivar	**Plant's height cm**	**Plant's diameter cm**	**Ratio H/D**	**No of flower cane/ plant**	**Length of flower cane cm**	**Diameter of inflorescence cm**
Local population	45-50	35-40		7-10	40-45	4-5
Soiul ″Denis″	35-45	30-45		8-12	30-55	5-7

Table 2. The qualitative characteristics of the new cultivar ″Denis″, comparing with its original population

Cultivar	**Plant's port**	**Colour of flowers**	**The blossom beginning**	**The blossom period**	**Resistance to winter**	**Branching degree**
Local population	bush	pink-lilac	20-25 June	June - Aug	good	strong
Soiul ″Denis″	branched bush	dark pink-lilac	10-55 June	June - Sept	very good	very strong

Table 3. The mineral content per plant`s organs at the analysed of *Origanum vulgare,* variety ″Denis″ (mg/100 g f.w.)

Elements	**Young stems**	**Mature stems**	**Leaves**	**Flowers**	**Roots**
Al	34,35	10,33	40,98	116,41	98,98
B	77,75	0,24	0,69	0,518	0,48
Ba	0,00	48,76	129,68	116,74	97,82
Ca	522,34	211,54	562,36	163,77	116,79
Cr	0,144	0,08	0,25	0,26	0,23
Cu	0,21	0,22	0,58	0,417	0,33
Fe	21,87	6,79	17,26	82,61	68,53
K	216,33	227,49	1970,35	557,64	331,06
Mg	101,66	49,65	80,67	132,37	98,61
Mn	1,29	0,47	0,77	2,836	1,96
Na	10,15	9,06	47,20	48,09	40,04
Ni	0,00	0,00	0,00	0,15	0,00
P 1859	4,45	6,87	14,90	4,72	2,72
P 2136	10,62	9,20	23,92	9,23	6,11
Pb	0,07	0,08	0,13	0,10	0,06
Sr	1,45	0,44	2,02	0,40	0,22
Zn	0,62	0,54	1,50	1,86	1,36

Table 4 . The analysis of volatile oil 1% in pentan

Nr. crt.	The content in volatile oil	%
1.	Thujen	0,69
2.	alfa-pinen	1,3
3.	camfen	1,7
4.	sabinen	5,12
5.	beta-pinen	0,61
6.	octen-3-ol	0,31
7.	mircen	0,98
8.	alfa-terpinen	2,05
9.	p-cimen	15,07
10.	silvestren	0,94
11.	trans-beta-ocimen	4,31
12.	m cis-beta-ocimen	2,34
13.	gama-terpinen	18,58
14.	cis-beta-terpineol	4,19
15.	terpinolen	0,76
16.	linalol	0,42
17.	borneol	2,69
18.	terpinen-4-ol	2,72
19.	alfa-terpineol	0,34
20.	carvacrol	0,37
21.	beta-cariofilen	13,46
22.	alfa-cariofilen	0,64
23.	alloaromadendren	1,01
24.	Elixen	0,63
25.	alfa-farnesen	2,46
26.	r-cadinen	0,14
27.	alfa-himacalen	1,45
28.	germacren D-4-ol	2,53
29.	cariofilen oxid	5,42
30.	ledol	0,29
31.	tau-muurolol	1,02
32.	alfa-cadinol	2,14
33.	longifolen aldehidç	0,5

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CONSIDERATIONS REGARDING THE EFFECTS OF GROWTH REGULATORS OVER THE „IN VITRO" MORPHOGENETIC REACTION AT *ORIGANUM VULGARE* L.

CRISTEA TINA OANA*, FĂLTICEANU MARCELA**, PRISECARU MARIA***

Abstract: *Origanum vulgare* L. – oregano, is a perennial plant of 0.6 - 0.8 m, that belongs to the *Lamiaceae* family. Oregano is an important aromatic plant utilised both as culinary and medicinal plants. Tissue culture „in vitro" is a useful method for large scale production of pathogen-free plants. In this study in order to determine the best hormone variant that allows the obtaining of a large number of plants, apical shoots of young plants grown in controlled conditions were utilised. The explants were cultured in solid MS medium supplemented with different concentrations of kinetin – 1.0 – 2.0 mg/L and 1.0 - 2.0 mg/L BAP in combination with 0.1 – 0.5 mg/L NAA and IAA. Multiple shoots were obtained from the apical explants, the higher frequency (85%) formation of shoots was observed in the media variant that contained BAP in combination with NAA. Initially 1 or 2 buds developed, later up to 12 shoots of above 3 cm length were formed in node in two weeks. Shoots were multiplied by subculture on the same medium. The shoots rooted on the same media. The rooted plantlets were hardened and successfully established in pots at 85% success rate.
The reported experimental dates represents a viable methods of plant regenerations of *Origanum vulgare* L. through shoot tip culture.

Key words: growth regulators, *Origanum vulgare*, "in vitro", morphogenetic reaction.

Introduction

Oregano is a perennial aromatic herb native to Europe and Asia, which is cultured all over the world. At present the demand of this aromatic herb is not only rising in Romania but also in other markets, capturing the interest of small and medium producers like an economic-productive alternative to be taken into account. These are versatile cultures that adapt to changing market modalities owing to their diverse uses, such as dry herbs, essential oils, etc.

Various approaches have been considered for *in vitro* multiplication of oregano (*Origanum vulgare* L.) apical meristem and axillary bud culture, induction and development of adventitious buds and somatic embryogenesis (Goleniowski et al., 2002).

Conventional techniques of vegetative propagation of *O. vulgare* based on cuttings are difficult because of the low rates of rooting. The cells and tissues cultures "in vitro" assure a unique opportunity to manipulate the morphogenesis in a perfectly controlled medium, thus offering a powerful complementary instrument that can help in overcoming such problems.

Therefore, the objective of this investigation was to develop a protocol for *in vitro*

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establishment, multiplication, rooting and acclimatization of leading oregano cultivars (*Origanum vulgare* L.) from Romania.

Material and methods

The selected mother plants utilised as donor source for explants are cultivars maintained at Vegetable Research Station Bacău in controlled conditions. Young shoots of 2 cm length were excised from actively growing plants.

The defoliated shoots were first washed in tap water and the sterilized in 0.1% HgCl2 for 15 minutes, and 3 rinses in sterile distilled water.

The apexes of almost 1,5 cm were excised and inoculated on Murashige Skoog, 1962 culture medium supplemented with different concentrations of kinetin – 1.0 – 2.0 mg/L and 1.0 - 2.0 mg/L BAP in combination with 0.1 – 0.5 mg/L NAA and IAA.

Cultures were incubated at 25 ± 1°C under 16 hr photoperiod of 3000-lux light intensity. The cultures were transferred each 2 weeks on fresh media, for a period of 90 days.

Observation of shoot multiplication and growth were recorded at weekly intervals. After two weeks, shoots of above 3 cm length were harvested and subcultured on the same medium. A part of the newly formed shoots that demonstrated a good development of leafs were transferred to rooting medium containing different concentration of NAA.

After eight weeks, the rooted plants were acclimatized and planted in a potting mixture of sterilized sand + vermiculite (1 : 1 ratio) in plastic cups, hardened in a mist chamber (80% relative humidity) for 2 weeks before transfer to a green house.

Experiments were set up in a completely randomized design and repeated three times, with at least 20 explants per treatment. The percentage of shoot regeneration [(number of explants with adventitious shoots/total number of explants) × 100%] and the number of shoots per explant (number of adventitious shoots/total number of explants) were calculated for the explants that had been cultured for 7 weeks.

Results and discussions

Shoot buds got initiated on nodal segments after 6 days of culture. Immediately after the inoculation, the explants raise their volume and the peripheral parts presented a slight necrosis. The higher frequency (85%) formation of maximum number of shoots was observed in the media variant that contained BAP in combination with NAA. Initially 1 or 2 buds developed, later up to 12 shoots of above 5 cm length were formed in explants in seven weeks.

The reaction of the explants on the 16 variants of nutrient medium utilised in our experiments vary depending on the hormonal formuli utilised. The morphogenetic reaction on medium that contained BAP on lower concentration – 1 mg/L and NAA 0.05 mg/L was quite strong with a very good proliferation of shoots, while the addition of a larger concentration induced only the longitudinal growth of shoots but without bud proliferation. A part of them degenerated in necrosis or were eliminated because of the secondary infections.

The media variants that allowed the induction of the regenerative processes were characterized through the presence of BAP in association with NAA or IAA. The replacement of BAP with other cytokinine (for example the kinetin) doesn't allow the regeneration. The results obtained by us underline once again the benefic effect that BAP has when comparing to other cytokinins.

After almost 17-18 days the shoots were transferred on fresh media that supported the regenerative processes, through the determination of a good proliferation of the shoots (**Fig. 1 a, b**).

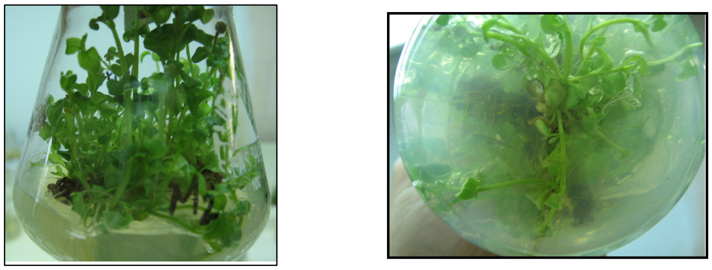

Fig. 1 a-b. Neo-formation of the plantlets at the basis of the initial shoot

This association between BAP and NAA also determined the apparition and developments of roots inside the media but also airing roots. This is extremely important because allow us to obtain plantlets more quickly by skipping the rooting period (**Fig. 2**).

Fig. 2. The apparition of the airing roots at the plantlets regenerated on BAP and NAA combination media

Depending on the way that plantlets evolved, they were transferred either on a rooting media or directly to hygroponic conditions. The rooting media containing NAA determine a good development of roots, in the same time allowing also the development of foliar system.

Roots were observed as early as 2 weeks after placing the microshoots (2-3 cm) on rooting medium. Most of the shoots had developed roots by week 4. The highest frequency of roots formation was induced in MS supplemented with 0.6 mg/L NAA (**Table 2**). Shoots exposed to higher concentrations of NAA (2.0 mg/L or more) became necrotic and lost leaves and the shoot tips died gradually.

The plants that presented a well developed rooting and foliar system were transferred directly in hydroponic conditions for their acclimatization (**Fig. 3**). Due to the fact that the humidity must be gradually reduced over time because tissue-cultured plants are extremely susceptible to wilting, the plants were covered with plastic folia for three days and then gradually discovered.

Fig. 3. The acclimatization stage

After the plants were fully adapted to the environmental conditions (almost 10 days), we passed them to soil substrate in plastic recipients (**Fig. 4**) and then utilized it in the breeding activity in open-field or greenhouses.

Fig. 4. Fully adapted plants, in plastic recipients

The potential of in vitro propagated *O. vulgare* plantlets to be used for ex vitro establishment was investigated with plantlets transferred to soil pots after 2 weeks of initial hardening under culture-room conditions. Almost 93% of these regenerants survived and showed new branch development. These may be useful for the production of somaclonal variants for breeding programs

Conclusions

- The results obtained in the present work showed that the micropropagation of *Origanum vulgare* L. „in vitro" is a viable tool for the production of identical pathogen-free plants for agriculture;
- The higher frequency (85%) formation of maximum number of shoots was observed in the media variant that contained BAP in combination with NAA. The replacement of BAP with other cytokinine (for example the kinetin) doesn't allow the regeneration of plants;
- The maximum number of shoots/explant was observed on hormonal formuli with BAP 2.0 mg/L and NAA 0.1 mgL, the increase in the quantity of hormons determined a decrease in the number of shoots as some of them become necrotic;
- The highest frequency of roots formation was induced in MS supplemented with 0.6 mg/L NAA.

– Almost 93% of these regenerants survived and showed new branch development. These may be useful for the production of somaclonal variants for breeding programs.

Table 1 Effect of different types and concentrations of plant growth regulators in MS media on organogenic regeneration directly from explants. Experiments were carried out 3 times

Growth regulators (mg/L)	Regeneration frequency (%)	No. of shoots/explant	Average length of shoots
kinetin			
0.1	38.55	1.5	4.0±0.6
0.5	35.20	1.7	4.0±0.5
1.0	43.33	2.9	4.1±0.1
2.0	36.28	3.0	4.5±0.5
BAP			
0.1	50.45	5.6	5.1±0.7
0.5	50.20	5.7	5.2±0.8
1.0	62.46	6.5	5.6±0.4
2.0	54.46	6.1	5.2±0.1
BAP+NAA			
1.0 + 0.1	78.93	10.2	5.0±0.3
1.0 + 0.5	82.69	11.9	5.2±0.1
2.0 + 0.1	85.36	12.1	5.9±0.3
2.0 + 0.5	83.12	10.3	6.0±0.2
BAP+IAA			
1.0 + 0.1	58.91	8.3	4.8±0.5
1.0 + 0.5	64.25	8.8	4.8±0.2
2.0 + 0.1	71.54	9.6	5.0±0.1
2.0 + 0.5	65.30	8.5	5.7±0.3

Table 2 Effect of different types and concentrations of plant growth regulators in MS media on root induction

Growth regulators (mg/L)	Rooting frequency (%)	No adventious roots/shoots
NAA		
0.4	88.30	5.15±0.47
0.6	91.80	6.28±0.18
0.8	77.51	3.59±0.33
1.0	60.23	3.30±0.32

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