UNIVERSITATEA „ALEXANDRU IOAN CUZA” IAŞI

BULETINUL GRĂDINII BOTANICE IAŞI

TOMUL 14

Editura Universităţii „Alexandru Ioan Cuza”

IAŞI – 2007

IMPORTANT: **Din 1993, titlul revistei "*Culegere de studii şi articole de biologie*", editată de Grădina Botanică Iaşi, a fost schimbat în "*Buletinul Grădinii Botanice Iaşi*".**

IMPORTANT: **Since 1993 the title of the "*Culegere de studii şi articole de biologie*", edited by the Botanical Garden of Iaşi, has been changed into "*Buletinul Grădinii Botanice Iaşi*"**

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ISSN 1224–2357

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CHRONICLE

In the period 25th – 28th of May, 2006, took place the works of the International Scientific Symposium, entitled "*IN SITU* AND *EX SITU* DIVERSITY PLANT", in Iaşi. At that event, we celebrated in fact, 150 years from the foundation of the first botanic garden, here in Iaşi. This symposium has been organised by the Botanic Garden „Anastasie Fătu", in collaboration with the Faculty of Biology, Dept. of Vegetal Biology, from the University „Alexandru Ioan Cuza" Iaşi.

Over 100 botanists, most of them from Romania, but also from: Hungary, Italy, R. of Moldova, Germany, Turkey, attended this symposium. In the opening of the symposium, has been a homage speech to the man who founded our botanic garden, namely Dr. Anastasie Fătu. Also, there has been a speech over the history of the Botanic Garden in Iaşi.

The participants have presented, in plenum, on sections or in the poster system, 87 scientific papers and synthesis essays, classified into three sections: 1. *Structure & function diversity of vegetal organisms;* 2. *Plant taxonomy & phytosociology;* 3. *Nature conservation & ecological education.*

This symposium has been greeted by the mayor of the Iaşi city, by the prefect of the Iaşi district, by the rector of the „Alexandru Ioan Cuza" Iaşi, a state secretary from the Ministry of Education & Research, by several representants of the Romanian Academy of Sciences, other official persons from the other botanic gardens from Romania and several from abroad.

In the afternoon of the 26th of May, 2006, all the participants have visited the Botanic Garden and the exhibition called „Spring Flowers" and have assisted to the unveil of an inox steel plaque, fixed on a rock in the front of the main administration building, having encripted on it the main data about our institution, as well an inscription in the latin language (see photo).

On the 27th of May, 2006, all the participants have attended a field survey, which took place in the Natural Park „Vânători – Neamț", on the route: Iași – Tg. Neamț – Agapia Monastery – Neamț Monastery – Natural Park „Vânători – Neamț" – Iași. But the weather was not properly for some detailed step surveys – it has been a rainy and pretty cold day.

On this event, we gave so-called „Onorary Diploma" and „Medal of Honor" to some scientists and institutions from Romania, which had had remarkable contributions to the development of the botanic gardens in particular and the Botany as a science, in general. Also, there have been edited „Jubilee Coins", celebrating those 150 years of life of our botanic garden.

As a conclusion of this symposium, one could say that the interdisciplinary researches are very important for the organisms – environment interrelation analysis, and for the histological, physiological, biochemical and biophysical effects of the action of some substances (including pollutants) upon the plants.

In the name of the Organizing Committee,
Senior Researcher Dr. Adrian OPREA

UNIVERSITATEA „ALEXANDRU IOAN CUZA" IAȘI

GRĂDINA BOTANICĂ „ANASTASIE FĂTU"

150 ANI DE LA ÎNFIINȚARE

(1856 – 2006)

PER ASPERA AD ASTRA

Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

MORPHO-STRUCTURAL ADAPTATIONS OF SOME AQUATIC CARNIVOROUS PLANT SPECIES (*ALDROVANDA VESICULOSA* L. AND *UTRICULARIA VULGARIS* L.)

STĂNESCU IRINA[*], TOMA CONSTANTIN[**]

Abstract. In the present work the authors emphasize a few structure particularities of two aquatic carnivorous plant species, *Aldrovanda vesiculosa* L. and *Utricularia vulgaris* L., underlining their adaptation to the aquatic medium and to the carnivory menu.

Key words: bladder, aeriferous canals, *Aldrovanda vesiculosa*, *Utricularia vulgaris*.

Introduction

Aldrovanda vesiculosa was first called *Aldrovandia* by G. Monti, in the eminent botanist's honor, Ulysse Aldrovandi, and then Linné [4] gave it the name we know today. It is a little aquatic plant, rootless, which floats horizontally. It belongs to the *Droseraceae* family, together with *Dionaea muscipula*, *Drosophyllum lusitanicum* and to the gender *Drosera*. It pays for our attention because of its traps of a complexity that we hardly see in the botanical kingdom; we are facing the last survivor of a gender which knew its climax little after the dianosaurs' extinction.

The gender *Utricularia* belongs to the *Lentibulariaceae* family, together with the species which form the genders *Genlisea* and *Pinguicula*; it includes the greatest number of carnivorous plant species (almost 275), spread in the entire terrestrial globe, excepting polar and desert regions. The most interesting particularity of this second species (*Utricularia vulgaris*) is the trap; it is usually called bladderwort, because of the bladder-like shape of its little traps, which capture minute aquatic organisms.

There is much information about the morphology and physiology of these studied species; for example, the synthesis referring to the dicotyledons' anatomy [6, 8] or to the angiosperms [7]. Some histo-anatomical observations about carnivorous plants were presented [3]. In our country, the carnivorous plants accommodation to surroundings was underlined [15, 16].

In the present work we show a few adaptative characters to the aquatic medium and to the carnivory menu of *Aldrovanda vesiculosa* and *Utricularia vulgaris*, as a sequel of our investigation regarding the anatomy of some carnivorous plants [9, 10, 11, 12, 13, 14, 18].

Material and methods

The material subjected to the histological analysis (the vegetative organs of *Aldrovanda vesiculosa* şi *Utricularia*), collected from the Danube Delta, has been fixed and preserved in 70% ethylic alcohol. The sections were cut by microtome,

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subsequently coloured with iodine green and alaun-carmine, then mounted in gel and analyzed in a Novex (Holland) light microscope. The light micrographs were performed by means of the same light microscope, using Canon A95 camera.

Results and discussions

The stem

The main characteristic of the studied species is the absence of the root, the absorption of water and minerals taking place on the entire body superficies.

Aldrovanda vesiculosa has the stem formed of successive whorls of leaves separated by short internodes (**Fig. 1**). The stem has a circular profile in cross section at *Utricularia vulgaris* and circular, but modified by prominent frames at *Aldrovanda vesiculosa*. Both species have the epidermis consisting in small isodiametric cells (**Fig. 2** and **8**), with the external wall thicker than the others. From place to place a few bicellular secretory trichomes are present (**Fig. 2 and 9**).

The cortical parenchyma is thick, with a lot (7-8) of large aeriferous canals, separated by radially multicellular one-layered rays at *Utricularia vulgaris* (**Fig. 8**) beside those, *Aldrovanda vesiculosa* presents strait aeriferous canals, too, outwards of the larger ones (**Fig. 3**).

At *Aldrovanda vesiculosa* the central cylinder is thin (**Fig. 3**), presenting a ring of conductive elements, a thin perimedullar zone and a central aeriferous canal. The ring of conductive elements is formed of few small external isles of sieved tubes and companion cells and more xylem vessels with less thickened and less lignified walls which are not different from the surrounding cells of the parenchyma, unless by their bigger diameter. *Utricularia vulgaris* has a thin central cylinder, too, but it consists in an homogenous mass of polygonal cells (**Fig. 10**), the majority of them having thickened, but cellulosed walls; we can not distinguish the phloem elements by the xylem ones; the most internal layer of the cortical parenchyma is a primary type endodermis, having Casparian thickenings in the radially walls of the cells.

The leaf

Both investigated species have metamorphosed leaves (*Utricularia vulgaris* presents normal leaves, too); precisely, the leaves are transformed in traps which capture minute aquatic organisms, as a characteristic feature to the carnivory menu.

At *Aldrovanda vesiculosa*, as we mentioned before, the leaves form successive whorls and have a cuneiform petiole; the upper epidermis, in front side view, presents polygonal elongated cells, with incurved lateral walls. Here and there, two-armed sessile secretory trichomes are present. The lower epidermis is formed of elongated cells, with incurved lateral walls; there are no trichomes present.

The extremity of the petiole bears a few trigger hairs, fan out disposed, forming a little concavity were the bilobed trap is, similar to that of *Dionaea muscipula*. The cells of the upper epidermis of the blade folds have irregular shape, with curved lateral walls.

Some of the boundary cells present rigid expansions (corresponding to the stiff trichomes belonging to the edges of the blade folds of *Dionaea muscipula*) oriented to the midrib. The upper (internal) epidermis presents a lot of secretory multicellular structures, called digestive glands, similar to those occurring in the upper epidermis of the blade folds of *Dionaea muscipula*, with the difference that the digestive gland of *Aldrovanda vesiculosa* consists in a small number of glandular cells (**Fig. 5**).

Besides, there are a lot of two-armed sessile secretory trichomes, similar to those from the petiole; sometimes, these trichomes join together, resulting a four-armed sessile secretory trichome, seen in the lower epidermis (**Fig. 6**). Another similitude with *Dionaea muscipula* is the presence of the multicellular one-layered bristle-like trichomes. They are sensitive to mechanical stimulations and present a very interesting structure. Each bristle-like trichome is formed of 5-7 superposed cellular stages. In the inferior part each stage is formed of four cells, parallelly disposed, but in the upper part, there are stages formed of two cells. The basal stage consists of big cells. Another three layers of elongated cells are queued, having a thick external wall and a thinner internal one. The next layer is formed of short cells, with very thin external and internal walls. If a minute aquatic organism touches the bristle-like trichome, this layer functions as an articulation. The latest layer consists in elongated cells, with thick external walls [17]. So, a touched bristle-like trichome does not bend on its whole length, because the parts situated up and down the articulation are not flexible, the external walls of the cells are very thick; it bends at the articulation. A repetitive touch of the bristle-like trichomes determines trap closure, resulting a vesicle, which gives the name of this species. The more bristle-like trichomes are touched the faster is the closure of the trap. The lower epidermis consists in polygonal cells, with curved lateral walls and two or four-armed sessile secretory trichomes.

So, *Aldrovanda vesiculosa* does not have a real cavity, unless the moments when the blade folds form the vesicle full of minute aquatic organisms. *Utricularia vulgaris* presents normal, small leaves and metamorphosed leaves, the little bladders which capture the aquatic organisms; in this case we can talk about a real cavity.

These pear-like bladders have very thin, semitransparent walls. The aperture, which presents a small lid with inward opening, is funnel-like shaped, and presents at its edges long one-layered sensitive trichomes; they guide the minute animals to the aperture of the bladder; their second role is to avoid the approach of the big animals, which could damage the bladders. The internal epidermis presents polygonal cells, with right or curved lateral walls. Here and there, a lot of four-unequal-armed (two long arms and two short arms) trichomes are present (**Fig. 11**); secretory glands (**Fig. 12**) consisting in one stalk cell, between the epidermic ones and an external layer of two hemispheric cells are accompanying the first group of secretory structures.

The finest contact of the minute aquatic organisms with the sensitive trichomes creates an aspiration force; the bladder distends, the lid opens inward and the water full of small animals is guided to the cavity. Then, the lid closes. The glands inside the bladder absorb most of the internal water and expel it on the outside, so, a partial vacuum is produced inside the bladder and the pressure from the outside becomes greater than inside. This causes the walls to squeeze inward and explains their slightly concave appearance. Soon, only the chitinuous parts of the small animals remain. We are facing an underwater process; the capture happens very fast, so the observations are quite impossible without special techniques [2]. Darwin did not point out weather the bladders of *Utricularia vulgaris* secrete, through the glands, enzymes or not. This problem had been positively resolved [5]; the secretory structures elaborate proteolytic enzymes, like trypsin, and the benzoic acid which, in his opinion, plays for an antiseptic. These substances are secreted by the armed-trichomes, and the resulted products are absorbed by the hemispheric secretory cells which belong to the internal epidermis of the blade.

Conclusions

The absence of the root, the absence of the cuticle, the presence of weak developed vascular tissues (especially the xylem one) represent some adaptations to the aquatic medium of the studied species. On the other hand, both species present a specialized mechanism which helps them capture minute aquatic organisms. So, the leaf is a metamorphosed organ, its different secretory structures (digestive glands of the upper epidermis of the blade folds belonging to *Aldrovanda vesiculosa*, the trichomes and the armed-glands from the internal epidermis of the bladder belonging to *Utricularia vulgaris*) represent the adaptations of this interesting plants to the carnivory menu.


Fig. 1

Fig. 2

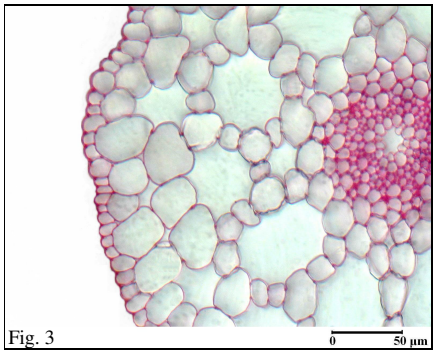

Fig. 3

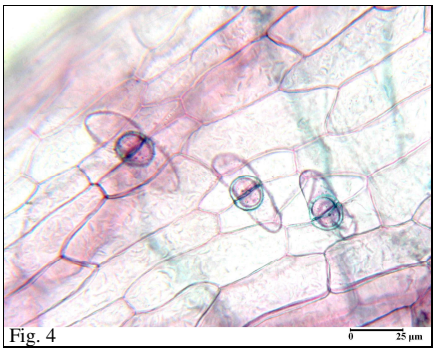

Fig. 4

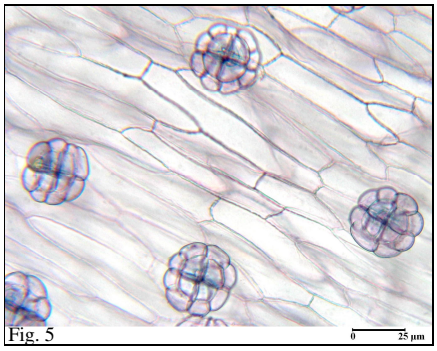

Fig. 5

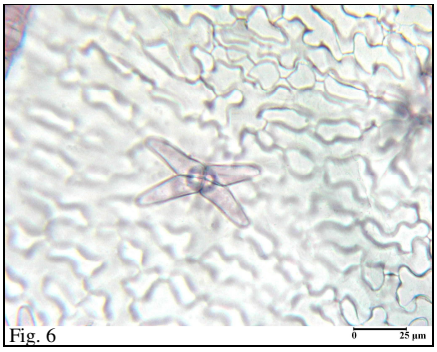

Fig. 6

Aldrovanda vesiculosa. Fig. 1: Macrosopic aspect. Fig. 2 and 3: Cross section trough the stem. Fig. 4: The upper epidermis of the petiole (front side view). Fig. 5: the upper epidermis of the blade folds (front side view). Fig. 6: the lower epidermis of the blade folds (front side view)

Fig. 7

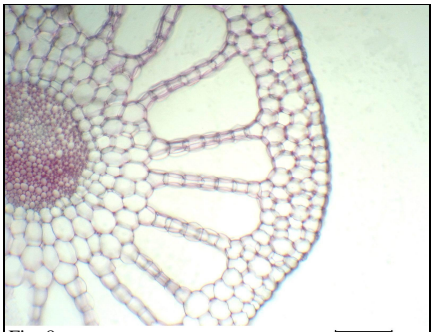

Fig. 8

Fig. 9

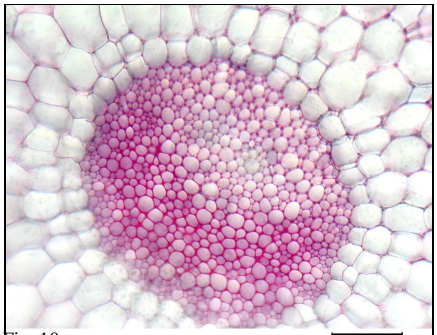

Fig. 10

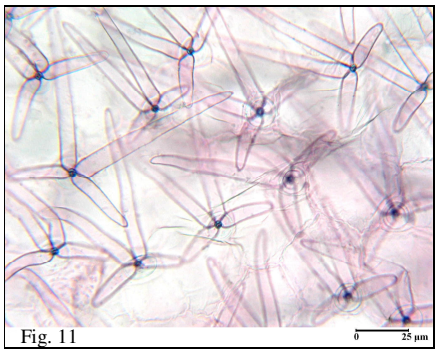

Fig. 11

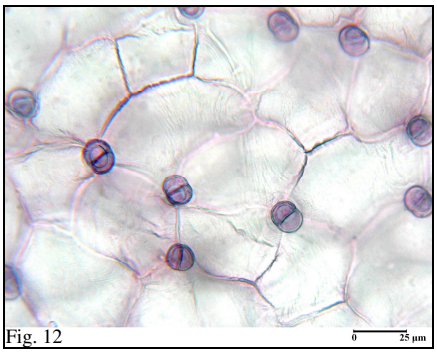

Fig. 12

Utricularia vulgaris. Fig. 7: Macroscopic aspect. Fig. 8-10: Cross section trough the stem. Fig. 11 and 12: The internal epidermis of the trap (front side view)

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

CONSIDERATIONS UPON THE ANATOMICAL FEATURES OF SOME TAXA OF *TRADESCANTIA* GENERA

IFRIM CAMELIA*

Abstract: The structure of two taxa of the *Tradescantia* genre is analyzed by using the classical anatomical methods. The results are correlated with all data of the specialized literature. It is specified the role of the epidemical cells within the water metabolism.

Key words: *Commelinaceae* family, anatomical features

Introduction

Tomlinson is the author who had consecrated a thorough study to is *Commelinaceae* [6,7] family, by supplying valuable anatomical information. As for the *Tradescantia* genre the information are sporadic and incomplete.

Useful information is to be found in the papers presenting the anatomy of the vascular tissues of the *Tradescantia albiflora* [2] stem, the histology of the vegetative offshoots that give birth to the variegated leaves at the decorative sorts [4].

Material and method

The vegetal material is represented by roots, stems and leaves of two taxa: ***Tradescantia albiflora*** Kunth ***'Aureo-vittata'*** and ***Tradescantia fluminensis*** Vell. ***'Albo-vittata'*** (*Commelinaceae* family) [1]. Both taxa were cultivated in the greenhouses of the Botanical Garden of Iaşi.

The fixation and processing of the material (red carmin and fast green coloration) was done according to the usual protocol of the Vegetal Morphology and Anatomy Laboratory belonging to the Biology Department of the University "Al. I. Cuza" of Iaşi [5].

There were made cross sections at the middle level of the root, of the stem and of the leaves. As well there were made superficial sections at the leaf level. The permanent preparations obtained were analyzed and photographed with the optical microscope type Novex.

Results and Discussions

The adventive root (**Fig. 1**) for both taxa has an exfoliated rizoderma; the protective role belongs to the exodermis with irregular-polygonal cells. The cellulose cortical parenchyma presents 3-4 layers (at ***T. albiflora 'Aureo-vittata'***) or 7-8 cell layers with slightly thickened walls (at ***T. fluminensis 'Albo-vittata'***) of big dimensions, which are decreasing towards the center. The endodermis, of tertiary type, presents square type cells, with internal and lateral walls more thickened that the external wall.

* Botanical Garden of Iasi University

The central cylinder presents four wooden areas (at ***T. albiflora 'Aureo-vittata'***) or six wooden areas (at ***T. fluminensis*** Vell. ***'Albo-vittata'***), which alternates with as many phloem, the latter being better represented. Each wooden area presents 2-3 vessels with strongly woodened walls but slightly lignified. In the middle we can observe one or two big metaxilem vessels with thickened walls but slightly lignified, separated by wooden fascicule.

The stem: the middle internode (**Fig. 2, 3**). The epidermis seen upfront presents rectangular cells and stomata type tetra-cyclic, disposed in rows that alternate from one inter-node to another, very rarely at ***T. albiflora 'Aureo-vittata'***. At this specie we can observe bi-cellular hairs, with sharp tip.

The outline of transvers section has a circular shape. The epidermis has polygonal cells, slightly elongated tangentially, with thickened internal and external walls, the last wall being covered by the cuticle. In the area where the internode is surrounded by the sheath (at ***T. albiflora 'Aureo-vittata'***), some cells are transformed into tri-cellular hairs, with a very thick basic cell with sharp tip. The first two hypodermically layers have the cells with collenchymatous walls. There follows 4-5 layers of assimilating parenchyma, with large cells, some of them containing grains of starch.

The central cylinder gives the impression of some sort of delimitation towards the cork because of the existence of pseudo-endodermis [7]. This is represented by a layer of cells with a special structure, with internal and lateral thickened walls straight forwardly of the leading external fascicles.

The vascular system is made of numerous vascular bundles disposed upon two concentrically rings (at ***T. albiflora 'Aureo-vittata'***) or three concentrically rings (at ***T. fluminensis 'Albo-vittata'***): an external one, immediately under the pseudo-endodermis, and the others internal. The external ring comprises 12 leading fascicles, each with 1-3 xylem vessels, accompanied by very few xylem and phloem parenchyma, with insufficient collenchymas elements.

The internal ring (or the concentrically rings) are disposed in the fundamental parenchyma. All these fascicles are surrounded by a parenchymatic sheath and the xylem is replaced by an aquiferous gap, which can occupy up to 2/3 of the fascicle surface (at ***T. fluminensis 'Albo-vittata'***).

The leaf. The limb (**Fig. 4-6**). The epidermis seen upfront presents polygonal cells with straight lateral walls. Through transparency we can observe oxalate calcium crystals. In the upper epidermis there are presents unicellular hairs with pointed tip, in large number at the edges of the limb. The stomata of tetra-perigenous type are very numerous in the lower epidermis, disposed in parallel rows with the limb edge. In small number (at ***T. albiflora 'Aureo-vittata'***) we can find them in the upper epidermis, mainly towards the edges of the limb, thus the limb is amfistomatous.

In cross section, the limb had the shape of a ribbon, the median nervure being slightly prominent upon the inferior side of the limb.

The upper epidermis has rectangular, very high cells (occupying almost half of the limb thickness at ***T. albiflora 'Aureo-vittata'***), with hyaline appearance, with all walls thin, the external one being bulged and covered with a very thin cuticle. Towards the edges of the limb, the epidemical cells are diminishing and among them we can observe some bi-cellular hairs, with the basis at the level of the epidemical cells and with a terminal cell with pointed tip and thick walls.

The lower epidermis presents square cells (almost half of the height of those of the upper epidermis), of small dimensions upfront the medial nervure and at the edges of the limb, with all walls slightly thickened. Some cells have slightly undulated lateral walls but

all cells have bulge external walls and covered by a thin cuticle. From place to place we can notice small stomata, with very large substomatal chamber.

The middle nervure had a similar structure with the two taxa, presenting a vascular bundle covered by an obvious parenchymatic sheath. In both situations the xylem is very slightly developed, being represented by 1-2, respectively 3-4 vessels with slightly thickened and lignified walls, as well as by a few cells of xylem parenchyma. At ***T. fluminensis 'Albo-vittata'*** we can notice also elements of phloem. In the secondary nervures the fascicles presents a well defined parenchimatic sheath at ***T. albiflora 'Aureo-vittata'***, while at ***T. fluminensis 'Albo-vittata'*** this sheath is absent.

Between the nervures the mesophyll is homogenous towards the edges of the limb at both taxa, and in the rest is differentiated in palisade tissue and a spongy parenchyma at ***Tradescantia albiflora 'Aureo-vittata'*** and homogenous parenchyma at ***T. fluminensis 'Albo-vittata'.*** The palisade has only one layer of not so tall cells which contain chlorophyll in the green areas of the limb. The spongy parenchyma is bi-layered, with slightly rounded cells, with small intercellular space between them.

Conclusions

- The differences between the two taxa are more obvious at the limb level;
- The epidermis cells with large dimensions are adapted to the function of accumulating water. Between the development of the mesophyll and the size of the epidermis cells there is well defined correlation;
- The presence of the sclerenchyma around the leading fascicules in leaves mentioned in literature [3] has not been observed at the studied material.

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Explanation of figures:

Fig. 1. ***Tradescantia albiflora*** Kunth ***'Aureo-vittata'*** - Root structure (detail of cork and central cylinder).

Fig. 2. ***Tradescantia albiflora*** Kunth ***'Aureo-vittata'*** - Stem structure (middle level - detail of vascular bundle in cork) (x 700).

Fig. 3. ***Tradescantia albiflora*** Kunth ***'Aureo-vittata'*** - Stem structure (middle level - detail of vascular bundle in central cylinder) (x 700).

Fig. 4. ***Tradescantia albiflora*** Kunth ***'Aureo-vittata'*** – Upper and lower epidermis structure (details).

Fig 5. ***Tradescantia fluminensis*** Vell. ***'Albo-vittata'*** – Lower epidermis structure (details of trichomes).

Fig. 6. ***Tradescantia albiflora*** Kunth ***'Aureo-vittata'*** – Lamina structure (details)(x 700).

Fig. 7 ***Tradescantia fluminensis*** Vell. ***'Albo-vittata'*** – Lamina structure (details)(x 700).

Abreviations

cam. subst - substomatal chamber; **cel. ep** - epidermal cells; **cel. st** - stomatal cells; **end** -endodermis; **exd** - exodermis; **ep** - epidermis; **ep. i** - lower epidermis; **ep.s** - upper epidermis; **fs. cond** - vascular bundle; **lb** - phloem; **lm** - xylem; **mez** - mesophyll; **mxl** - metaxylem; **par. asimil** - asimilating parenchyma; **par. clz** – cellulosic parenchyma; **p. t** - hair; **sc** - cork; **tc. par** - parenchymatous sheat; **tc. sc** - sclerenchimatic sheat; **ţ. lc** - spongy parenchyma; **ţ. psd** - palisade parenchyma.

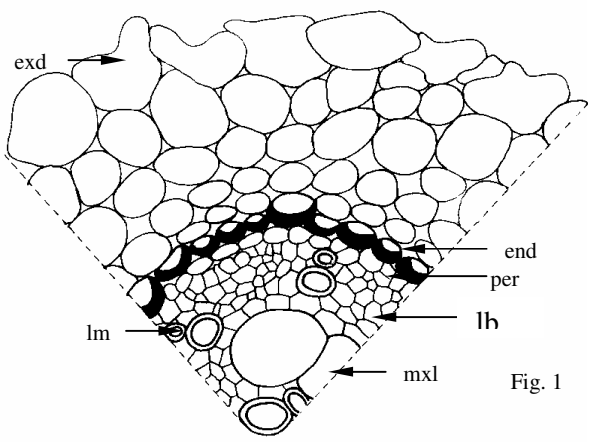


Fig. 1

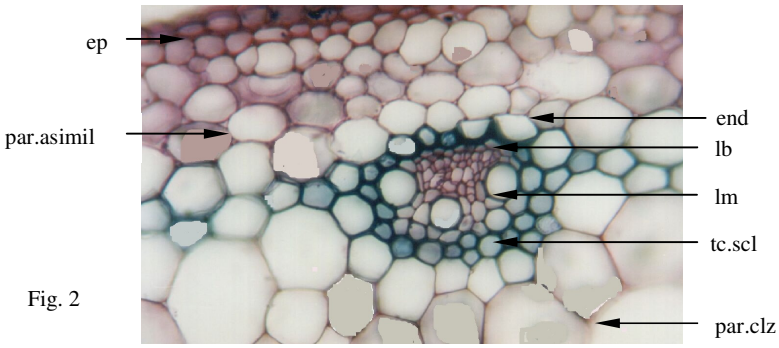


Fig. 2

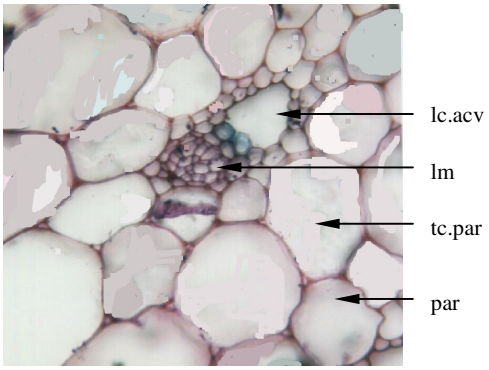


Fig. 3

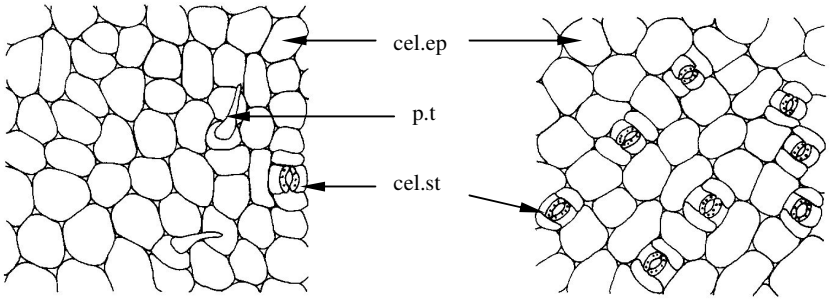
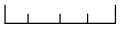


Fig. 4



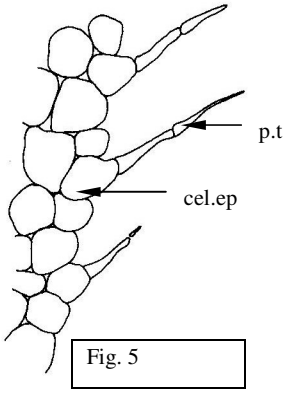


Fig. 5

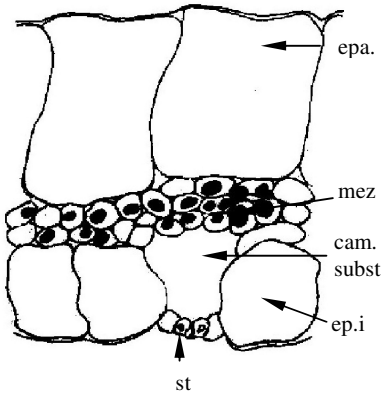


Fig. 7

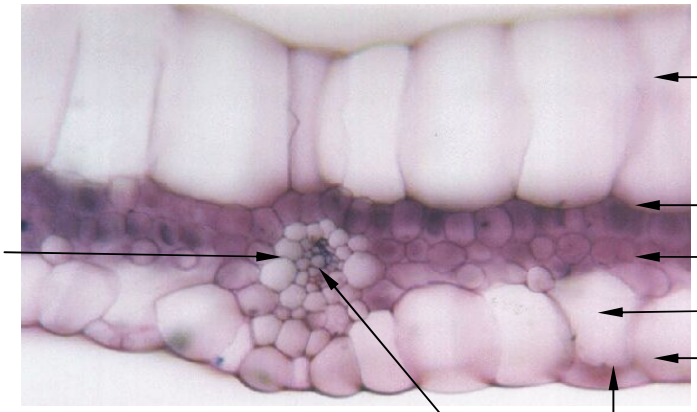


Fig. 6

Buletinul Grădinii Botanice Iaşi
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THE MORPHOLOGY AND ANATOMY OF STRUCTURE SOMATIC AND REPRODUCTIV OF THE SPECIES OF *PHOMOPSIS* (SACC.) BUBÁK

CRISTESCU CRISTINA*

Abstracts: The species of *Phomopsis* have the conidiomata eustromatic, pycnidial, and two types of spores; alpha and beta. Alpha-spores are hyaline, fusiform, straight, aseptate, usually biguttulate. Beta-spores are hyaline, filiform, straight or more often hamate, aseptate, very rare with oily drops.

Key words: *Phomopsis*, mycelium, conidiomata, spores.

Introduction

The genus *Phomopsis* (Sacc.) Bubák is a sporadic kind studied in România, slightly knowed from taxonomic, nomenclatural, citologic and ecologic.

As per the system of classification elaborated of Sutton in the year 1973, this the kind is framed in class *Coelomycetes*, the order *Sphaeropsidales*, the family *Sphaeropsidaceae*, the group *Phyallostromatineae* [2, 5].

The genus is remarked through the abundance of the species in micobiota of the globe (across 900), pathogenetic species to an impressive number of plants hosts, the majority be spermatofite [6].

Material and methods

In our analyses of fotonic microscopy utilized classic techniques of obtain microscopic preparations.

The protocol of thing for the procurance microscopic preparations contained the following stages: the division into sections of biological tissue, colouring with bleu ton in lactophenol Amann or Sudan III and the assembling. Were întocmite drawings microscopically used the clear chamber. The examinations in the electronic microscopy with sweeping permited the of a procurance tridimensional images, with complex emphases in what he looks structure of sporea and mycelium. The visualization of the images he achieved with a microscope of sweeping (SEM) of guy TESLA BS 301 to a tension of 15 Kv.

Results and discussions

The micoma them is of type mycelium, and conidiomele are of type picnidial, stromatice, in they formed, as a rule, two types of spores: alpha and beta.

The mycelium is endofit, intercelular, composed from furcate hife monopodial, septate, with the cells hifale at large uninucleate, the mycelium is hyalin, but to most species, after a certain time, is become darker becoming brown more or less intense, due to

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accumulation of melanins (**Fig. 1**). A special form of modify hifa are apresoria, They have the roles of fixation [3]. To the fungi from this these kinds structures were observate very rare.

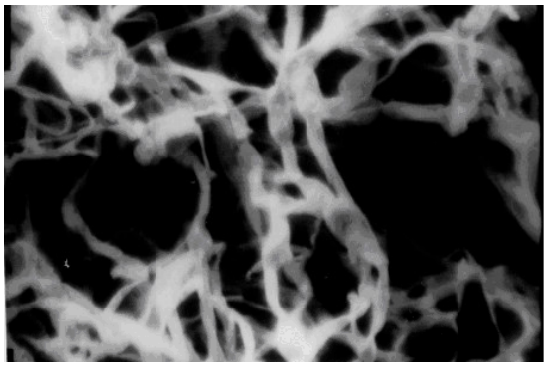

Fig. 1 *Phomopsis juglandina*: hyphae 1100x

The conidiomata are of types picnidial and is formed on the primary mycelium the haploid. Pycnidia are stromatic, units and or confluent, globuloase, ampuliforme, cylindrical, elipsoidale, conical, hemisferice, aplanate, unilocular or multiloculare. Peridia is thin his thick, brown as far as brown, to most many species with the *texture angularis* (**Fig. 2**). To different species of *Phomopsis* exists differences in the stratification peridiei. Ostiole is single, or several in complex conidiomata, circular, often papillate. The size conidiomata variation between limits nice and big, depending on the average conditions, with decern the nature of the substratum, humidity, temperature etc.

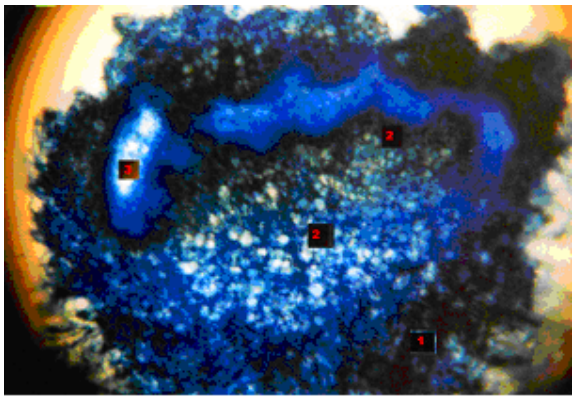

Fig. 2 *Phomopsis juglandina*: 1. stroma; 2. peridia; 3. conidiogenous cell

Conidiophores are branch out and septate at the base and above, occasionally short and only 1-2-septate, most frecvently multiseptate and filiform, hyaline, formed from the inner cells of the locular walls.

Conidiogenous cells is enteroblastic, phialidic, determinate, integrated [1]. The mechanism for form's sake conidia be in progress thus: conidia is elongated and is swollen were separate of a sept of the conidiogenous cell, between the internal wall of this from trace existing a structural continuity with the external wall of conidia.

The typical species of *Phomopsis* presents two tyes of spores: alpha and beta. The terms alpha and beta were used first of Diedicke in the year 1911 [4].

Alpha-spores are hyaline, fusiform, straight, aseptate, with the round acute heads and or round, membranous smooth. To her maturity presents most frequently two oily drops, sometimes still more many, these number be inducted of different physiological factors (**Fig. 3** & **4**).

Beta-spores are hyaline, filiform, straight or more often hamate, aseptate, membranous smooth his fine ornate, very rare with oily drops (**Fig. 4**).

Five species were described as having and of third types of gamma-spores: *Phomopsis hordei* from *Hordeum vulgare*, *Phomopsis oryzae* from *Oryza sativa*, *Phomopsis phyllanthi* from *Phyllanthus* sp., *Phomopsis amaranthicola* from *Amaranthus* sp. and *Phomopsis viticola* from *Vitis vinifera*. These are fusoizi up to subcilindrici, with acute his round apexul, base sometimes truncated, multigutulate, hyalin.

A taxonomic important character, seldom meeted to the species of *Phomopsis* are present the the deads hyphae, freely to apex, among conidiofori or the cells conidiogenous, named parafize. These structures were observate merely to *Phomopsis theae* Petch., *Phomopsis javanica* Uecker et D. Johnson and *Phomopsis longiparaphysata* Uecker.

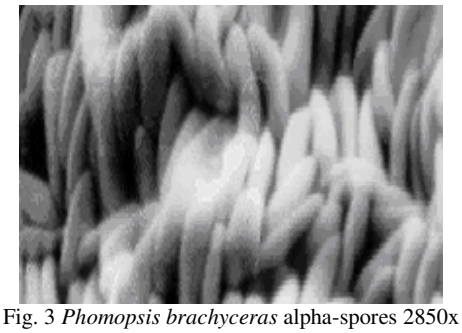

Fig. 3 *Phomopsis brachyceras* alpha-spores 2850x

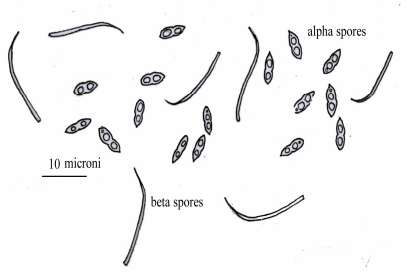

Fig. 4 *Phomopsis vaccinii*

Conclusions

- The genus *Phomopsis* (Sacc.) Bubák is a sporadic kind studied in România.
- The micoma them is of tyes mycelium, and conidiomas are of type picnidial.
- The typical species of *Phomopsis* presents two tyes of spores: alpha and beta.
- Alpha-spores are hyaline, fusiform, straight, aseptate, with the oily drops.
- Beta-spores are hyaline, filiform, hamate, aseptate, very rare with oily drops.

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Tomul 14, 2007

PLANTS FROM THE HABITAT DIRECTIVE – ANNEX IIb, PRESENTS IN ROMANIA

SÂRBU ANCA[*], OPREA ADRIAN[**], SÂRBU ION[**]

Summary: In order to assist the Romanian Government in fulfilling their obligations required to become a full member of the European Union, the Dutch Agency for International Business and Cooperation (EVD) developed a special project, focused on Habitat Directive plants, having as result a preinventory for a draft list of Natura 2000 sites (SCIs) for plant species. In this frame the Romanian botanists evaluated the existing lack of information concerning the plants distribution in Romania, the difference between national and internal approach and the requirements for well understand and document this group of taxa, very important for Habitat Directive implementation in Romania.

Key words: Romanian accession agreement, threatened plants, lack of information, up-date database

Introduction

The objective of this paper was to realize an overview on the existing information about the plant species from the Habitat Directive 92/43/EEC, present in Romania and nominated in the Accession Agreement of Romania to the European Union, including a clear discussion on the arrised problems and gaps, results and future needs [5].

This contribution is a result of the project "The implementation of the EU Nature Conservation legislation in Romania" developed in the framework of the PSO Pre-Accession programme (PPA) and financial supported by the Netherlands.

Methodology

The present overview used as working background international and national relevant documents and scientific reference publications, as:

- Habitat Directive 92/43/EEC
- The list of the plant taxa from Habitat Directive (Annex IIb) presents in Romania and nominated in the Accession agreement of Romania to the European Union
- Council Directive 92/43/EEC of 21st of May 1992 on the conservation of natural habitats and of wild fauna and flora
- The Romanian law no. 422/2001 (with all the modification and up-dating)
- The Romanian Flora (vol. 1-13) (1952-1976) [7]
- The flora of Romanian Pteridophyta and Spermatophyta [2]
- The Romanian Red List of vascular plants [3]
- The Critical list of vascular plants from Romania [4]
- Important Plant Areas in central and eastern Europe [1]
- Important areas for plants in Romania [5]

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- Special areas for plant conservation in Romania [Sârbu et al., 2007]

The existing information about those 50 plant taxa included in the Accession Agreement of Romania to the European Union was evaluated from the following point of views: distribution on the Romanian territory (location from the literature and location confirmed in the last 5 years), information about the populations state (unknown, poor, medium, good), conservation state (globally threatened, european threatened, national conservation value), distribution maps, photos with plants and their habitats and existing gaps in knowledges.

Results and discussions

From the whole amount of plants listed in Annex IIb of the Habitat Directive 92/43/EEC, are still present in Romania 50 species and subspecies (47 vascular plants and 3 briophytes): 8 taxa are globally threatened and 40 taxa are European threatened (**Table 1**).

Tab. 1. Plant for the Habitat Directive – on overview on the existing information in Romania

Taxa (Annex IIb)	Number of locations from the literature	Number of locations confirmed in the last 5 years	Information about the population state				Conservation state		
			un-known	poor	medium	good	Globally threatened	European threatened	National statute
1. *Adenophora lilifolia* (L.) Ledeb. ex A.DC.	22	6	•					•	-
2. *Agrimonia pilosa* Ledeb.	18	6	•					•	R
3. *Aldrovanda vesiculosa* L.	44	5		•				•	EN
4. *Angelica palustris* (Besser) Hoffm.	18	5	•					•	VU/R
5. *Apium repens* (Jacq.) Lag. – **uncertain presence**	3	-						•	EX
6. *Asplenium adulterinum* Milde	8	4	•					•	B, R
7. *Astragalus peterfii* Jáv.	3	1				•	•		A, EN/R
8. *Caldesia parnassifolia* (L.) Parl.	13	1	•					•	VU/R
9. *Campanula romanica* Săvul.	29	9				•	•		A, VU/R
10. *Campanula serrata* (Kit.) Hendrych	44	49			•			•	-
11. *Centaurea jankae* D.Brândză	6	3				•	•		A, EN
12. *Centaurea pontica* Prodan & Nyár.	2	3				•	•		A, EN
13. *Cirsium brachycephalum* Juratzka	15	-	•					•	B, VU/R
14. *Colchicum arenarium* Waldst. & Kit	3	2				•		•	B, EN/R
15. *Crambe tataria* Sebeók	29	12	•					•	VU/R
16. *Cypripedium calceolus* L.	41	19	•					•	V/R
17. ***Dianthus diutinus*** Kit. – **uncertain presence**	1	-						•	B, EX
18. *Draba dorneri* Heuff.	6	3	•				•	•	A, VU/R
19. *Dracocephalum austriacum* L.	4	2	•					•	R
20. *Echium russicum* J.F.Gmel.	22	27		•				•	-
21. *Eleocharis carniolica* Koch	39	6			•			•	-
22. *Ferula sadleriana* Ledeb.	2	1	•					•	VU/R

23.	*Galium moldavicum* (Dobrescu) Franco	3	2	•					•	b, VU/R
24.	*Gladiolus palustris* Gaud.	4	1	•					•	?
25.	***Himantoglossum hircinum*** ssp. ***caprinum*** (Bieb.) V. Koch	38	7	•					•	R
26.	*Iris aphylla* L. ssp. *hungarica* Hegi	49	5	•					•	-
27.	*Iris humilis* Georgi ssp. *arenaria* (Waldst. & Kit.) A. & D. Love	9	3	•					•	VU/R
28.	*Ligularia sibirica* (L.) Cass.	57	19		•				•	R
29.	*Liparis loeselii* (L.) Rich.	20	9	•					•	R
30.	*Luronium natans* (L.) Raf. – **uncertain presence**	2	-						•	EX
31.	*Marsilea quadrifolia* L.	42	7		•				•	VU
32.	*Moehringia jankae* Griseb. ex Janka	8	4			•			•	b, R
33.	*Paeonia officinalis* L. ssp. *banatica* (Rochel) Soó	5	1	•					•	b, R
34.	***Poa granitica*** Braun–Blanq. ssp. ***disparilis*** (Nyár.) Nyár.	25	4	•					•	A, R
35.	*Potentilla emilii-popii* Nyár.	9	8			•			•	b, VU/R
36.	*Pulsatilla patens* (L.) Mill.	21	3	•					•	R
37.	*Pulsatilla pratensis* (L.) Mill. ssp. *hungarica* Soó	15	1	•				•		-
38.	*Pulsatilla vulgaris* ssp. *grandis* Wenderoth	35	7	•					•	R
39.	*Salicornia veneta* Pignatti & Lausi	7	1	•				•		R
40.	*Saxifraga hirculus* L.	5	1				•		•	VU/R
41.	*Serratula lycopifolia* (Vill.) A.Kern.	17	3	•					•	VU/R
42.	*Stipa danubialis* Dihoru & Roman	4	1				•	•		A, R
43.	*Syringa josikaea* Jacq.f.	14	2				•		•	b, VU/R
44.	*Thesium ebracteatum* Hayne – **uncertain presence**	3	-						•	EX
45.	***Thlaspi jankae*** A.Kern.	5	3	•					•	b, R
46.	*Tozzia carpathica* Woł. (*Tozzia alpina* L. ssp. *carpathica* (Woł.) Dostál)	33	23		•				•	R
47.	*Tulipa hungarica* Borbás	9	3			•			•	R
48.	*Drepanocladus vernicosus* (Mitt.) Varnst.	**6**	6	•					•	-
49.	*Meesia longiseta* Hedw.	4	5	•					•	-
50.	*Sphagnum pylaisii* Brid.	1	-	•					•	-

Globally threatened (G) – (IUCN Red List + Habitat Directive – Annex IIb & IVb + Bern Convention – App I)
European threatened (EN) - (Habitat Directive – Annex IIb & IVb + Bern Convention – App I)
National statute (N) – according the "Romanian Red List", 1994 (Oltean & colab.): EX – extinct, A – endemic, R – Rare, b – near endemic, VU – vulnerable, EN – threatened, B – European areal, ? – without information.
In aldine letter – the taxa included under the Habitat Directive 92/43/EEC, as a result of Romania and Bulgaria accession to the EU.

***Crambe tataria* Sebeók**

Family name: Brassicaceae

Short description:
Vascular, perennial, herbaceous plant. Xeromezophyte.
Long root about 120 cm length.
Hairly and branched stalked about 60-100 cm length.
Big basal leaves, rhomb-shaped, 2-3 pinnately-sected with long leaf-stalk.
Short petiolate, pinnately-lobed stalk leaves.
Compact racemous, umbel-like inflorescence.
Flowers with white corolla about 5-6 mm length and 3 mm wide. Silicule about 5-7 mm length.
Plants growing in grassy and sunny hills.

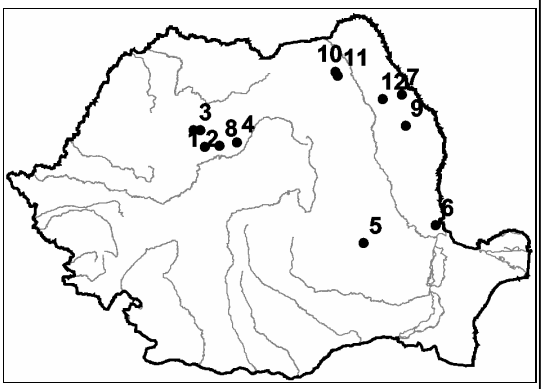
Habitat type: Grasslands

Regions of occurrence in Romania:
Continental, Pannonic, Steppic, Black Sea (bio-geographical regions)

Status in Romania (Romanian Red List):
Vulnerable/Rare

Relevance for EU: high (European threatened)

Occurrence in Romania:
- Location from literature: 29 sites
- Up-date information (5 years): 12 sites



Distribution map – actual recent occurrence:

1. Dealul cu Fluturi
2. Fânaţele Clujului – Copârşaie
3. Fânaţele Clujului – Valea lui Craiu
4. Fânaţele de pe Dealul Corhan – Săbed
5. Pâcle Sud – Vulcanii Noroioşi
6. Pădurea Parc "Gârboavele"
7. Pădurea şi Pajiştile de la Mârzeşti
8. Rezervaţia de bujori de stepă Zau de Câmpie
9. Rezervaţia Naturală "Fânaţele Glodeni"
10. Rezervaţia Naturală "Ponoare" – Bosanci
11. Rezervaţia Naturală "Frumoasa" – Moara
12. Rezervaţia Naturală "Valea lui David"

Gaps in knowledge:
- location, size of populations, rank in Romania, photos
- 35% of the information on the location is older than 30 years

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Fig. 1 *Crambe tataria* – Existing information and gaps in knowledges

The existing informations about these plants, nominated in the Accession Agreement of Romania to the European Union show many gaps in knowledge, especially with regard to their location, maps of distribution and populations state. For those 50 nominated taxa, 876 locations were identified from the botanic literature. Some of them have very large areas as Carpathian mountains or all the Romanian regions (Maramureş, Transilvania, Crişana, Banat, Oltenia, Muntenia, Moldova, Bucovina & Dobrogea). Unfortunately, we have up-date information for only about 220 populations, belonging to 38 taxa. For the other populations only the information from literature was available and this information is, in different proportions, older than 30 years. Four taxa nominated in the literature as present in Romania (e.g. *Apium repens*, *Dianthus diutinus*, *Luronium natans* and *Thesium ebracteatum*) have an uncertain presence in Romania.

In order to better underline the existing lack on information an example (*Crambe tararia*) has been presented in **Fig. 1**.

Conclusions

- The existing information about the 50 plants taxa from the Habitat Directive 92/43/EEC – Annex IIb is incomplete, not full up-date and breaked-up. Consequently it's not in accordance with the European requirements.
- A special programme needs to be developed in order to establish an up-date database on the Romanian plant taxa, nominated in the Habitat Directive – Annex IIb. The field activity made by botanists and phytocoenologists is required as a basic source of information. Without this type of activity the information will be not up-date, and the existing old, incomplete and an very general information will be continuous used.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

THE PROTECTED SPECIES INCLUDED IN ROMANIAN RED LIST FROM THE NATURAL PARK VÂNĂTORI-NEAMȚ

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Abstract: This article intends to present to you the protected plants from the Natural Park Vânători Neamț

Key words: Romanian Red List, protected species, species conservation

Introduction

This park is placed in north of Neamt County on the boundary with Suceava County, nearby some localities: Crăcăoani, Agapia, Vânători-Neamț, Tg. Neamț town and two resorts - Bălțăteşti and Oglinzi. From the geographical point of view, the park stretches over the eastern slope on Stânişoarei Mountains and Neamț Sub-Carpathian hills.The results of the investigation developed between the years 2004-2006, as well as the existing literature data in the field, on the floristic diversity of the Natural Park Vânători Neamț, put into evidence the presence of 982 chormophyte species (**Tab.1).**

Until now, from the studies performed, a number of 99 plants are protected, being included in Romanian Red Lists [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12].

Material and methods

The establishment of the protected plants was made on the basis of: *Red List of extinct endangered, vulnerable and rare higher plants of Romania flora* (Boşcaiu N., Coldea Gh., Horeanu Cl., 1994), *Rare vulnerable and endemic plants of Romania flora – The Red List* (Dihoru Gh., Dihoru Alexandrina, 1994), *The Red List of higher plants of Romania flora* (Oltean M., Negrean G., Popescu A., Roman N., Dihoru G., Sanda V., Mihăilescu S., 1994), *The threatened plants from Moldova* (Sârbu I., Oprea A., Lupu I., 2005) [13, 14, 15, 16].

Results and discussions

Until now, 99 species are included in Romanian Red List, such as: 6 endemic species, 72 rare species, 7 vulnerable species, one specie is endangered (*Hippocrepis comosa L.*), 3 disappeared species (*Potentilla thyrsiflora* Zimm., *Euphorbia brittingeri* Opis., *Thelypteris palustris* Schott) and 10 unthreatened species (**Tab. 1**) [13, 14, 15, 16, 17, 18].

The Natural Park Vânători Neamț has three natural reservations in which are protected plants such as: „The Silver Forest": *Genista tinctoria* L. ssp. *oligosperma* (Andrae) Borza, *Melampyrum pratense* L., *Listera ovata* (L.) R.Bv., „Copper Forest":

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Genista tinctoria L. ssp. *oligosperma* (Andrae) Borza, „The Oak Reservation Dumbrava": *Epipactis helleborine* (L.) Crantz, *Sisymbrium strictissimum* L. [17, 18]

One of the major objectives of Vânători Neamț Natural Park´s Administration is the keeping of biodiversity through the maintenance of the key species and ecosystems, as well as of the landscapes within the park. Starting to 2002, five monitoring protocols have been implemented in the field with the help of a team of volunteer biologists from different scientific institutions with which the park´s administration co-operates. These protocols are:

- Identification and mapping of species of tisa (*Taxus baccata*) - a species declared nature monument in Romania.
- Monitoring and mapping of breeding areas of the species of amphibians and lenctic habitats, focused mainly on the study of the species of *Triturus montandoni* - Carpathian endemism.
- Monitoring of oak sapling´s regeneration from Dumbrava Oak Reservation.
- Monitoring of storks which nest within the park – the storks being species that indicate ecosystems unaffected by the antropic impact.
- Monitoring of pastures within the park [18].

Tab. 1 Plants registered in various Romanian Red Lists

The Red List	Oltean M., Negrean G. & al. 1994	Boşcaiu N., Coldea Gh., Horeanu Cl., 1994	Dihoru Gh., Dihoru Alexandrina, 1994	In this article
1. Abies alba Miller	B E	-	-	-nt
2. Aconitum moldavicum Hacq. (*A. hostenum* Schur)	-	-	-	R Ed
3. Adenophora liliifolia (L.) A. DC.	-	-	V	V
4. Agrimonia repens L.	R	-	-	R
5. Alchemilla crinita Busev	R	-	-	R
6. Allium schoenoprasum ssp. *sibiricum* (L.) Hartman	R	-	-	R
7. Anacamptis pyramidalis L. (L.C.M. Richard)	V/R	-	-	V
8. Arnica montana L.	V	-	-	V
9. Asperula taurina ssp. *leucanthera* (G.Beck) Hayek	R	-	-	R
10. Athyrium distentifolium Tausch.	-	-	R	R
11. Carex depauperata Curt. ex.With	R	-	R	R
12. Carex disticha Huds.	R	-	-	R
13. Carex secalina Wahlenb.	R	-	R	R
14. Carex strigosa Huds.	R	R	R	R
15. Centaurea solstitialis L.	-	-	-	R
16. Centaurea melanocalathia Borbás *(C. phrygia* ssp. *melanocalathia* (Borbás) Dostál)	-	-	-	R Ed

17. Cephalanthera damasonium Miller (Druce)	-nt	-	-	-nt
18. Cephalanthera longifolia (L.) Fritsch	-nt	-	-	-nt
19. Cephalanthera rubra L. (L.C.M. Richard)	R	-	-	R
20. Cerasus mahaleb (L.) Miller	R	-	-	R
21. Chamerion dodonaei (Vill.) Holub	-	-	-	R
22. Cirsium decussatum Janka	B R	-	-	R
23. Cirsium grecescui Rony	R	-	R	R
24. Cnidium dubium (Schkuhr) Thell	R	-	R	R
25. Centaurea carpatica (Porcius) Porcius ssp. *raraurensis* (Prodan) Ciocârlan	A R	-	-	R
26. Cystopteris sudetica A.Br. et Milde	R	-	R	R
27. Dactylorhiza cordigera ssp. *cordigera* Fries (Soó)	R	-	-	R
28. Dactylorhiza maculata (L.) Soó	R	-	-	R
29. Dactylorhiza sambucina (L.) Soó	R	-	-	R
30. Dianthus campestris Bieb. ssp. *campestris*	R	R	V	R
31. Dianthus collinus Waldst et Kit. ssp. *glabriusculus* (Kit.) Thaisz	R	-	I	R
32. Dianthus superbus L.	R	-	-	R
33. Dryopteris cristata (L.) A. Gray	R	-	R	R
34. Epipactis atrorubens (Hoffm.) Besser	R	-	-	R
35. Epipactis helleborine (L.) Crantz	R	-	-	R
36. Epipogum aphyllum (Schmidt) Sw	R	V	R	R
37. Epipogium purpurata Sm.				R
38. Euphorbia brittingeri Opis.		-	I	Ex
39. Fragaria moschata Weston	K	-	-	-nt
40. Galium rotundifolium L.	-	-	R	R
41. Genista tinctoria L. ssp. *oligosperma* Andrae	-	-	-nt (Ed)	R Ed
42. Gentiana pneumonanthe L.	-	V	-	-nt
43. Gladiolus imbricatus L.	-	-	R	-nt
44. Gymnadenia conopsea ssp. *conopsea* (L.) R. Bv.	R	-	-	R
45. Gymnadenia odoratissima L. (L.C.M. Richard)	R	-	-	R
46. Helleborus odorus W. et K.	Ex	-	V	R
47. Hepatica transsilvanica Fuss	A nt	-	-nt Ed	R Ed

48. Hieracium virosum Pall.	-	-	R	R
49. Hippocrepis comosa L.	-	R	V	E Ed
50. Hyoscyamus niger L.	-	R	-	-nt
51. Juncus acutiflorus Ehrh. ex Hoffm.	-	-	-	R
52. Larix decidua ssp. *decidua* (Domin) Siman	b R	R	-	R
53. Legousia speculum-veneris (L.) Chaix	R	-	-	R
54. Leucanthemum waldesteinii (Schultz Bip.) Pouzar	B R	-	-	R
55. Listera ovata (L.) R. Bv.	-	-	-	R
56. Luzula forsteri (Sm.) DC.	R	-	-	R
57. Luzula luzulina (Vill.) Dalla Torre & Sarnth	R	-	R	R
58. Lychnis viscaria L. ssp. *atropurpurea* (Griseb.) Chater	R	-	R	R
59. Melampyrum nemorosum L.	-	-	R (K)	-nt
60. Melampyrum pratense L.	-	-	-	R
61. Mercurialis annua L.	-	-	R	R
62. Mercurialis ovata Steinb. et Hoppe	R	-	-	R
63. Microstylis monophyllos (L.) Lindley	R	-	-	R
64. Monotropa hypopitys L.	R	-	-	R
65. Neottia nidus-avis L. (L.C.M. Richard)	R	-	-	R
66. Orchys coriophora L. ssp. *coriophora* (Pollini) K. Richter	R	-	-	R
67. Orchys coriophora L. ssp. *fragrans* (Pollini) K. Richter	-	-	-	R
68. Orchys morio L. ssp. *morio*	R	-	-	R
69. Pedicularis exaltata Besser	R	-	-	R
70. Pedicularis sceptrum-carolinum L.	R	V	V	V
71. Petasites paradoxus (Retz.) Baumg.	K	-	-	R
72. Phleum bertolonii DC. (*H. nodosum* auct.non L.)	-	-	-	R
73. Pinus sylvestris L.	R	-	-	R
74. Platanthera bifolia L. (L.C.M. Richard)	R	-	-	R
75. Polemonium caeruleum L.	R	E	R	R
76. Potamogeton compressus L.	R	R	R	R
77. Potamogeton obtusifolius Mert. et Koch	-	-	-	V
78. Potentilla neumaniana Rchb.	R	-	R	R

79. Potentilla thyrsiflora Zimmeter	Ex	-	-	Ex
80. Ranunculus carpaticus Herb.	b R	-	-	R Ed
81. Ranunculus circinatus Sibth.	R	R	-	R
82. Ribes spicatum Robson	R	I	R	R
83. Rubus colemannii Bloxam. ssp. *colemannii*	R	-	-	R
84. Rumex obtusifolius L. ssp. *subalpinus* (Schur) Čelak	-	-	-	R
85. Salix bicolor Ehrh.	R	R	-	R
86. Scabiosa lucida Vill. ssp. *barbata* E.I. Nyárády	A R	-	-	R
87. Scabiosa columbaria L. ssp. *pseudobanatica* (Schur) Jáv. et Csapody	A R	-	-	R
88. Scandix pecten-veneris L. ssp. *pecten-veneris*	R	-	-	R
89. Scorzonera humilis L.	R	-	R	R
90. Serratula lycopifolia Vill.	V/R	-	-	V
91. Symphytum cordatum Waldst. et Kit.	-	-	-	R Ed
92. Sisymbrium officinale (L.) Scop.	-	-	E	-nt
93. Sisymbrium strictisimmum L.	-	-	E	-nt
94. Taxus baccata L.	V/R	V	R	V
95. Tetragonolobus maritimus (L.) Roth	-	-	-	R
96. Thelypteris palustris Schott	B E	-	-	Ex
97. Traunsteinera globosa (L.) Rchb.	R	-	-	R
98. Trolius europaeus L. ssp. *europaeus*	R	-	V	R
99. Valeriana dioica L.	R	-	-	R

Conclusions

From the studies performed until now was identified 982 chormophyte species, and a number of 99 plants are protected: 6 endemic plants, 72 rare plants, 7 vulnerable plants, one species is endangered (*Hippocrepis comosa*), 3 disappeared plants (*Euphorbia brittingeri, Potentilla thyrsiflora, Thelypteris palustris*) and 10 unthreatened species.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

114 NEW RECORDS FOR THE BISTRIȚA RIVER BASIN BETWEEN PIATRA NEAMȚ AND BACĂU TOWNS

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Abstract: The results presented in the article below were obtained after a study made in the Bistrița river inferior basin, between 2005 and 2006. This article presents 114 taxa that were not specified before in the area by any other scientists.

Key words: Bistrița river basin, Bacău, Piatra Neamț, new records, Moldova, Romania

Introduction

The studied area is situated on the lower course of Bistrița river in two counties from Moldova: Neamț and Bacău.

Geomorphologically speaking, the studied area lies on four natural units (1400 Km^2): Oriental Carpathians – the Goşmanu Mountains, Moldavian Sub Carpathians (with two subdivisions – Bistrița's Sub Carpathians and Cracău – Bistrița depression) and Moldavian Plateau on a small area between Racova and Bacău.

The climate is temperate – continental with different temperatures due to the landscape's altitude and by its forms and particularities. The climate is more continental in the East and a bit more moderate in the West, with cold, wet winters and hot, dryer summers.

The hydrographic network is represented by Bistrița and its affluents. The most important affluent in this sector (Piatra Neamț – Bacău) is Cracău, followed by streams like Calu, Iapa, Nechit, Trebiş, Negel and so on. By building hydropower stations on the river, appeared artificial lakes like Bacău, Buhuşi, Gârleni, Lilieci, Racova, Şerbăneşti.

Materials and method

For analyzing the vascular flora of the region were used the classical methods and the usual materials for this kind of research. The working stages begin with documentation and study of the bibliography, followed by a terrain research stage and then a herbarium stage, finally ended with a stage of data interpretation and a complete list of taxa.

The list with all the species identified in the field, is compared to the one extracted from bibliography [1 – 10, 11, 13 – 22, 24] and merged, in the end resulting a complete list of the vascular species that inhabit the area of interest.

For synonyms was used the paper: *Flora şi vegetația Moldovei* by T. Chifu and colaborators. Among the identification guides used are: *Flora României* (vol. I – XIII) 1952 – 1976; Ciocârlan V. – *Flora ilustrată a României. Pteridophyta et Spermatophyta*., 2000; Sârbu I. and colaborators – *Flora ilustrată a plantelor vasculare din estul României* (vol. I, II) 2001 and so on.

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In this article are presented only the new taxa for the region, taxa that were not specified before in the consulted scientific literature. The taxa are presented below in the botanical family's systematic order and in each family in alphabetical order, followed by a number given to the place where they were encountered (**Fig. 1**):

Bacău county: **1** – Bacău Lake, **2** – Mărgineni, **3** – Trebiş, **4** – Valea Budului, **5** – Trebiş – Seaca forestry road, **6** – Poiana, **7** – Hemeiuşi, **8** – Andrişeşti, **9** – Bogdan Vodă, **10** – Iteşti, **11** – Ciumaşi, **12** – Şurina (+ Lake), **13** – Gura Văii, **14** – Ilieşti, **15** – Racova, **16** – Racova – Buda, **17** – Racova Lac, **18** – Buhuşi;

Neamț county: **19** – Costişa, **20** – Frunzeni, **21** – Podoleni, **22** – Podoleni – Negriteşti, **23** – Hoiseşti, **24** – Mărgineni, **25** – Dochia, **26** – Doina, **27** – Doina – riverside coppice, **28** – Săvineşti, **29** – Dumbrava Roşie – Cut, **30** – Cernegura (Văleni village), **31** – Piatra Şoimului village, **32** – Piatra Şoimului – forestry road, **33** – Poieni village, **34** – Poieni - forestry road, **35** – Falcău forestry road, **36** – Rantău forestry road, **37** – Neguleşti, **38** – Borleşti, **39** – Borleşti – Nechit, **40** – Nechit Monastery, **41, 42** – Nechit - forestry road 1 and 2.

Fig. 1 Bistrița river inferior basin (Piatra Neamț – Bacău sector)

Results and discussions

Fam. *Lycopodiaceae*: *Lycopodium selago* L. – 32. Fam. *Equisetaceae*: *Equisetum hyemale* L. – 40; *E. sylvaticum* L. – 32. Fam. *Aspleniaceae*: *Asplenium ramosum* L. – 31, 32, 33, 34; *Dryopteris dilatata* (Hoffman) A. Gray – 5, 7, 32, 33, 34; *Matteucia struthiopteris* (L.) Tod. – 33, 34; *Polystichum aculeatum* (L.) Roth. – 32; *P. braunii* (Spenner) Fee – 32, 42. Fam. *Ranunculaceae*: *Aquilegia vulgaris* L. – 33; *Clematis alpina* Miller – 35, 36; *Consolida orientalis* Schrodinger – 19; *C. regalis* S. F. Gray ssp. *paniculata* (Host) Soo – 11;

Ranunculus acris L. ssp. *strigulosus* Hyl. – 33; *R. x variifolius* A. Nyar. – 7. Fam. *Ulmaceae*: *Ulmus pumila* L. – 15. Fam. *Fagaceae*: *Quercus pedulculiflora* C. Koch – 7. Fam. *Caryophyllaceae*: *Cerastium dubium* (Bast.) Guepin – 33; *Scleranthus annuus* L. ssp. *polycarpus* (L.) Bonnie et Leyens – 15, 38; *Silene armeria* L. – 31, 32, 33, 34; *S. dichotoma* Ehrh. ssp. *dichotoma* – 31, 32, 33, 34; *S. dioica* (L.) Clairv. – 31, 32, 33, 34; *S. italica* (L.) Pers. ssp. *nemoralis* (Waldst. et Kit) Nyman – 31, 32, 33, 34; *S. viscosa* (L.) Pers. – 19; *Stellaria neglecta* Weiche – 39; *S. uliginossa* Murray – 42. Fam. *Polygonaceae*: *Polygonum lapathifolium* L. ssp. *brittingeri* (Opiz) Jav – 11, 12; *P. lapathifolium* L. ssp. *incanum* F.W.Schmidt – 34; *P. minus* Hudson – 12, 19, 25, 26; *Rumex aquaticus* L. – 36; *R. longifolius* DC. in Lam. et DC. – 23. Fam. *Rosaceae*: *Alchemilla connivens* Buser – 40; *A. glabra* Neygenf – 31, 32, 33, 34; *Cerasus mahaleb* (L.) Miller – 34, 36; *Crataegus rhipidophylla* Gand. ssp. *rhipidophylla* – 16, 39; *Malus pumila* Miller – 15; *Potentilla ternata* C. Koch – 36; *Prunus cerasifera* Ehrh. – 7; *Rosa andegavensis* Bast – 15; *R. jundzilii* Besser – 40, 41; *R. micrantha* Sm. – 12, 16, 39; *R. nitidula* Besser – 12, 15, 16, 39, 40; *R. pendulina* L. – 41; *Rubus candicans* Weiche ex Reichenb. ssp. *phyllostachys* (P.J. Mueller) Gayer – 39, 40; *R. scleicheri* Weiche – 33, 34, 40. Fam. *Cesalpiniaceae*: *Gleditsia triacanthos* (L.) C. Koch – 5. Fam. *Fabaceae*: *Vicia dasycarpa* Ten. – 16, 20; *V. grandiflora* Scop. ssp. *grandiflora* – 11, 41, 42. Fam. *Eleagnaceae*: *Eleagnus angustifolia* L. – 8. Fam. *Aceraceae*: *Acer negundo* L. – 5. Fam. *Geraniaceae*: *Geranium pyrenaicum* Burm. fil. – 26. Fam. *Apiaceae*: *Anthriscus nemorosa* (Bieb.) Spregnel – 7; *Orlaya grandiflora* (L.) Hoffman – 31. Fam. *Hypericaceae*: *Hypericum humifusum* L. – 12; *H. terapterum* L. – 42. Fam. *Violaceae*: *Viola alba* Besser ssp. *denhardii* (Ten.) W.Beker – 16; *V. ambigua* Waldst. et Kit – 5, 6, 16; *V. canina* L. ssp. *ruppii* (All.) Schubler et Martens – 39, 40; *V. persicifolia* Schreber – 4, 16; *V. riviniana* Reichenb – 5, 7, 16, 39; *V. tricolor* L. ssp. *tricolor* var. *lutea* Peterm. – 41; *V. tricolor* L. ssp. *subalpina* Gaudin var. *subalpina* – 31. Fam. *Brassicaceae*: *Arabis planisiliqua* (Pers.) Reichenb – 21; *Brassica juncea* L. Gzerm – 11, 26; *Camelina alyssum* (Miller) Thell – 17, 18; *Cardamine amara* L. ssp. *opizii* (J. et C. Presl.) Celak – 34, 35; *C. flexuosa* With. – 26, 39; *Cardaminopsis arenosa* (L.) Hayek ssp. *arenosa* – 30; *Rorippa pyrenaica* (Lam.) Reichenb. – 36; *Sisymbrium strictissimum* L. – 19, 38. Fam. *Salicaceae*: *Populus x canescens* (Aiton) Sm. – 18. Fam. *Pyrolaceae*: *Pyrola rotundifolia* L. – 40. Fam. *Boraginaceae*: *Myosotis ramossissima* Rochel – 39, 41; *M. stenophylla* Knaf in Berctold et Opiz. – 35; *Pulmonaria rubra* Schott – 7, 16, 34; *Symphytum cordatum* Waldst et Kit – 5, 7, 32, 34, 36; *S. tannaicense* Steven – 36. Fam. *Lamiaceae*: *Mentha nemorosa* Willd. – 14; *Salvia pratensis* L. ssp. *dumetorum* (Andrz. ex Besser) – 7. Fam. *Scrophulariaceae*: *Verbascum crassifolium* Lam. – 36; *V. lychnites* L. ssp. *lychnites* – 38, 42; *V. speciosum* Schrader – 12; *Veronica agrestis* L. – 31, 32, 33, 34; *V. austriaca* L. ssp. *dentata* L. – 7, 8; *V. hederifolia* L. ssp. *triloba* (Opiz.) Celak – 8, 16; *V. montana* L. – 34, 41, 42; *V. opaca* Fries – 5, 6, 16, 38; *V. serpyllifolia* L. ssp. *humifusa* (Dikson) Syme – 36; *V. urticifolia* Jacq. – 32, 40. Fam. *Campanulaceae*: *Campanula rapunculus* L. – 14, 26, 39; *C. rotundifolium* L. – 40. Fam. *Rubiaceae*: *Galium divaricatum* Pourret ex Lam. – 7; *G. tenuissimum* Bieb. – 40; *G. uliginosum* L. – 32. Fam. *Caprifoliaceae*: *Sambucus racemosa* L. – 32. Fam. *Asteraceae*: *Achillea stricta* (Koch) Schleicher – 40; *Centaurea melanocalathia* Borbas – 34, 41, 42; *Helianthus tuberosus* L. – 8, 25; *Hieracium caesium* Fries – 40; *Inula oculi-christi* L. – 38; *Lactuca virosa* L. – 11; *Leontodon crispus* Vill. ssp. *crispus* – 20; *Senecio viscosus* L. – 26, 31; *Taraxacum hoppeanum* Griseb. – 36. Fam. *Liliaceae: Gagea minima* (L.) Ker. – 7, 8, 16, 18. Fam. *Orchidaceae*: *Dactylorhhizza maculata* (L.) Soo ssp. *schurii* (Klinge) Soo – 32. Fam. *Juncaceae*: *Juncus tenuis* Willad. – 23. Fam. *Cyperaceae*: *Carex canescens* L. – 34; *C. dioica* L. – 26, 33; *C. otrubae* Podp. – 41, 42; *C. pseudocyperus* L. – 36; *Cyperus*

serrotinus Rottb. – 8; *Rhynchospora alba* (L.) Vahl. – 36. Fam. *Poaceae*: *Echinichloa oryzoides* (Ard.) Frisch – 12; *Sesleria heufflerana* Schur – 31, 32, 33, 34.

Conclusions

The article presents the floristic records of 114 taxa (including two hybrids) previously not known from the area of interest that belongs to 32 botanical families. There are 76 genera, 111 species, 24 subspecies and 2 varieties. By now, the entire list of taxa that inhabit the area rises to 1.436, the new records presented here representing 7,93 %.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

CONSIDERATIONS REGARDING THE ALIEN PLANTS FROM MOLDAVIAN FLORA (ROMANIA), DELIBERATELY INTRODUCED BY MAN

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Summary: The most plant species cultivated in Moldavia (Romania) for various uses aren't native in this territory. Their introduction by man, from various geographical regions, started long time ago, in ancientness, and now it is also in a continuous evolution. The most of these plants are met in crop only but a small proportion of them, escape from crops (they turn to wildness), becoming elements of the spontaneous flora. Such plants named hemerophytes can cause peculiar damages to the natural or anthropic invaded ecosystems and their knowledge represents an essential support in the rational management of the biological immigration and invasion. After consulting a great lot of bibliographic sources and based on the field observations of the author in the last years, it results for the Moldavian territory a number of 169 vascular hemerophytes, among which 21.3% have an invasive character, 15.4 % are naturalized ones, and 63.3% are only occasional escaped from crops. The paper gives informations about geographical provenance of these species; period, place and reason of their introduction; types of affected habitats; first mention in the wild, and their current spreading in Moldavia.

Key words: alien plants, hemerophytes, introduction mode, invasive status.

The deliberately introduction by man of useful plants, from a geographical region to the other one, started long time ago, in Neolithic era, at the same time with the beginnings of the plant cultivation, occupation that gradually was extended from some domesticity centers of the wild plants (Proximal-Oriental, Chinese, Central-American, South-American, North-American, Neo-Guinean [20]), on all geographical regions populated by man. This phenomenon was determined by a lot of causes: the continuous extension of the cultivated fields; the frequent man's migrations from a geographical region to the other one (that began since antiquity); the movements of the troops in wars; the colonization of new territories; the extension of the trade etc.

Some of the cultivated plants introduced by man into a certain geographical region, after a more or less long phase of naturalization, escaped from culture, first on anthropic habitats, then on semi-natural and natural ones, they becoming constituents of the spontaneous flora in their adoptive country. Such alien (non-native, exotic) plants deliberately introduced by man into a certain area are known as *hemerophytes*, in contrast to the accidentally introduced ones, that are known as *xenophytes* [1; 10; 33; 35].

The constitution of alien (hemerophytic or xenophytic) floras got a remarkable magnitude at global level, since the second half of the last millenium, as a result of the intensification of the man's movement around the world, after the great geographical discoveries were possible. For this reason, the year 1500 is considered as a conventional limit between *archaeophytes* (plants immigrated before 1500) and *neophytes* (plants immigrated after 1500, till now) [10; 33 etc.].

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Material and method

The list of the alien plant species from Moldavia, deliberately introduced by man (hemerophytes), is based on a great lot of bibliographic sources, numerous herbarium data (IASI), and the field observations of the author in the last years. In the appreciation of the species' invasive status we took in consideration their chorology in Moldavia, the occupied habitats and their capacity of reproduction and formation of stable populations, without the human intervention. Thus, the species was grouped in three categories, namely: *casual*, *naturalized* and *invasive* [32]. We have utilized the nomenclature after Tutin et al. (eds) 1964-1980 [40]; Ciocârlan 2000 [6], and Oprea 2005 [29].

Abbreviations: arh-archaeophyte; **neo**-neophyte; **habit**-habitat (**h**-human-made (anthropic), **sn**-semi-natural, **n**-natural); **intr**.: introduced as…(**orn**-ornamental, **alim**-alimentary, **med**-medicinal, **fodd**-fodder, **arom**-aromatic, **spi**-spicy, **ol.**-oleaginous, **mell**-melliferous, **antieroz**.**-**anti-erosion, **tinct.–**tinctorial, **forest**-forestry, **ser.–**sericicultural, **text**-textile, **ins**-insecticide; **other**-other uses); **chorology**: **s**-single locality, **r**-rare (2-5 localities), **sp**-sporadic (> 5 localities, but not in abundance), **la**-locally abundant, **c**-common (in all territory, in abundance); **Moldavian counties**: **VN**-Vrancea, **GL**-Galaţi, **VS**-Vaslui, **BC**-Bacău, **NT**-Neamţ, **IS**-Iaşi, **BT**-Botoşani, **SV**-Suceava; **first mention**- first mention as a wild plant.

Results and discussions

As a result of our investigations, we find out that the hemerophytic flora of Moldavian territory includes 169 vascular species (with 22 species moreover in relation to anterior evaluations [37]), including 9 subspecies and 1 variety, from 126 genera. These taxa belong to 53 plant families among which the best represented are the next: *Asteraceae* (20 species), *Fabaceae* (18 species), *Poaceae* (11 species), *Brassicaceae* (10 species), *Lamiaceae* (10 species), *Rosaceae* (9 species), *Malvaceae* (6 species), *Solanaceae* (6 species), *Polygonaceae* (5 species) and *Chenopodiaceae* (5 species).

Geographical origin. The most hemerophytic alien species in the flora of Moldavia originate from Mediterranean basin (32.5%), Asia (30.2%) and America (26.6%), while a small percentage of them have their origin in Central, West and South Europe (5.91%), Africa (4,14%), or in the pan-tropical regions (0.59%) (**Fig. 1**), as follows:

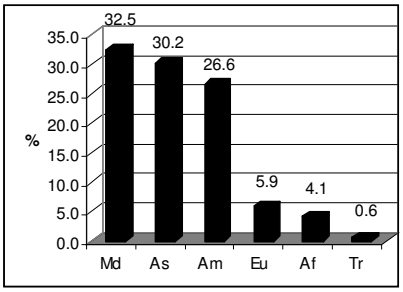

Fig. 1 Geographical origin of hemerophytes

– Asian species: *Ailanthus altissima, Callistephus chinensis, Commelina communis, Glycine max, Hemerocallis fulva, Koelreuteria paniculata, Lycium barbarum, Malva verticillata, Morus alba, Phytolacca esculenta, Polygonum aubertii, P. orientale, Polystichum falcatum, Reynoutria japonica, R. x bohemica, Rosa rugosa, Spiraea japonica* (E Asia); *Caragana arborescens, Thladiantha dubia* (NE Asia); *Acorus calamus, Duchesnea indica, Impatiens balsamina, I. glandulifera* (SE Asia); C*amelina sativa (?), Panicum miliaceum, Ulmus pumila* (C & E Asia); *Artemisia dracunculus, Atriplex hortensis, Dracocephalum moldavica, Elaeagnus angustifolia, Fagopyrum esculentum, Gypsophila acutifolia, G. elegans, Kochia scoparia, Medicago sativa, M. x varia (?), Triticum aestivum* (C Asia); *Artemisia annua, Avena barbata, A. sterilis* subsp. *ludoviciana, A. strigosa, Secale cereale* (C and SW Asia); *Anethum graveolens* (S Asia); *Balsamita major, Cannabis sativa* subsp.

sativa (SW Asia); *Carthamus tinctorius, Lonicera tatarica, Prunus armeniaca, P. cerasus, P. domestica, Setaria italica* (W Asia);

– Mediterranean (including sub-Mediterranean) species: *Alcea rosea, Allium ampeloprasum, Amaranthus lividus, Antirrhinum majus, Armoracia rusticana, Borago officinalis, Brassica rapa* subsp. *rapa* & subsp. *oleifera, Briza maxima, Calendula officinalis, Castanea sativa, Chenopodium foliosum, Colutea arborescens, Dianthus barbatus* subsp. *barbatus, Eruca vesicaria, Euphorbia lathrys, E. oblongata, Hemerocallis lilioasphodelus, Hyssopus officinalis, Iberis umbellata, Lallemantia iberica, Lathyrus sativus, Lavatera olbia, L. trimestris, L. cretica, Lolium multiflorum, Lonicera caprifolium, Lunaria annua* subsp. *annua, Lupinus albus, Malva moschata, Melissa officinalis, Mentha spicata, M. x gentilis* (?), *M. x piperita* (?), *Morus nigra, Narcissus poeticus* subsp. *poeticus, Nigella damascena, N. sativa, Papaver somniferum, Pisum sativum, Raphanus sativus, Reseda odorata, R. phyteuma, Rubia tinctorum, Ruta graveolens, Salvia officinalis, Satureja hortensis, Silybum marianum, Sinapis alba* subsp. *alba, Spartium junceum, Stachys byzantina, Tanacetum parthenium, Trigonella caerulea, T. foenum-graecum, Vicia articulata, V. sativa* subsp. *sativa.*

– American species: *Acer negundo, Amaranthus hypochondriacus, Amorpha fruticosa, Asclepias syriaca, Aster x salignus, A. x versicolor, Catalpa bignonioides, Coreopsis tinctoria, Datura inoxia, Echinocystis lobata, Euphorbia marginata, Gleditsia triacanthos, Helianthus annuus, H. decapetalus, H. tuberosus, Juglans nigra, Lupinus polyphyllus, Oxybaphus nyctagineus, Panicum capillare, Parthenocissus inserta, P. quinquefolia, Phacelia tanacetifolia, Phytolacca americana, Rhus typhina, Robinia pseudacacia, Rudbeckia laciniata, Sagittaria latifolia, Solidago canadensis, Tradescantia virginiana, Vitis vulpina* (N America); *Cosmos bipinnatus, Cucurbita pepo, Tagetes patula, Zinnia elegans* (C America); *Amaranthus cruentus, Chenopodium ambrosioides, Ipomoea hederacea, I. purpurea, I. tricolor, Lycopersicon esculentum, Mirabilis jalapa, Nicandra physalodes, Nicotiana alata, Portulaca grandiflora, Solanum tuberosum* (S America).

– European species: *Ribes rubrum* (W Europe); *Cymbalaria muralis, Portulaca oleracea* (S Europe); *Brassica nigra* (S & W Europe); *Cyclamen purpurascens, Lilium bulbiferum* (C Europe); *Artemisia abrotanum, Juglans regia* (C & SW Europe); *Aesculus hippocastanum* (Balc.); *Prunus cerasifera* (Pont.-Balc.).

– African species: *Chenopodium schraderianum, Phalaris canariensis, Sorghum sudanense, Vicia faba* (Africa); *Citrullus colocynthis, Coriandrum sativum, Saxifraga cymbalaria* var. *cymbalaria* (N Africa & W Asia).

– Pan-tropical species: *Vallisneria spiralis.*

Place and period of plant introductions. The introduction of exotic plants on the Moldavian territory, mainly from Central-Western Asia and Mediterranean basin, started long time ago, at the same time with the expansion of the proximal–oriental Neolithic agriculture towards the western region of the Mediterranean basin, and, through the Danube valley, toward Central and NW Europe [20].

Various species native from Central or Western Asia (*Triticum dicoccon*, *T. aestivum*, *T. durum*, *Hordeum vulgare, H. distichon, Panicum miliaceum, Cannabis sativa, Prunus insititia*), Mediterranean basin (*Vicia ervilia, Pisum sativum*), Southern Europe (*Triticum spelta*), Pontic-Balcanic regions (*Prunus cerasifera*), Northern Africa (*Vicia faba*) and so on, were already cultivated in the IV-III millennium b.ch., by Neolithic populations from Moldavia [27].

This introduction of exotic plants was gradually made by farmers, traders, navigators, missionaries, diplomats, lovers of flowers, healers, settlers, on the same time with the extension of agricultural fields, rise of urban localities and progress of gardening.

After the retreat of Romans from Dacia, the destructions and the instability due to the frequent invasions of migratory races, for almost a millennium and a half, stopped this process [43] which got a new magnitude only after the consolidation of the Moldavian state, when, around the palaces, mansions, inns or monasteries, but also in the crops, more and more plant species began to be introduced from more and more distant regions (especially from Eastern Asia, America etc.).

Since the 19th century, the introduction of exotic plants got a quicker course, especially after 1856, when A. Fătu founded at Iaşi the first botanical garden in Romania. In that garden, up to 1870 year, over 2350 vascular plant species were cultivated [12], about 50% of them with an exotic provenance. From the same period, a lot of parks of monarch or boyar palaces also date; on such places, competent gardeners from Germany, Switzerland or other occidental countries, planted numerous exotic species of trees, shrubs, and lianas, as for instance at Văleni-Neamț (58 exotic taxa) [4], Climeşti-Neamț (18 exotic taxa) [18], Țibăneşti-Iaşi (28 exotic taxa) [19] etc.

Nowadays, this process is also in a continuous progress, thousands of exotic plants being introduced and kept in culture into various didactic or scientific collections (botanical gardens, didactic or experimental lots of some universities or research institutions), public or private gardens and parks, along the streets, into crops, nurseries, cemeteries etc.

In present, some of the most important introduction centers of exotic (cultivated) plants in Moldavia are as follows:

– Botanical Garden Iaşi: in 1995, here they were cultivated 3522 exotic plant taxa, which originated from all floristic domains of the world: Holarctic (1830 taxa), Neo-tropical (1222 taxa), Palaeo-tropical (357 taxa), Australian-Antarctic (67 taxa), Pan-tropical (46 taxa) [36];

– Dendrological parks Hemeiuş and Dofteana (Bacău county), where there are 1411, respectively 677 woody plant taxa, for the most part with an exotic origin [22; 23];

– Botanical Garden Galați (although it was recently founded - in 1992, it already shelters over 2500 plant taxa);

– Public or private gardens and parks from various localities. The ornamental woody flora of a number of 43 urban localities from all Moldavia includes 403 species [25], the most of them being exotics. In Vrancea county, 177 (83%) of the 214 ornamental plant species, which are cultivated in different rural and urban localities [7], have an exotic provenance, too. In the northern part of Moldavia, 76 exotic ornamental species was identified, and 5 of them were already escaped from culture [21].

– Research institutions for agricultural plants (Podu Iloaiei, Bacău, Secuieni, Suceava etc.);

– Sylvan or horticultural nurseries;

– Firms what trade in ornamental plants or designing and making centers for green spaces etc.

Among all these species which were introduced in the culture, along the time, only a small percentage have escaped from the gardens or crops (they have returned into wildness), becoming ephemeral or permanent components of the spontaneous flora on this area. In the hemerophytic flora of Moldavia, the archaeophytes have a smaller proportion (53 species) in comparison with the neophytes (116 species), as a result of a more

accelerated introduction of exotic plants in the past few centuries in comparison with the ancient or medieval periods.

We include in the archaeophytes category, those old cultivated plants, which meantime have become subspontaneous ones, as the majority of hemerophytic species with Central or Western Asian, Mediterranean, Central or Southern European origin (*Armoracia rusticana, Atriplex hortensis, Brassica nigra, B. rapa, Calendula officinalis, Eruca vesicaria, Fagopyrum esculentum, Juglans regia, Melissa officinalis, Panicum miliaceum, Portulaca oleracea, Tanacetum parthenium, Vicia articulata* etc.). The neophytes are especially represented by American species as well as by the majority of species native from Eastern Asia, Africa and other far-away regions, and which have reached Europe only after the great geographical discoveries were possible, starting with the 15 th-16th centuries.

Purpose of plant introductions. Analyzing the purpose of introduction of these plants into culture, we find that the majority of them were introduced as ornamental plants (100 species), so we can confirm that horticulture is a major factor of continuous enrichment of alien flora [13; 17 etc.]. Less species were introduced for other uses: alimentary (29 species), medicinal (23 species), fodder (22 species), aromatic and spicy (19 species), oleaginous (9 species), melliferous (7 species), tinctorial (5 species), forestry and anti-erosion (5 species) etc. (**Fig. 2**).

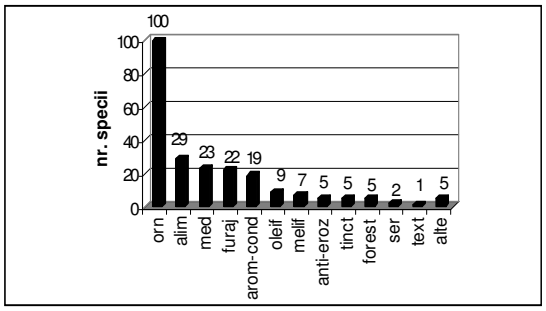

Fig. 2 Purpose of plant introduction

Certainly, a lot of species can be found in two or more categories. For instance, *Balsamita major, Borago officinalis, Calendula officinalis, Malva verticillata, Salvia officinalis* are both ornamental and medicinal plants; *Brassica rapa* subsp. *rapa*, *Cucurbita pepo, Pisum sativum, Panicum miliaceum* were introduced both as alimentary plants and for their fodder values etc.

At the same time, some hemerophytes (for instance, at Iaşi, *Euphorbia oblongata* [34]) were initially introduced not for a certain practical utility, but for the enrichment of some scientific or didactic collections (botanical gardens, dendrological parks etc.).

The habitats affected by invasion of hemerophytes are firstly the human-mad ones (surrounding of private or public garden, roadsides, railways, train stations, rubbles, waste depots, wastelands etc.). On these sorts of habitats, the majority of alien plants escaped from culture were met. Less species (proving a high capacity of competition against the native plants or as a result of some structure disturbances of the plant communities) are able to penetrate not only in the human-made habitats but also in the semi-natural or natural ones (banks, ruderal meadows, bushes, canals, ponds, and respectively, meadows, forests, rivers, everglades), as the next: *Acer negundo*, *Acorus calamus*, *Ailanthus altissima*, *Amorpha fruticosa*, *Armoracia rusticana*, *Cyclamen purpurascens*, *Echinocystis lobata*, *Helianthus tuberosus, Impatiens glandulifera, Lolium multiflorum*, *Lycium barbarum*, *Medicago sativa*, *Melissa officinalis*, *Parthenocissus inserta*, *P. quinquefolia*, *Polystichum falcatum*, *Reynoutria japonica, R. x bohemica*, *Robinia pseudacacia*, *Sagittaria latifolia*,

Saxifraga cymbalaria var. *cymbalaria*, *Solidago canadensis*, *Spiraea japonica*, *Tanacetum parthenium*, *Trigonella caerulea*, *Vallisneria spiralis*, *Vicia sativa* subsp. *sativa* etc.

The invasive status. Taking into account their present-day spread on the area, state of populations and affected habitats, we consider that among the 169 alien species, deliberately introduced by man in Moldavia, 36 species (21.3%) have an **invasive character**, they being able to reproduce themselves, without human intervention, and to extend their area, both on anthropic and semi-natural or natural habitats. We give below an alphabetical list of invasive hemerophytes from Moldavia:

Acer negundo: neo; intr.: orn, forest; habit.: h, sn, n; orig.: N America; spread: VN.sp, VS.sp, GL.sp, BC.sp, NT.sp, IS.sp, BT.sp, SV.r; first mention: 1958 (leg.: 1952)-Fârţăneşti (GL) [2].

Ailanthus altissima: neo; intr.: orn; habit.: h, sn; orig.: East Asia; spread: VN.sp, GL.sp, VS.sp, BC.sp, NTsp, IS.sp-la, BT.r; first mention: 1906 -Iaşi (IS) [34].

Amaranthus lividus: arh.; intr.: alim (acc.?); habit.: h; orig.: Md; spread: VN.sp, GL.sp, VS.r, BC.sp, NT.sp, IS.sp, BT.r, SV.r; first mention: (1835) 1853-Moldavia [11]; 1842-1848 (as *A. blitum* L.)-Moldavia [16]; 1938-Aroneanu (IS) [30].

Amorpha fruticosa: neo; intr.: orn; habit.: h, sn; orig.: N America; spread: VN.r, GL.sp, VS.r, BC.r, NT.r, IS.sp-la, BT.r, SV.r; first mention: 1898-Iaşi (IS) [15].

Armoracia rusticana: arh.; intr.: spi; habit.: h, sn; orig.: SE Europe-W Asia; spread: VN.sp, GL.sp, VS.sp, BC.sp, NT.sp, IS.sp, BT.sp, SV.sp; first mention: 1836-Moldavia [8]; (1835)1853 (as A*rmoracia vulgaris*)-Brateş (NT) [11].

Artemisia annua: arh. (?); intr.: arom, ins; habit.: h; orig.: C, SW Asia; spread: VN.c, GL.c, VS.c, BC.c, NT.c, IS.c, BT.c, SV.c; first mention: 1842-1848-Moldavia [16].

Brassica nigra: arh.; intr.: spi, med; habit.: h; orig.: S, W Europe.; spread: VN.sp-la, GL.sp, VS.sp, BC.sp, NT.sp, IS.sp, IS.sp-la, BT.sp-la, SV.sp-la; first mention: 1842-1848 (as *Sinapis nigra*)-Moldavia [16].

Chenopodium foliosum: neo; intr.: alim; habit.: h; orig.: Md; spread: BC.r, NT.sp, IS.sp, BT.s, SV.sp; first mention: 1836 (as *Blitum virgatum*)-Moldavia [8]; 1841-Neamţ Monastery (NT) [38].

Duchesnea indica: neo; intr.: orn; habit.: h; orig.: Asia; spread: IS.s-la; first mention: 1871 (as *Fragaria indica*)-Iaşi (cult.) [12]; 1949-Iaşi (IS) [14]. Although it is cited only from Iaşi county, this species can be considered as an invasive one, taking in consideration their whole naturalization, and their continuous extension through the urban spaces of Iaşi [44].

Echinocystis lobata: neo; intr.: orn (acc. ?); habit.: h, sn, n; orig.: N America; spread: VN.r, GL.r, VS.sp, BC.sp, NT.sp, IS.sp, BT.sp-la, SV.sp; first mention: 1968-Bănceşti (VS) [39]; 1971 (leg. 1964-herb. IASI)-Izvorul Muntelui (NT) [45].

Eruca vesicaria: arh.; intr.: ol.; habit.: h; orig.: Md; spread: VN.r, GL.sp, VS.sp, BC.s, IS.sp, BT.r; first mention: 1938-Aroneanu, Cristeşti (IS) [30].

Gleditsia triacanthos: neo; intr.: orn; habit.: h ; orig.: N America; spread: VN.sp, GL.sp, VS.sp, BC.r, NT.r, IS.sp, BT.sp; first mention: 1898-without locality (cult.) [15]; 1934-Iaşi (IS) [34].

Helianthus decapetalus: neo; intr.: orn; habit.: h, sn, n; orig.: N America; spread: VS.sp-la, BC.sp-la, NT.s, IS.s, BT.s; first mention: 1972-Măgura, Letea (BC) [24].

Helianthus tuberosus: neo; intr.: orn, fodd; habit.: h, sn, n; orig.: N America; spread: VS.r, BC.sp-la; NT.s, IS.r; first mention: 1841-Moldavia [38]; 1945-Cucuteni (IS) [41].

Impatiens glandulifera: neo; intr.: orn; habit.: h, sn, n; orig.: Asia-Himalaya; spread: VN.s, BC.r, NT.r, IS.s, SV.sp; first mention: 1972-Broşteni (SV), Comăneşti, Brusturoasa (BC) [24], Vama (SV) [28].

Kochia scoparia: arh.; intr.: brooms, orn; habit.: h; orig.: Asia; spread: VN.sp-la, GL.c, VS.sp-la, BC.r, NT.r, IS.sp-la, BT.r; first mention: 1841 (as *Chenopodium scoparia*) –Moldavia [38]; (1835) 1853-Moldavia [11]; 1938-Iaşi (IS) [30].

Lolium multiflorum: neo; intr.: fodd; habit.: h, sn; orig.: Md; spread: VN.r, VS.r, BC.r, NT.r, IS.r, BT.r, SV.sp; first mention: 1939-Slănic (BC), Neamț Monastery (NT) [32].

Lycium barbarum: neo; intr.: orn; habit.: h, sn; orig.: E Asia; spread: VN.c, GL.c, VS.c, BC.c, NT.c, IS.c, BT.c, SV.c; first mention: 1842-1848 (as *L. europaeum*)-Moldavia [16].

Medicago sativa: neo; intr.: fodd; habit.: h, sn, n; orig.: Asia; spread: VN.sp, GL.sp, VS.sp, BC.sp, NT.sp, IS.sp, BT.sp, SV.sp; first mention: 1841-Galaţi (GL) [38].

Medicago x varia: neo; intr.: fodd; habit.: h, sn, n; orig.: x; spread: VN.sp, GL.r, VS.s, BC.r, NT.sp, IS.sp, BT.sp, SV.r; first mention: (1835)1853 (as *M. media*)-Moldavia [11]; 1926- Nemțişor basin (NT) [5].

Melissa officinalis: arh.; intr.: med, mell, arom; habit.: h, sn, n; orig.: Md; spread: VN.r, GL.r, VS.r, BC.r, NT.r, IS.r, BT.r, SV.r; first mention: 1842-1848-Moldavia [16]; 1863-Focşani (VN), Bacău (BC), Neamț (NT) [9].

Morus alba: arh.; intr.: orn, alim, ser, ind; habit.: h, sn; orig.: E Asia; spread: VN.sp, GL.sp, VS.sp, BC.r, NT.r, IS.sp, BT.sp, SV.r; first mention: Edel (1835)1853-Moldavia [11]; 1841-Moldavia [38].

Panicum capillare: neo; intr.: orn, fodd; habit.: h; orig.: N America; spread: VN.r-la, GL.sp-la, VS.r-la, IS.r-la, SV.r; first mention: 1983-Socola (IS) [26].

Panicum miliaceum: arh.; intr.: alim, fodd; habit.: h; orig.: Asia; spread: VN.sp-la, GL.r, VS.s, BC.r, NT.r, IS.sp-la, BT.s; first mention: 1836-Moldavia (cult.) [8]; 1923-Războeni (NT) [31].

Parthenocissus inserta: neo; intr.: orn; habit.: h, sn; orig.: N America; spread: NT.r, IS.r; first mention: 2006-Iaşi (IS), Bicaz (NT) (inedit).

Parthenocissus quinquefolia: neo; intr.: orn; habit.: h, sn ; orig.: N America; spread: VN.s, IS.r; first mention: 1945-Miroslava (IS) [41].

Portulaca oleracea: arh.; intr.: alim (acc. ?); habit.: h; orig.: S Eur.; spread: VN.c, GL.c, VS.c, BC.c, NT.c, IS.c, BT.c, SV.c; first mention: (1835)1853-Moldavia [11]; 1842-1848-Moldavia [16].

Reynoutria japonica: neo; intr.: orn; habit.: h, sn, n; orig.: E Asia; spread: VN.s, BC.s, NT.sp, IS.r, SV.r; first mention: 1971 (leg.: 1969)-Lunca Bistricioarei (NT) [45].

Reynoutria x bohemica: neo; intr.: orn; habit.: h, sn, n; orig.: x (E Asia); spread: NT.r-la, IS.s; first mention: 2006-Broşteni, Galu (NT), Iaşi (IS) (inedit).

Robinia pseudacacia: neo; intr.: orn, forest, mell; habit.: h, sn; orig.: N America; spread: VN.c, GL.c, VS.c, NT.c, IS.c, BT.c, SV.c; first mention: (1835)1853-Moldavia [11]; 1836-Moldavia [8].

Setaria italica: arh.; intr.: fodd; habit.: h; orig.: Asia; orig.: W Asia; spread: VN.r, GL.sp, VS.sp, BC.r, IS.sp, BT.s, SV.r; first mention: 1836 (as *Pennisetum germanicum*)-Moldavia [8]; 1883-Adjud (VN) [3].

Solidago canadensis: neo; intr.: orn; habit.: h, sn; orig. N America; spread: VN.r, VS.r, BC.r, NT.r, IS.r-la, BT.r; first mention: 1898-Dragomireşti (NT) (cult.) [15].

Tanacetum parthenium: arh.; intr.: orn; habit.: h, sn; orig.: Md; spread: VN.r, GL.r, VS.sp, BC.sp, NT.s, IS.r, BT.r, SV.s; first mention: (1835)1853-Moldavia [11]; 1841-Moldavia [38].

Thladiantha dubia: neo; intr.: orn; habit.: h; orig.: NE Asia; spread: VS.r, BC.sp, NT.r, IS.r, BT.r, SV.s; first mention: 1947-Iaşi (IS) [42].

Trigonella caerulea: arh ?; intr.: fodd; habit.: h, sn, n; orig.: Md; spread: GL.r, VS.sp, BC.sp, NT.r, IS.sp-la, BT.s; first mention: (1835)1853 (as *Melilotus coerulea*)-Moldavia [11]; 1898-Bacău (BC) [15].

Vicia sativa subsp. ***sativa***: arh.; intr.: fodd; habit.: h, sn, n; orig.: Md; spread: VN.c, GL.c, VS.c, BC.c, NT.c, IS.c, BT.c, SV.c; first mention: 1836 (as *V. angustifolia*)-Moldavia [8]; 1883-Bârlad (VS), Ferăstrău, Verşeşti (BC) [3].

Other 26 species (15.4%) can be considered as naturalized ones, as they form stable populations without human aid, especially on the anthropic habitats, although they haven't shown till now a great capacity for expansion. Populations of these species are sometimes locally in abundance and if the future evolutions of genetic, ecologic and anthropic factors will be favorable to them, they can be considered as potential invasive ones: *Acorus calamus, Atriplex hortensis, Calendula officinalis, Callistephus chinensis, Cannabis sativa* subsp. *sativa, Chenopodium schraderianum, Commelina communis, Cosmos bipinnatus, Cymbalaria muralis, Dianthus barbatus* subsp. *barbatus, Dracocephalum moldavica*, *Elaeagnus angustifolia, Ipomoea purpurea, Juglans regia, Malva verticillata, Mentha spicata, Morus nigra, Oxybaphus nyctagineus, Phacelia tanacetifolia, Phalaris canariensis, Phytolacca americana, Polygonum aubertii, P. orientale, Prunus cerasifera, Saxifraga cymbalaria* var. *cymbalaria, Sinapis alba* subsp. *alba.*

Nevertheless, the most part of the hemerophytic flora (63.3%) is constituted by ***casual*** species, which have been cited, as sub-spontaneous ones, by different authors till now, only from few localities; their persistence on the anthropic or natural habitats someway still depends on human activity, either through the making or maintaining of some favorable conditions of substratum (ground disturbance and manuring) or through their continuous introduction into area (throwing wastes with seeds or vegetative organs; cultivation year by year, constant import of the seeds etc.).

In present, in our country there are very few restrictions regarding the import of plant species for culture. Our quarantine legislation mainly pursues pests, pathogens, as well as some weeds or weed seeds. There aren't any regulations concerning the valuation of invasion risk of a plant species before its introduction in culture, as a function of its biological, ecological and genetic features.

The introduction of exotics for varied uses into gardens, parks, crops, experimental plots etc., must get a problem of responsibility for horticultural, agricultural and sylvan institutions or enterprises, commercial firms, people or local communities which are implied in this process.

Otherwise, our satisfaction to admire the beauty of an exotic species at our place, or to profit by alimentary or medicinal qualities of the other, could turn against us through the damages caused by the invasive plants escaped from culture, regarding of the biodiversity, structure and function of natural or anthropic ecosystems and human activity.

A continuous monitoring of those species with tendency to escape from culture serves as an early warning system for prevention of new invasions; it may also indicate the immediate actions that need to be taken to eradicate certain species at an early stage, before they become established over a broad geographical area, or to control those species with a particularly invasive and aggressive character.

Conclusions

- Hemerophytic flora from Moldavia includes 169 vascular species, which are native especially from Mediterranean basin, Asia and America;
- Deliberately introduction of these species by man was made mostly for their ornamental value, but also for other uses (alimentary, medicinal, fodder, aromatic etc.), or to enrich some scientific or didactic collections;
- The most species (63.3%) are casually met as sub-spontaneous ones, but an important part of species (21.3%) are invasive in anthropic and natural habitats, they causing marked damages, and other 15.4% of them are naturalized ones, they being able to become invasive in short time if the future evolutions of genetic, ecologic and anthropic factors will be favorable to them;
- These data may represent an useful support in the rational management of the biological immigration and invasion in our country.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

CONTRIBUTIONS TO THE KNOWLEDGE OF LICHENS COMMUNITIES FROM BISTRITA MOUNTAINS (EASTERN CARPATHIANS)

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Abstract: This paper presents two lichens communities (*Parmelietum caperatae* Felf. 1941 and *Usneetum filipendulae* Hil. 1925) from *Physcietea* Tomaselli and Micheli 1957 and *Hypogymnietea physodes* Follm. 1974 classes, identified in Bistrita Mountains territory, in 5 locations: Arşita lui Macovei, Zugreni, Tulgheş, Barnar and Pârâul Văcăriei. These associations are analyzed from the bioforms, ecological requests and floristic elements perspectives.

Key words: lichens communities, Bistriţa Mountains, Romania.

Introduction

The study of lichens communities from Bistriţa Mountains has been realized in 2004 – 2005 years during several field trips in various locations of these mountains. The purpose of the field trips was to identify the lichens coenosis and to realize phytosociological relevés that have led us to the establishment of the lichens associations. The species that could not have been identified in field, have been collected and identified in laboratory (on the microscopic characters basis).

Material and methods

The study method adopted in this type of research of lichens associations from Bistrita Mountains is that established by Klement [7] in concordance with the principles of central European phytosociology school, used and adapted to our country lichens vegetation by Ciurchea et al. [2], Bartok [1] and other romanian researchers [5], [8], [9].

On international plan the "association" notion is unanimous accepted for the saxicolous lichens communities. The terricolous and corticolous groupings can have different cenotaxonomic values, some authors interpreting them as associations, other as synusia or microcenosis. In this paper, the presented corticolous groupings have been considered as associations. The identification of these associations has been made on the basis of the characteristic species indicated in the specialty literature [4], [10]. For each association, an analysis of bioforms and floristic elements has been made. In text, we used the next abbreviations for the bioforms [2]:

- HE Pa – epiphyte hemicryptophyte lichens having an *Parmelia* thallus type;
- HE Ra – epiphyte hemicryptophyte lichens having an *Ramalina* thallus type;
- HE Us – epiphyte hemicryptophyte lichens having an *Usnea* thallus type;
- HE hyp. – epiphyte hemicryptophyte lichens having an hypophloeodic thallus type;
- HE so. – epiphyte hemicryptophyte lichens having an sorediate crust thallus type.

The floristic elements abbreviations [2], [4] are:

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- bor.-med. – boreal – mediterranean;
- bor.-med. mo. – boreal – mediterranean mountain;
- bor.-submed. mo. – boreal – submediterranean mountain;
- bor.-mid.eur. – boreal – middle european;
- south bor.-med. – south boreal mediterranean;
- south bor.-mid.eur.-mo. – south boreal – middle european mountain;
- arct.-med. – arctic – mediterranean;
- mid.eur.-med. – middle european – mediterranean;
- mid.eur.-med. mo. – middle european – mediterranean mountain;
- arct.-bor.-med. – arctic – boreal – mediterranean;

An analysis (after Ellenberg [6]) of ecological indices (L-light, U-humidity, T-temperature, R-substratum ph), expressing the ecological requests of the associated lichens species has been realized. Also, the graphic representation followed by their interpretation and each association characterization have been realized.

The two associations described in this paper are mentioned for the first time in the Bistrita Mountains territory.

Results and discussions

The two lichens associations presented are subordinated to the next superior coenotaxa:

PHYSCIETEA Tomaselli and Micheli 1957

PHYSCIETALIA ADSCENDENDIS Hadac 1944 em. Barkm. 1958

Xanthorion parietinae Ochsner 1928

Parmelietum caperatae Felf. 1941

HYPOGYMNIETEA PHYSODES Follm. 1974

ALECTORIETALIA Dahl and Hadač 1944 (syntax. syn. Hypogymnietalia physodo – tubulosae Barkm. 1958)

Usneion barbatae Ochsner 1928

Usneetum filipendulae Hil. 1925

Tab.1 Ass. *Parmelietum caperatae* Felf. 1941

						Tree species	Fagus sylvatica			Picea abies	Quercus petraea	
						Altitude (m)	850	800	800	825	860	
						Coverage (%)	90	70	70	65	80	
						Aspect	S	SE	SE	S	SE	
						Plot area	0,5	0,5	0,5	0,5	0,5	
						Nr. of revelé	1	2	3	4	5	
Car. ass.												
6	4	6	4	HE Pa	Mid.eur.-med.	Flavoparmelia caperata	4	3	3	3	3	V
Xanthorion parietinae												
7	3	5	7	HE Pa	Bor.-med.	Xanthoria parietina	+	1	-	+	-	III
7	3	5	7	HE Pa	Bor.-med.	Physcia adscendentis	+	-	-	-	+	II
7	3	5	5	HE Pa	Bor.-med.	Melanelia exasperatula	-	-	+	1	-	II
7	3	0	6	HE Pa	Arct.-bor.-med.	Physcia tenella	-	+	-	-	+	II
5	4	5	3	HE Pa	Mid.eur. med. mo.	Melanelia glabra	-	-	+	-	2	II
Physcietalia adscendentis												
7	3	5	3	HE Ra	Bor.-med.	Evernia prunastri	1	-	1	1	+	IV

3	4	6	5	HE ex	mid.Eur.–med. mo	Pyrenula nitida	+	-	+	-	-	II
3	4	5	5	HE hyp.	South - bor.-med.	Graphis scripta	+	-	+	-	+	III
3	4	5	5	HE hyp.	South - bor.-med.	Arthonia radiata	+	-	+	-	-	II
3	5	7	6	HE hyp.	mid.eur – subatl.-med.	Opegrapha viridis	+	-	-	-	-	I
4	3	5	3	H so	Bor.-mid.eur.-med.	Lepraria incana	-	+	-	+	-	II
7	7	4	6	HE Pa	Bor.-med.	Melanelia glabratula	-	1	-	+	-	II
7	3	0	3	HE Pa	Bor.-med.	Hypogymnia tubulosa	-	-	-	+	+	II
Physcietea												
7	3	0	3	HE Pa	Arct.-med.	Hypogymnia physode	2	+	1	+	-	IV
7	3	0	5	HE Pa	Arct.-med.	Parmelia sulcata	+	1	-	1	+	IV
Variae syntaxa												
8	3	4	2	HE Pa	Bor.-med. mo.	Pseudevernia furfuracea	+	+	-	-	1	III

Place and date of relevées: 1- Arşiţa lui Macovei (18.06.2005); 2,3,4 – Zugreni (14.09.2004); 5 – Tulgheş (30.09.2005)

The *Parmelietum caperatae* association is characteristic to the hilly zone but also is frequently met in the sub-mountain and even mountain zones. In our study area it is wide spread, being identified at 800 – 900 m altitude on *Fagus sylvatica*, *Picea abies* and *Quercus petraea* trunks, having a general covering degree between 65 – 80% and prevalent southern and south-eastern aspects (**Table no. 1**). The characteristic and dominant species *Flavoparmelia caperata* is accompanied by other species, characteristic to the superior coenotaxa: *Xanthorion parietinae* (*Xanthoria parietina, Physcia adscendentis, Melanelia glabra*), *Physcietalia adscendentis* (*Evernia prunastri, Pyrenula nitida*) and *Physcietea* (*Hypogymnia physodes, Parmelia sulcata*).

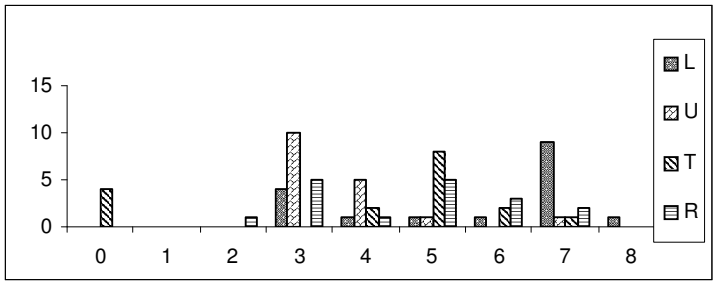

Fig. 1 Ecological indices spectrum of *Parmelietum caperatae* association

The ecological indices spectrum (**Fig. 1**) reveals that this association reunites moderate photophylous species, xero-mesophylous, meso-thermophylous, acidophylous and moderate acidophylous species, installed both on trees having smooth bark *(Fagus sylvatica*) and trees having wrinkled bark (*Quercus petraea*).

The bioforms spectrum (**Fig. 2**) indicates the prevalence of epiphyte hemicryptophyte species presenting a *Parmelia* thallus type (60%), followed by the lichens having hypophloeodic thallus (16%). The hemicryptophyte lichens with sorediate crust, that

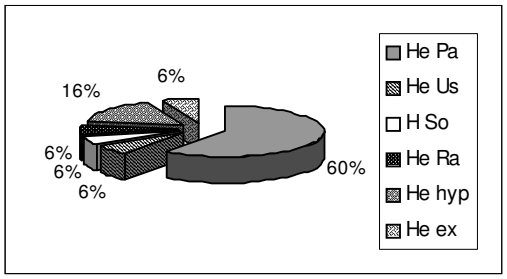

Fig. 2 Bioforms spectrum of *Parmelietum caperatae* association

epiphyte hemicryptophyte with extern crust and also the lichens having *Usnea* or *Ramalina* types of thallus are present in reduced proportions.

The floristic elements spectrum (**Fig. 3**) presents the prevalence of boreal – mediterranean and arcto – mediterranean elements (11%).

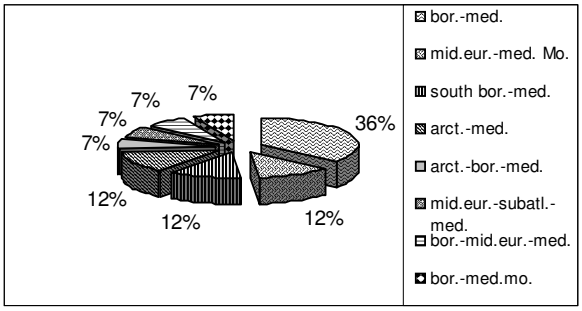

Fig. 3 Floristic elements spectrum of *Parmelietum caperatae* association

The others floristic elements (middle european – mediterranean, boreal – mediterranean mountain etc.) categories are present in equal proportions (7%).

Tab. 2 Ass. *Usneetum filipendulae* Hil. 1925

L	U	T	R	BF	FE	Tree species	Picea abies					K
						Altitude (m)	600	620	650	700	950	
						Coverage (%)	90	70	70	65	70	
						Aspect	NV	NV	N	NE	NV	
						Plot area (m^2)	0.5	0.5	0.5	0.5	0.5	
						Nr. of relevé	1	2	3	4	5	
						Car. ass.						
7	6	4	3	HE Us	Bor.-med. mo.	Usnea filipendula	3	3	2	3	4	V
7	7	5	5	HE Us	Mid.eur.-med. mo.	Usnea florida	1	+	+	2	2	V
		Usneion barbatae										
8	3	4	2	HE Pa	Bor.-med. mo.	Pseudevernia furfuracea	+	1	+	+	-	I V
6	7	3	3	HE Pa	Bor.-mid.eur.	Hypogymnia vittata	+	1	1	1	+	V
7	7	3	3	HE Ra	Bor.-submed.mo.	Evernia divaricata	-	-	+	+	-	II
6	7	3	3	HE Us	South bor.-mid.eur. mo.	Bryoria implexa	-	+	-	-	-	I
7	3	0	3	HE Pa	Bor.-med.	Hypogymnia tubulosa	+	-	-	+	-	II
7	5	4	3	HE Us	Bor.-mid.eur.	Usnea hirta	+	-	1	-	-	II

7	6	4	3	HE Us	Bor.-med. mo.	Bryoria fuscescens	+	-	+	-	-	II
Alectorietalia												
7	3	5	3	HE Ra	Bor.-med.	Evernia prunastri	1	+	1	+	+	V
7	3	5	5	HE Pa	Bor.-med.	Melanelia exasperatula	-	1	+	-	-	II
Hypogymnietea physodes												
7	3	0	3	HE Pa	Arct.-med.	Hypogymnia physodes	-	+	+	1	1	I V
7	3	0	5	HE Pa	Arct.-med.	Parmelia sulcata	1	-	1	+	-	II I
Variae syntaxa												
4	4	5	5	H So	South bor.-med.	Chrysotrix candelaris	+	-	+	-	-	II
3	6	4	3	H So	South bor.-mid.eur.-med. mo.	Calicium abietinum	-	+	-	-	-	I
7	3	5	7	HE Pa	Bor.-med.	Xanthoria parietina	-	-	+	-	+	II
7	7	4	6	HE Pa	mid.eur.-med. mo.	Melanelia glabra	-	-	-	+	-	I

Place and date of relevées: 1,4 – Pârâul Văcăriei (18.06.2005); 5 – Barnar (19.06.2005)

The *Usneetum filipendulae* association could be met in the mountain zones presenting increased humidity, usually installed on the corona of coniferous trees but also on these trees trunks. The lichenocenosis of this association have been identified along the valleys of Pârâul Văcăriei and Barnar rivers on *Picea abies* trunks and branches, having a general covering degree between 65 and 90% and prevalent northern, north-western and north-eastern aspects (**Table no. 2**). The association is edified by *Usnea filipendula* and *Usnea florida*; besides these also *Hypogymnia vitatta*, *Pseudevernia furfuracea, Evernia prunastri, Hypogymnia physodes* are frequently met.

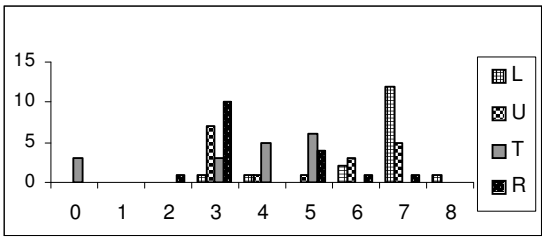

Fig. 4 Ecological indices spectrum of *Usneetum filipendulae* association

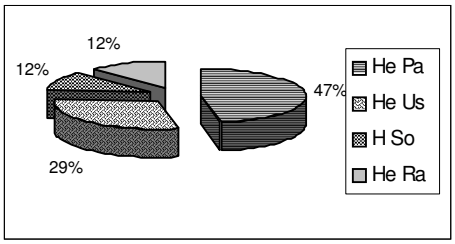

Fig. 5 Bioforms spectrum of *Usneetum filipendulae* association

The ecological indices spectrum (**Fig. 4**) shows that the most of the component species are moderate photophylous, xeromesophylous, micro-mesothermophylous and acidophilous species.

The bioforms spectrum (**Fig. 5**) presents the preponderance of the lichens epiphyte hemicryptophyte with *Parmelia* type thallus (47%), followed by the *Usnea* type thallus (29%). The lichens hemicryptophyte having sorediate crust and also the lichens with *Ramalina* thallus type are present in reduced proportion (12%).

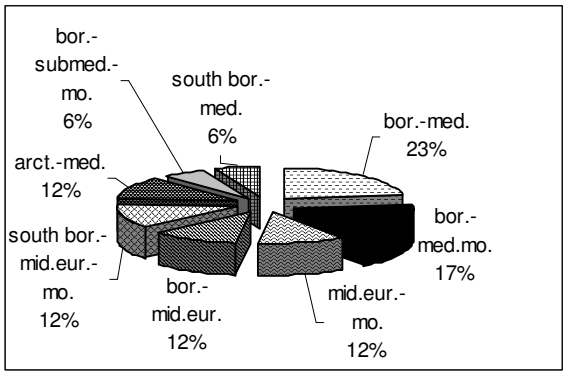

Fig. 6 Floristic elements spectrum of *Usneetum filipendulae* association

The floristic elements spectrum (**Fig. 6**) indicates the prevalence of the boreal–mediterranean elements (23%), followed by the boreal–mediterranean–mountain elements (17%). A equilibrate repartition is observed in the case of middle european-mountain, boreal–middle european, south–boreal–middle european and arcto–mediterranean elements, each of them present in a 12 % proportion.

Conclusions

The analysis of *Parmelietum caperatae* and *Usneetum filipendulae* lichens communities reveals that both prevalently have in composition moderate photophilous, xeromesophilous, mesothermophilous and acidophilous species. Also, floristic elements and bioforms spectrums are dominated by the boreal – mediterranean with a *Parmelia* thallus type species.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

A VEGETATION ISLAND WITH WHITE OAK (*QUERCUS PUBESCENS* WILLD.) IN THE SUB-CARPATHIANS OF BUZĂU

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Abstract: The vegetation of a forest-steppe type from a part of the river Buzău Basin is presented in this paper. After a short presentation of the natural conditions of the forest Crivineni (near the village Valea Lupului, Buzău county), we are making an analysis of the present-day vegetation, as well as the coenotaxons identified by us in that forest.

Key words: forest-steppe vegetation, associations, Crivineni forest, Romania.

Introduction

Natural conditions: the forest Crivineni is situated at the flexion of the Carpathians Mountains (C), sub-region Vrancea (C_2), in the area of durmast and beech forests, as well as the transitions between these (C_{250}), in the middle basin of the Buzău river, in the Depression Larga – Pătârlagele. The whole surface of that forest is around 26 ha.

The whole area is partially situated on a sarmatian-pliocenic syncline, replete with marls, sands and gravels (belonging to levantine and inferior pleistocen ages). The lithological substratum is made from low brassy systems (marls, sandy marls, low consolidated sands, gravels, and loams). Erosions of various types take places without difficulty, frequently even on those fields covered by a forestry vegetation, being favoured by the increased energy of the relief.

The geomorfological prevalent unit is the corrugated slope, having predominantly southern and eastern aspects, sunlited. Also, the geomorfological prevalent unit is a shady aspect (38%), being followed by a partially sunlited (37%) and fully sunlited (25%) ones. Altitudinal, the forest Crivineni, is situated between 250 m.s.l. (at the level of Buzău river meadow) and 1.090 m.s.l. (in the summit Plăiaş). The prevalent altitudes are between 400 and 800 m.s.l. The average altitude is 624 m.s.l. The average inclination of the slopes is $28,4^{g}$. The geomorfology of the area, through its parameters, exert some influences over the climatic factors and, therefore, over the vegetation.

The main water basins of the rivers in that area penetrated over by various rivers, and close to the Crivineni forest there is the river called "Valea Lupului", a right side tributary of the Buzău river. The output of this river is formed by a predominantly pluvial supply, changing and varying with the seasons and the yearly precipitations. The flow capacity has a marked torrential feature, being also unsteady. During the freshets, there are registered significant damages downstream, by entrapment of driftwood, gravels, detritus, and boulder from upstream.

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According to the climatic division into districts, the forests from UP V Pătârlagele are part of the hills and plateaux region, with altitudes between 200 and 800 m.s.l. According to Köppen, that area is part of the boreal climate province Df, characterized by cold and humid winters, with average temperature of the coldest month under – 1,8ºC and average temperature of the warmest month over + 10ºC. As a climatic province, our territory belongs to the sub-province Dfbx, with average temperature of the warmest month over + 12ºC, precipitations all over the year and cold winters. The average yearly temperature in Pătârlagele is + 9,9ºC. The months with the lowest, and irrespectively the highest average temperatures, are: January (– 1,8ºC) and August (+ 19,5ºC). The temperatures on the surface of the UP V Pătârlagele varies with the altitude, and frequently are registered thermal inversions. The maximum absolutely temperature is 38,0ºC in that area; the minimum absolutely temperature is – 23,5ºC. Early frosts happen, as a rule, after the finishing of the vegetation season; on the other hand, the late frosts happen after the beginning of the vegetation season, producing lesser or higher damages over the fruition.

The average yearly precipitations in Pătârlagele are of 635,8 mm, most of them falling in June (112,3 mm), the lesser being registered in October (25,3 mm). The number of days with downpour is between 25 and 30, over 50% of them taking place in June and July. The downpour days, accompanied by flash of lightnings are registered during the warmest months (June and July). The hail is a rare phenomena, happening only in the warm season.

The winds has an average speed of 3,3 m/sec., with a larger intensity from the North (4,9 m/sec.), and the lowest intensity from the west (2,1 m/sec.). The wind frequency is of 30,6% per year, most of them being in January (36,1%), and the lowest frequency being in July (18,4%).

According to the climatic division into districts of the Romanian territory (Geographic Monography of R. P. R. [7]), the forests from U. P. V Pătârlagele are part of the region, having a hilly climate (200 – 800 mm precipitations/year), within the climatic province Dfbx (Köppen classification), characterized by a boreal climate, favourable to the forest vegetation.

The Dryness Index De Martonne is 32. This index having a value over 30, denote the situation of the Crivineni forest into the forest region of Romania.

From pedologic point of view, the soils from the surveyed region, are the next ones: illuvial clay soils (rendzina, brown illuvial typical and lithic, luvisol albic typical), and cambisoils (brown eu-mesobasic: typical, mollic, rendzinic, pseudo- rendzinic, and lithic). Still, the prevalent soils on the territory of the Crivineni forest, are the next ones: regosoils and regosoils with a salinized sub-type, in U. A. 86, plots: A, B, D & E; 87 plots A & C (25.9 ha).

Material and methods

All the plant species have been colected, identified in the laboratory, accordingly to Ciocârlan, 2000 [2]. The nomenclature follows the paper [5]. The methodolgy used for the phytosociological research is according to the Central–European Plant Sociology School (i. e. Braun-Blanquet, 1921) [1].

Discussions

Our investigations on the vegetation of the Crivineni forest (Buzău county) have been done during the autumn season (2005), and in the spring season of 2006. In those two period of the field surveys, we analyzed all the vegetation types of that forest.

Surprisingly, we have discovered in that region, definitely a sub-montane one, a strong influence of a warm climate over the vegetation. Thus, the presence of an island having a forest-steppe vegetation, is a result of some factors, like the next ones:

- the dominat aspects of the surveyed area is south or south-east ones;
- the slope gradient vary between 5 and 40 degrees;
- the geologic substratum is made by marls;
- the pedologic stratum is dominated by rendzinas and pseudo-rendzinas soils;
- those termic and humidity gradients vary a lot – on the northern slopes the yearly temperatures are lower and the humidity is higher (being covered by the phytocoenoses with beech (Ass. *Galio schultesii – Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994), while the southern and south-eastern slopes, having yearly temperatures higher and the humidity lower, are covered by the phytocoenoses with white oak (Ass. *Orno – Quercetum pubescentis* Horanszky, Jakucs et Zólyomi 1958; Ass. *Seslerio heufflerianae – Hippophaëtum rhamnoidis* Ştefan 1995; Ass. *Taraxaco serotini - Botriochloëtum ischaemi* (Burduja et al. 1956, Răvăruţ et al. 1956) Sârbu, Coldea et Chifu 1999):
- even so, the most pregnant influence over that area is the existence of a strong foehn at the flexion of the Carpathians Mountains; those „warm winds" is the major climate factor which favor the existence of that type of vegetation, as it is also concluded by Ciocârlan, 1968 [2], Mititelu & colab., 1980 [6], as well as by Ştefan, 1995 [4].

All the xero-termophilous plants from the area of the Crivineni forest are installed there after the glaciation age – in Holocen, in the so called „the mixted-oak forest" phase. On that period, a lot of xero-termophilous species, having a Pontic and sub-Mediterranean origins, have invaded the forest-steppe region, as well as parts of the *Quercus petraea* subzone (of the forest zone), from the Buzău river basin. The ways of the penetration of the xero-termophilous elements in the flora of Romania, are the next ones: the „Pontic route" from the eastern part of Europe (for *Asparagus verticillatus, Crambe tataria, Peucedanum tauricum, Salvia nurtans, Centaurea orientalis*, and so on); the „Illyrian route" from the south-western part of Europe (for *Quercus pubescens, Q. virgiliana, Q. dalechampii*, and so on), and the „Moesian route" from the south-eastern part of Europe (for *Quercus pedunculiflora*). The presence of these plant species is depending now on the soil coverage and the climate of the region [2].

The vegetation of the Buzău river basin is made by mixed forests (of beech and spruce, of beech and oaks, of white oaks and ashes, and so on), bushes of sea-buckthorn, hawthorns and so forths, or meadows of various green grasses etc.

The coenotaxonomic framing of the vegetation in the Crivineni forest, Buzău county, is like the next ones:

Quercetea pubescenti – petraeae (Oberd. 1948) Jakucs 1960
Orno – Cotinetalia pubescentis Jakucs 1960
Orno – Cotinion Soó 1960
1. *Orno – Quercetum pubescentis* Horanszky, Jakucs et Zólyomi 1958
Prunetalia Tx. 1952

Prunion spinosae Soó 1950

2. *Seslerio heufflerianae – Hippophaëtum rhamnoidis* Ştefan 1995

Querco-Fagetea Br. – Bl. et Vlieger 1937 em. Soó 1964

Fagetalia sylvaticae (Pawl. 1928) Tx. et Diem. 1936

Lathyro hallersteinii – Carpinion Boşcaiu et al. 1982

Galio schultesii – Carpinenion Taűber 1992

3. *Galio schultesii – Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994

Festuco – Brometea Br. – Bl. et Tx. 1943

Festucetalia valesiacae Br. – Bl. et Tx. 1943

Festucion rupicolae (*sulcatae*) Soó (1929 n.n.) 1940 corr. Soó 1964

Jurineo – Euphorbinenion nicaeensis Dobrescu et al 1971, corr. Sârbu. Coldea et Chifu 1993

4. *Taraxaco serotini - Botriochloëtum ischaemi* (Burduja et al. 1956) Sârbu, Coldea et Chifu 1999

5. Phytocoenoses with *Sesleria heuflerana* ssp. *heuflerana*

Description of the associations

1. Ass. *Orno – Quercetum pubescentis* Horanszky, Jakucs et Zólyomi 1958

The phytocoenoses of this coenotaxa are situated on the slopes of the Crivineni hill, on Eastern and Southern aspects. The density of stand vary between 0.6 and 0.8. The herbaceous stratum have a coverage varying between 3% and 80% at the time of the recording relevées. The white oak (*Quercus pubescens*) has a natural regeneration, mostly from the stub, due to the forest cuttings in the past, but also from the seeds – only in some very rare cases (**Table no. 1**).

Tab. no. 1 Ass. *Orno – Quercetum pubescentis*

Aspect (dominant)	E	S–E	S	S	S	S	N–E
Slope (°)	30	25	25	30	30	35	30
Density of stand	0.6	0.8	0.8	0.7	0.75	0.80	0.90
Tree height (m)	10	12	10	12	12	12	12-14
Tree diameter (cm)	15-25	15-30	15-25	25	5-30	5-25	7-40
Coverage of shrub & juvenile layer (%)	10	5	5	10	30	3	3
Coverage of herbaceous layer (%)	80	60	3	60	15	5	15
Surface of relevé (m^2)	400	400	400	400	400	200	200
Relevé number	1	2	3	4	5	6	7
Charact. ass.							
Quercus pubescens	3	5	3	3	3	4	4
Quercus pubescens juv.	+	+	+	+	1	+	1
Fraxinus ornus	2	+	2	1	2	1	-
Fraxinus ornus juv.	2	+	-	1	1	+	+
Orno – Cotinion et Orno – Cotinetalia pubescentis							
Asparagus tenuifolius	+	-	-	-	-	-	+
Rhamnus saxatilis ssp. tinctorius	-	+	+	-	-	+	-
Tilia tomentosa	-	-	-	-	-	-	+
Quercetea pubescenti – petraeae							
Acer campestre	-	-	+	-	-	-	+

Brachypodium sylvaticum	-	-	+	-	+	-	-
Buglossoides purpurocaerulea	-	-	-	+	+	+	+
Calamintha clinopodium	+	+	-	+	-	-	-
Calamintha sylvatica	-	+	-	-	-	-	-
Campanula bononiensis	+	+	-	-	-	-	-
Campanula persicifolia	-	+	-	-	-	-	+
Campanula sibirica	-	+	-	-	-	-	-
Campanula trachelium	-	-	-	-	-	+	-
Carex humilis	-	-	-	-	1	-	-
Carpinus betulus	-	-	-	-	-	-	+
Clematis vitalba	-	-	-	-	+	-	-
Cornus mas	-	-	-	-	-	-	+
Corylus avellana	-	+	-	-	1	-	-
Crataegus monogyna	-	+	+	1	-	+	+
Crataegus monogyna juv.	-	+	-	+	-	-	-
Cytisus hirsutus	-	-	+	-	-	+	+
Cytisus nigricans	1	+	-	-	-	-	-
Dactylis glomerata	-	-	-	1	-	-	+
Dictamnus albus ssp. albus	-	-	-	-	-	+	+
Fragaria viridis	-	+	-	+	-	-	-
Lathyrus niger	-	-	+	-	-	-	-
Lathyrus vernus	-	-	-	-	-	-	+
Ligustrum vulgare	-	-	+	-	-	-	-
Lilium martagon	-	-	-	-	-	-	+
Lonicera xylosteum	-	-	-	-	-	-	+
Malus sylvestris	-	-	-	-	-	-	+
Peucedanum oreoselinum	+	-	-	-	-	-	-
Poa nemoralis	-	1	1	-	-	-	-
Polygonatum latifolium	-	-	-	-	-	-	+
Primula veris	-	-	-	+	-	-	+
Querco-Fagetea							
Quercus × pseudopubescens	+	+	+	-	-	-	-
Quercus pedunculiflora	-	-	-	-	+	-	-
Rosa canina	-	+	+	+	-	-	-
Sedum telephium ssp. maximum	+	+	-	-	-	+	+
Sorbus domestica	-	-	-	-	-	+	-
Tanacetum corymbosum	-	+	+	-	-	+	+
Teucrium chamaedrys	-	-	-	+	-	-	-
Thalictrum aquilegifolium	-	-	-	-	-	+	-
Tilia platyphyllos	-	-	+	-	-	-	-
Tilia platyphyllos juv.	-	+	-	-	-	-	-
Trifolium alpestre	+	-	-	-	-	-	-
Ulmus minor	+	-	-	+	-	+	-
Ulmus procera	-	+	-	-	+	-	-
Vicia dumetorum	-	-	+	-	-	-	-
Vincetoxicum hirundinaria ssp. hirundinaria	-	-	+	+	+	+	-
Festuco-Brometea							
Agrimonia eupatoria ssp. eupatoria	+	-	-	+	-	-	-
Brachypodium pinnatum	-	+	-	1	-	+	-
Carex praecox	2	2	2	-	-	-	-
Coronilla varia	-	-	-	+	-	-	+
Daucus carota	+	-	-	-	-	-	-
Dichanthium ischaemum	-	+	-	-	-	-	-
Dorycnium pentaphyllum ssp. herbaceum	-	+	-	1	-	-	-
Erysimum cuspidatum	-	+	-	-	-	-	-

Euphorbia cyparissias	+	+	-	-	-	-	-
Festuca valesiaca	3	1	-	-	-	-	-
Galium verum	-	+	-	-	-	-	-
Hieracium pilosella ssp. pilosella	-	+	-	-	-	-	-
Hypericum perforatum	+	-	-	-	-	-	-
Inula ensifolia	-	+	-	-	-	-	-
Inula hirta	-	+	-	-	-	-	-
Phleum phleoides	-	+	-	-	-	-	-
Pimpinella saxifraga	-	+	-	-	-	-	-
Poa angustifolia	-	1	-	1	+	-	-
Salvia nemorosa	-	+	-	-	-	-	-
Salvia verticillata	-	-	-	+	-	+	-
Scabiosa ochroleuca	+	-	-	-	-	-	-
Seseli annuum	+	+	-	-	-	-	-
Thymus pannonicus	+	-	-	-	-	-	-
Trifolium montanum	-	-	-	-	-	+	-
Veronica austriaca ssp. austriaca	+	-	-	-	-	-	-
Viola hirta	+	-	-	-	-	+	-
Aliae							
Anthericum ramosum	+	-	-	-	-	-	-
Calamagrostis arundinacea	1	+	-	-	-	-	-
Campanula rapunculoides	-	-	-	-	-	+	-
Carex tomentosa	-	-	-	+	-	-	-
Cnidium silaifolium	+	+	+	+	+	+	-
Cruciata glabra	+	+	+	+	-	-	+
Digitalis grandiflora	+	-	-	-	-	-	-
Echinops sphaerocephalus	-	-	-	+	-	-	-
Euphorbia villosa ssp. villosa	-	-	-	+	-	-	-
Ferulago sylvatica	-	+	-	-	-	-	-
Filipendula vulgaris	+	+	-	+	-	-	-
Galium album	-	+	-	-	-	+	-
Inula salicina	+	-	-	-	-	-	-
Laserpitium latifolium	-	-	-	-	-	-	+
Leucanthemum vulgare	+	-	-	-	-	-	-
Sesleria heuflerana ssp. heuflerana	-	-	-	-	-	+	2
Silene nutans ssp. nutans	+	+	+	-	-	-	-
Silene vulgaris	+	+	-	-	-	-	-
Stachys officinalis	+	-	-	-	-	-	-
Verbascum nigrum	-	+	-	-	-	-	-

Date and place of the relevées: Forest Crivineni, Buzău county; 1–3 at 16.09.2005; 4–7 at 16.05.2006

The xero-termophilous features of this association is emphasized by the presence of some of termophilous plant species in the relevées, for instance*: Quercus pubescens, Fraxinus ornus, Cotinus coggygria, Tilia tomentosa, Cornus mas, Quercus pedunculiflora, Sesleria heuflerana* ssp. *heuflerana*, *Asparagus tenuifolius*, and so on; also, there are other plant species having some xero-termophilous preferences, for instance: *Veronica austriaca* ssp. *austriaca, Echinops sphaerocephalus, Thymus pannonicus, Dichanthium ischaemum, Vincetoxicum hirundinaria* ssp. *hirundinaria, Sorbus domestica, Dictamnus albus* ssp. *albus, Rhamnus saxatilis* ssp. *tinctorius*, and so on. The same type of vegetation is also met in other neighbouring areas, i. e. the Slănic river basin (Buzău county) [2].

2. Ass. *Seslerio heufleranae – Hippophaëtum rhamnoidis* Ştefan 1995

The sea-buckthorn (*Hippophaë rhamnoidis* ssp. *rhamnoidis*) occupies relative small areas in the Cirvineni forest, being installed as a pioneer vegetation on degraded

grounds as result of the landslides and soil erosion. This association has been described by Ştefan, 1995 [6], from the Milcov river basin (Vrancea county). Like there, in the Buzău river Basin (namely, the Crivineni forest), all the phytocoenoses of this association are installed on southern slopes, on pseudorendzines, having average to strong erosional features. Those two characteristic plant species of the association (*Hippophaë rhamnoidis* ssp. *rhamnoidis* and *Sesleria heuflerana* ssp. *heuflerana*) are, also, dominants in those two layers (shrub and herbaceous layers). The vegetation coverage of the soils vary between 90 and 95% (**Table no. 2**).

Tab. no. 2 As. *Seslerio heufleranae – Hippophaëtum rhamnoidis*

Aspect (dominant)	S	S-E
Slope (°)	5	5
Coverage of vegetation (%)	95	90
Surface of relevé (m^2)	25	25
Relevé number	1	2
Charact. ass.		
Hippophaë rhamnoidis ssp. rhamnoidis	5	5
Sesleria heuflerana ssp. heuflerana	1	1
Teucrium chamaedrys		
Prunion spinosae		
Rosa canina	+	+
Prunetalia et Quercetea pubescenti – petraeae		
Brachypodium pinnatum	+	+
Carex humilis	+	+
Salvia nemorosa	+	+
Veronica chamaedrys	+	+
Viola hirta	+	+

Date and place of the relevées: Forest Crivineni, Buzău county; 1–2 at 16.05.2006

This kind of vegetation, made predominantly by the bushes of sea-buckthorn (*Hippophaë rhamnoidis* ssp. *rhamnoidis*) is also described from the Râmnicu Sărat - Higher and Middle river basin, Ştefan, 1995 [6]. Due to the fact that bushes of sea-buckthorn cover the soil between 90% and 95%, and the soil erosion is pretty higher, there are other few plant species, accompanying the characteristic species, i. e.: *Teucrium chamaedrys, Rosa canina, Viola hirta*, and so on.

3. Ass. *Galio schultesii – Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994

The phytocoenoses of this association are situated only on the northern slopes of the same Crivineni hill. The density of the stand vary between 0.7 and 0.9. The herbaceous stratum had a coverage between 10% and 40% at the time of the recording relevées. The regeneration is also present, existing there some juvenile individuals of the beech trees (i.e. *Fagus sylvatica* ssp. *sylvatica* and *Fagus taurica*) (**Table no. 3**).

Tab. no. 3 As. *Galio schultesii – Fagetum*

Aspect (dominant)	N	N	N–E
Slope (°)	35	35	25
Density of stand	0.7	0.9	0.85
Tree height (m)	15	18-20	18-20
Tree diameter (cm)	20-25	25-30	25
Coverage of shrub & juvenile layer (%)	25	10	5
Coverage of herbaceous layer (%)	40	10	5
Surface of relevé (m^2)	400	400	400

Relevé number	1	2	3
Charact. ass.			
Fagus sylvatica	4	4	4
Fagus sylvatica juv.	+	+	+
Fagus taurica	+	+	+
Galium schultesii	-	1	-
Fagetalia sylvaticae et Querco-Fagetea			
Quercus dalechampii	-	1	-
Populus tremula	+	-	-
Tilia cordata	-	+	-
Cerasus avium	-	-	+
Corylus avellana	+	+	-
Cornus sanguinea	+	-	-
Euonymus europaeus	-	+	-
Rosa canina	-	+	-
Rubus caesius	+	-	-
Salvia glutinosa	-	-	+
Teucrium chamaedrys	+	-	-
Veronica urticifolia	-	+	-
Luzula luzuloides	-	+	-
Euphorbia amygdaloides	-	+	-
Quercetea pubescenti – petraeae			
Fraxinus ornus	-	1	-
Fraxinus ornus juv.	+	+	+
Tilia tomentosa	-	+	-
Crataegus monogyna	+	+	+
Cytisus hirsutus	+	-	-
Cytisus nigricans	-	-	+
Campanula trachelium	-	-	+
Poa nemoralis	2	1	-
Brachypodium sylvaticum	-	+	-
Lathyrus vernus	-	+	-
Melittis melissophyllum ssp. melissophyllum	-	+	-
Aliae			
Hieracium lachenalii	-	-	+
Cruciata glabra	-	-	+
Euphorbia cyparissias	+	-	-
Sesleria heuflerana ssp. heuflerana	+	-	+
Medicago falcata	+	-	-
Hieracium umbellatum	+	+	-
Inula ensifolia	+	-	-
Tanacetum corymbosum	+	+	-
Peucedanum alsaticum	+	-	-
Calamagrostis arundinacea	-	+	-
Digitalis grandiflora	-	+	-
Solidago virgaurea ssp. virgaurea	-	+	-

Date and place of the relevées: Forest Crivineni, Buzău county; 1–2 at 16.09.2005; 3 at 16.05.2006

Though this vegetation type is situated only on northern slopes of the Crivineni Hill, where the air & soil humidity is pretty higher, there are some plants of xero-termophilous nuances, like the next one: *Fagus taurica, Quercus dalechampii, Fraxinus ornus, Tilia tomentosa, Sesleria heuflerana* ssp. *heuflerana*, and so on. The presence of these species in our relevées emphasize, one more time, the termophilous influence of the climate conditions over the entire area of the Crivineni Hill.

4. Ass. *Taraxaco serotini - Botriochloëtum ischaemi* (Burduja et al. 1956) Sârbu, Coldea et Chifu 1999

The phytoceonoses of this association are installed in the forest clearings, as well as in the surroundings of the Crivineni forest, on the slopes of the same hill (**Table no. 4**).

Tab. no. 4 As. *Taraxaco serotini - Botriochloëtum ischaemi*

Aspect (dominant)	S	E
Slope (g)	40	5
Coverage of vegetation (%)	70	90
Surface of relevé (m^2)	100	100
Relevé number	1	2
Charact. ass.		
Botriochloa (Dichanthium) ischaemum	4	5
Taraxacum serotinum	+	+
Festucetalia valesiacae		
Astragalus onobrychis	+	1
Carlina biebersteinii ssp. brevibracteata	-	+
Centaurea biebersteinii ssp. biebersteinii	+	-
Chrysopogon gryllus	-	+
Dianthus rehmanni	-	+
Dorycnium pentaphyllum ssp. herbaceum	+	-
Onobrychis viciifolia	1	1
Stachys recta	-	+
Festuco-Brometea		
Anthericum ramosum	+	+
Calamintha clinopodium	+	+
Campanula bononiensis	+	+
Carex praecox	+	-
Euphorbia cyparissias	+	-
Muscari neglectum	-	+
Phleum phleoides	-	+
Plantago media	+	-
Salvia nemorosa	+	-
Scabiosa ochroleuca	-	+
Seseli annuum	+	-
Tanacetum corymbosum	+	-
Teucrium chamaedrys	+	+
Trifolium arvense	-	+
Aliae		
Arabis hirsuta	-	+
Calamagrostis arundinacea	-	+
Campanula persicifolia	-	+
Cytisus nigricans	+	+
Dactylis glomerata	-	+
Daucus carota	-	+
Trifolium alpestre	-	+
Verbascum phlomoides	+	-

Date and place of the relevées: Forest Crivineni, Buzău county; 1–2 at 16.09.2005

This association is definitely a xero-termophilous one, being a remnants of a more termophilous climate from the past (see the chapter „Introduction"). In fact, the phytoceonoses of this association are localized predominantly on southern and eastern slopes, on fields affected by a medium to a strong erosion of the soil stratum. Also, in the floristic compostion of the phytocoenoses, there are some xero-termophilous plant species, as the next ones: *Chrysopogon gryllus, Centaurea biebersteinii* ssp. *biebersteinii, Carlina*

biebersteinii ssp. *brevibracteata.* Thus, is emphasized the termophilous nature of the herbaceous vegetation on Crivineni Hill.

5. Phytocoenoses with *Sesleria heuflerana* ssp. *heuflerana*

The phytocoenoses having *Sesleria heuflerana* ssp. *heuflerana* asa a dominat species is spreaded in clearings of the forest, in more or less shady places, on eroded soils, even on the rock substratum.

Normally, this type of vegetation could be placed under the association *Seslerio heufleranae – Caricetum sempervirentis* Coldea 1984; this association is spreaded from the hillock zone to the mountane and sub-alpine belts of vegetation in Romania. But, in the lower regions (like here, in the Crivineni forest), the above mentioned association (Ass. *Seslerio heufleranae – Caricetum sempervirentis*) is totally devoided by *Carex sempervirens*, but in change is present the other species – *Sesleria heuflerana* ssp. *heuflerana*, as a differential species for these phytocoenoses (**Table no. 5**).

Tab. no. 5 Phytocoenoses with *Sesleria heuflerana* ssp. *heuflerana*

Aspect (dominant)	E	E
Slope (°)	25	25
Coverage of vegetation (%)	60	80
Surface of relevé (m^2)	4	4
Relevé number	1	2
Sesleria heuflerana ssp. heuflerana	4	4
Agrimonia eupatoria	+	-
Asperula tenella	+	
Brachypodium pinnatum	-	+
Crataegus nigra juv.	+	+
Cytinus nigricans	+	-
Dichanthium ischaemum	-	+
Filipendula vulgaris	+	
Inula hirta	+	-
Lithospermum officinale	+	-
Melilotus officinalis	+	+
Onobrychis viciifolia	+	+
Peucedanum alsaticum	+	-
Phleum phleoides	+	+
Quercus pubescens juv.	+	-
Rhamnus saxatilis	+	+
Rosa canina juv.	-	+
Salvia verticillata	+	+
Teucrium chamaedrys	+	+
Tragopogon pratensis ssp. orientalis	1	-
Verbascum nigrum	+	-

Date and place of the relevées: Forest Crivineni, Buzău county; 1–2 at 16.09.2005

The characteristic species, *Sesleria heuflerana* ssp. *heuflerana,* is a dominat plant in those phytocoenoses, having coverage indices varying between 60% and 80%. Thus, the other species has only a minimal presence in our relevées. Among the accompanying species only the juveniles of *Quercus pubescens* has a termophilous feature.

Conclusions

1. The Crivineni forest (Buzău county) represent an island, having a xero-termophilous vegetation, situated right at the flexion of the Carpathians Mountains (C), sub-region Vrancea (C_2), at the higher limit of this type of vegetation, from the Forestry Ward Cislău;

2. The determinantive factors for the existence of that vegetation of the xero-termophilous type, in the area of the Forestry Ward Cislău, are the next ones: the dominat aspect of the Crivineni Hill, the dominant slope declivity, the geological factors (substratum of marls), pedological factors (rendzinas and pseudorendzinas soils), and, especially, a very strong influence of the foehn ("warm winds") over the whole region;

3. The dominant vegetation is edifyed by forests of white oak and ash (Ass. *Orno – Quercetum pubescentis*) and almost pure beech stands (Ass. *Galio schultesii – Fagetum*) or bushes of the sea-buckthorn (Ass. *Seslerio heufleranae – Hippophaëtum rhamnoidis*), which are hosting most of the xero-termophilous species;

4. A secondary vegetation is represented in that area by meadows of *Dichanthium ischaemum* (Ass. *Taraxaco serotini - Botriochloëtum ischaemi*) and phytocoenoses with *Sesleria heuflerana* ssp. *heuflerana*, which are hosting other pontic and sub-Mediterranean plant species.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

CONTRIBUTIONS TO THE STUDY OF AQUATIC VEGETATION IN THE VASLUI RIVER BASIN

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Summary: This paper presents two associations from the ***Lemnetea minoris*** de Bolós et Masclans 1955 class and one from the ***Potametea pectinati*** Klika in Klika et Novák 1941 class identified in Vaslui river basin, described in a phytocoenological table and analysed from the point of view of bioforms, floristic elements, and ecological indices.

Key words: phytocoenology, aquatic vegetation.

Introduction

The basin of the river Vaslui is located between the city of Jassy and the town of Vaslui, in the central part of the Central Moldavian Plateau. The Vaslui river springs in the vicinity of the Păun Hill, at an altitude of 340 m, and flows into the Bârlad river, southwards Vaslui. The climate is temperate continental, with an average annual temperature of 10.2ºC and average annual precipitations of 560.8 mm.

After analysing some recent papers on phytosociological nomenclature and classification [7 – 13], the three associations have been included in the following phytocoeno-system:

LEMNETEA MINORIS de Bolós et Masclans 1955
LEMNETALIA de Bolós et Masclans 1955
LEMNION MINORIS de Bolós et Masclans 1955

Lemnetum minoris Oberd. ex T. Müller et Görs 1960

LEMNION TRISULCAE Den Hartog et Segal 1964

Lemnetum trisulcae Knapp et Stoffers 1962

POTAMETEA PECTINATI Klika in Klika et Novák 1941
POTAMETALIA Koch 1926
UTRICULARION VULGARIS Passarge 1964

Lemno-Utricularietum vulgaris Soó 1947

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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). The ecological indices were noted having in mind the works of H. Ellenberg [4].

Results and discutions

Ass. ***Lemnetum minoris*** Oberd. ex T. Müller et Görs 1960
(Syn.: *Lemnetum minoris* Soó 1927, *Lemnetum minoris* Oberd. 1957)

This association populates both sedentary, and slow running waters, or ponds formed by abundant rains, with not very deep water, sometimes surrounded by paludous vegetation.

The characteristic and dominant species is the *Lemna minor*, fully covering the water surface. Other species are part of the *Phragmiti-Magnocaricetea* and *Bidentetea* classes (**Tab. 1**).

After the analysis of the relevées, we noticed the following:

- the **bioforms spectrum** shows the dominance of geophytes (29.41%) and terophytes (29.41%) in equal proportions, followed by hemicryptophytes (17.64%), hydrophytes (11.76%) and hydrohelophytes (11.78%);
- within the **phytogeographic spectrum**, one may notice the presence of a large number of cosmopolitan (41.18%) and Eurasian (41.18%) elements, followed by circumpolar (11.76%) and European ones (5.88%);
- within the **spectrum of ecological indices**, there is a predominance of species which have a low lever of tolerance for shade (7-43.75, 8-31.25%), amphitolerant towards the temperature indice (43.75%), with a spreading area in Central Europe (37.5%), hydrophilic (37.5%), preferring areas with a moderate content of mineral nitrogen (31.25%).

Observations: The association was first recorded in 1970, by C. Dobrescu, within the river Vaslui basin, but with no precise location. In 1975, it was also mentioned by D. Mititelu, but without attaching a table of floristic relevées, and C. Dobrescu (1978) mentions the association from the lacustrian complex at Poenita, presenting just a floristic list.

Table 1
Ass. ***Lemnetum minoris*** Oberd. ex T. Müller et Görs 1960

Number of relevé	1	2	3	4	5	6	
Altitude m s.m.	260	390	120	94	94	345	
Cover of the vegetation (%)	100	100	100	100	95	100	
Surface (m²)	15	10	20	20	10	15	
Number of species	4	1	6	5	10	3	K
Association's characteristics et Lemnion, Lemnetalia, Lemnetea							
Lemna minor	5	5	5	5	4	5	V
Potametea							
Myriophyllum spicatum	+	-	-	-	-	-	I
Phragmiti-Magnocaricetea							
Typha latifolia	+	-	-	+	+	+	III
Alisma plantago-aquatica	-	-	-	+	+	-	II

Phragmites australis	1	-	-	-	-	-	I
Carex vulpina	-	-	1	-	-	-	I
Bolboschoenus maritimus	-	-	+	-	-	-	I
Lycopus europaeus	-	-	-	-	+	-	I
Typha laxmannii	-	-	-	-	+	-	I
Schoenoplectus lacustris	-	-	-	-	-	+	I
Bidentetea							
Bidens tripartita	-	-	+	+	1	-	III
Polygonum minus	-	-	-	1	+	-	II
Bidens cernua	-	-	+	-	-	-	I
Echinochloa crus-galli	-	-	+	-	-	-	I
Variae syntaxa							
Trifolium pratense	-	-	-	-	+	-	I
Cyperus flavescens	-	-	-	-	1	-	I
Epilobium hirsutum	-	-	-	-	+	-	I

Date and place relevées: 1. Dobrovăţ, 23.08.2003; 2. Bârnova, 17.06.2003; 3. Codăeşti, 24.08.2003; 4,5. Vaslui, 20.08.2003; 6. Poieni, 27.07.2003

Ass. ***Lemnetum trisulcae*** Knapp et Stoffers 1962
(Syn.: *Salvinio natantis-Lemnetum trisulcae* Gehu et al. 1995, *Lemnetum trisulcae* Soó 1927, *Lemnetum trisulcae* Den Hartog 1963)

The association has been found in sedentary water ponds, with a high anthropo-zoological influence, that is, with a high level of nitrates, which ensures a rapid development of the *Lemna trisulca* species (**Tab. 2**).

After the analysis of the relevées, we noticed the following:

- within the **bioforms spectrum**, one may notice the presence of a large number of terophytes (40%), due to the anthropic influence, followed by hemicryptophytes (30%), hydrophytes (20%) and geophytes (10%);

- within the **phytogeographic spectrum**, the dominance of Eurasian elements is noticeable (50%), followed by cosmopolitan (40%) and circumpolar ones (10%);

- within the **spectrum of ecological indices**, the species growing in this type of association need a lot of light (60%); they are also amphitolerant towards the temperature index (50%), they have a spreading area in Central Europe (40%), they are hydrophilic (8-30%, 9-30%), and prefer areas with a high content of mineral nitrogen (30%).

Observations: The association has been recorded in this area within a study written by D. Mititelu and his contributors (1995), but without presenting a table of floristic relevées.

Table 2
Ass. ***Lemnetum trisulcae*** Knapp et Stoffers 1962

Number of relevé	1	2	3	4	5	
Altitude m s.m.	196	196	196	196	196	
Cover of the vegetation (%)	100	100	100	95	100	
Surface (m²)	10	10	10	10	10	
Number of species	6	3	4	3	2	K
Association's characteristics						
Lemna trisulca	5	5	5	5	5	V
Lemnion et Lemnetalia						
Lemna minor	1	-	-	-	+	II
Phragmiti-Magnocaricetea						
Lycopus europaeus	-	-	+	+	-	II
Veronica anagallis-aquatica	+	-	-	-	-	I
Phragmites australis	-	-	-	+	-	I

Bidentetea						
Bidens tripartita	+	-	+	-	-	II
Polygonum hydropiper	+	+	-	-	-	II
Bidens cernua	+	-	-	-	-	I
Echinochloa crus-galli	-	-	+	-	-	I
Galio-Urticetea						
Myosoton aquaticum	-	+	-	-	-	I

Date and place relevées: 1-5. Dobrovăț, 23.08.2003

Ass. ***Lemno-Utricularietum vulgaris*** Soó 1947
(Syn.: *Lemno-Utricularietum vulgaris* Soó 1928)

This association grows in sedentary waters, strongly mudded, rich in disintegrating organic substances.

Floating species, such as *Lemna minor*, grow on the water surface, and *Utricularia vulgaris* develops within the submerse stratum; thus, one may notice a bistratified structure. In addition to these, one can also find species belonging to the *Phragmiti-Magnocaricetea* class (**Tab. 3**).

After the analysis of the relevées, we noticed the following:

- the **bioforms spectrum** shows the dominance of hemicryptophytes (30%), followed by hygrophytes (20%), hydrohelophytes (20%), geophytes (20%) and phanerophytes (10%);

- the **phytogeographic spectrum** indicates the predominance of circumpolar elements (40%), followed by cosmopolitan (20%), Eurasian (20%) and European ones (20%);

- the **spectrum of ecological indices** reveals a dominance of species in need of a lot of light (70%), moderately termophilic (40%), up to amphitolerant towards the temperature indice (40%), with a spreading area in Central Europe (50%), hydrophilic (40%), preferring areas with a moderate content of mineral nitrogen (30%).

Observations: In 1970, C. Dobrescu presented a floristic list of this association but omitted to mention a precise location. In 1978, he presented a floristic list of the Poenita Lake.

Table 3
Ass. ***Lemno-Utricularietum vulgaris*** Soó 1947

Number of relevé	1	2	3	4	5	
Altitude m s.m.	290	290	290	290	290	
Cover of the vegetation (%)	90	70	60	100	70	
Surface (m²)	10	10	10	10	10	
Number of species	6	3	6	4	7	K
Association's characteristics						
Lemna minor	4	3	2	5	4	V
Utricularion, Potametalia et Potametea						
Utricularia vulgaris	1	2	1	1	+	V
Phragmiti-Magnocaricetea						
Typha angustifolia	1	-	2	-	+	III
Lythrum salicaria	+	-	+	-	-	II
Carex vulpina	+	-	+	-	-	II
Carex elata	+	-	-	-	+	II
Phragmites australis	-	+	-	-	+	II
Alisma plantago-aquatica	-	-	+	+	-	II

Variae syntaxa						
Salix cinerea	-	-	-	+	1	II
Calamagrostis canescens	-	-	-	-	+	I

Date and place relevées: 1-5 Poeniţa Lake, 10.08.2004

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

CONTRIBUTIONS TO THE STUDY OF VEGETATION IN TINOVUL MARE (POIANA STAMPEI – DISTRICT OF SUCEAVA)

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Abstract: We analyze in this paper the association ***Vaccinio – Betuletum pubescentis*** Libbert 1933 from the class ***Vaccinio – Piceetea*** Br.-Bl. in Br.-Bl. et al. 1939, from the phytocoenological point of view as well as from the point of view of the bioforms, floristic elements and ecological indices.

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

Introduction

The phytocoenoses of the association ***Vaccinio – Betuletum pubescentis*** Libbert 1933 was identified on the territory of the **scientific reservation Tinovul Mare** (Poiana Stampei, district of Suceava). The reservation is located at about 17km south-west from the town Vatra-Dornei, on the terrace at the confluence of the river Dorna with its affluent Dornişoara, at the altitude of 900-910m (where the meridian 27°7' longitude east meets the parallel 47°17' latitude north). The climate is temperate continental, average annual temperatures being low (4.2ºC). The average value of rains is over 740 mm/year. The soil is peat, lacking texture and very little aerated. Even though the reserve of organic material is huge (over 500 t/ha), this type of soil is poor in humus and nutritive substances. The soil reaction is very low [1].

The reservation, whose surface is of 681.8 ha, was included by the Romanian Government in the category of Natural reservations and monuments by Law 5/2000.

Material and method

For the study of vegetation we used the method of the phytocoenological school in Zürich – Montpellier, perfected by J. Braun-Blanquet and J. Pavillard. On taking into account several phytocoenological papers of classification [8, 9, 10], the association ***Vaccinio – Betuletum pubescentis*** Libbert 1933 was classified as follows:

Vaccinio – Piceetea Br.-Bl. in Br.-Bl. et al. 1939
Piceetalia excelsae Pawl. in Pawl. et al. 1928
Betulion pubescentis Lohmeyer et R. Tx. in R. Tx. ex Oberd. 1957
Vaccinio – Betuletum pubescentis Libbert 1933

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Results and discutions

Corology: *Tinovul Mare* (*Poiana Stampei*).

Ecology: phytocoenoses of the association *Vaccinio – Betuletum pubescentis* Libbert 1933 were identified in the area of lagg (marginal) of Tinovul Mare in the villager Poiana Stampei, in form of dense clusters (**Photo 1, 2**).

We have to mention the fact that this association was not signalled before on the territory of Moldavia [2]. According to the specialty literature [10, 12], the association *Vaccinio – Betuletum pubescentis* Libbert 1933 was identified in Mohoş and Luci (district of Harghita).

Phytocoenological characterization: *Betula alba* ssp. *glutinosa* is the main species in this association, realizing coverings of 100%. In the tree layer there are also from place to place some species as *Picea abies* and *Pinus sylvestris*. The herbaceous layer is weakly developed, realizing coverings of average 30% - 40%, rarely reaching 50%. We have to notice also the presence of the muscinal layer, formed by different species of *Polytrichum*, *Sphagnum*. The association is poor in species, perfectly natural situation if we take into account the very restrictive stational conditions. The floristic composition of these phytocoenoeses is realized by species characteristic to the alliance *Betulion pubescentis* (*Eriophorum vaginatum*, *Oxycoccus palustris*, *Pinus sylvestris*), order *Piceetalia excelsae* (*Dryopteris dilatata*, *Calamagrostis arundinacea*), as well as species characteristic to the class *Vaccinio – Piceetea* (*Campanula abietina*, *Campanula abietina*, *Lycopodium selago*, *Oxalis acetosella*). We have to underline the fact that in these peat phytocoenoeses, the species *Vaccinium myrtillus* and *Vaccinium vitis – idaea* have high constancies (**Tab. 1**).

The bioforms spectrum shows the predominance of hemicryptophytes (H – 40%), but also relatively high percentage of fanerophytes (Ph) and camephytes (Ch): 26.67% each. The only geophyte species among these phytocoenoses is *Equisetum sylvaticum* (**Fig. 1**).

The analysis of geoelements underlines the net dominance of the circumpolar element (Circ. – 60%), followed at big distance by the Euro-Asian element (Euras. – 13.33%). Equal percentages (6.67%) realize the central element – European, Carpathian – Balkan and endemic, these elements being represented by one single individual (**Fig. 2**).

The analysis of ecological indices underlines the fact that 53.33% among the species of these phytocoenoses there are plants of light, which do not stand the shadow, 13% are plants of full shadow, and 33.33% are plants of demi-shadow. 66.67% of the total number of species are not related to the thermal factor, and 46.67% are plants adapted to excessive humidity. As for the preference for the soil reaction, the analysis of the ecological indices shows that 60% among the species prefer the soils with acidity varying from very acid to moderately – low acid, 40% among species being tolerant to water from this point of view. Most of the species are developed on an under – layer with low to moderate content in mineral nitrogen (**Fig. 3**).

Conclusions

The phytocoenological characterization shows that this association is poor in species, perfectly natural situation if we take into account the very restrictive stational conditions. The analysis of bioforms, of geoelements and of ecological indices shows that our results are according with specialty literature [4, 5, 6].

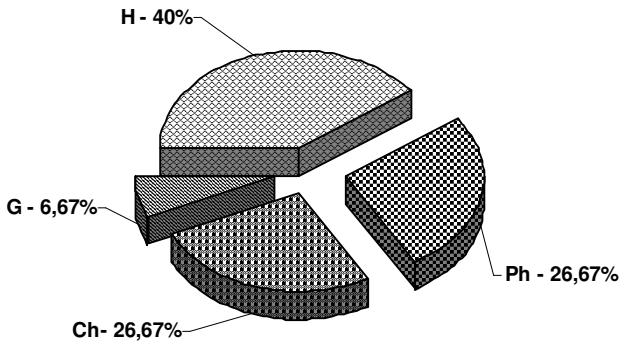

Fig. 1. The bioforms spectrum – ass. *Vaccinio – Betuletum pubescentis* Libbert 1933
(Ph – fanerophytes; H – hemicryptophytes; Ch – camephytes; G – geophytes)

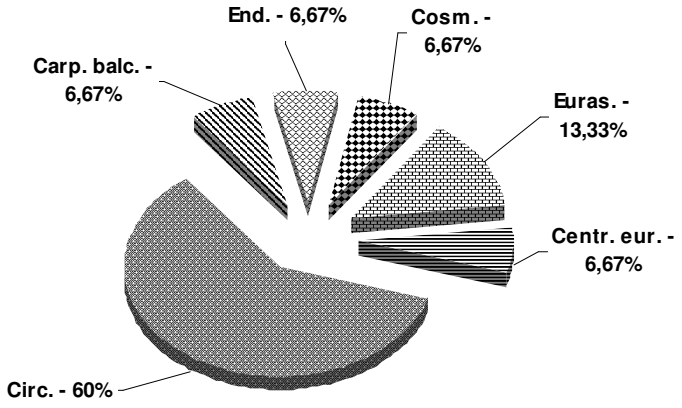

Fig. 2 The floristic elements spectrum – ass. *Vaccinio – Betuletum pubescentis*
Libbert 1933 (Circ. – circumpolar; Euras. – European-Asian; Centr. eur. – Central European; Carp. balc. – Carpathian-Balkan; End. – Endemic; Cosm. – cosmopolite)

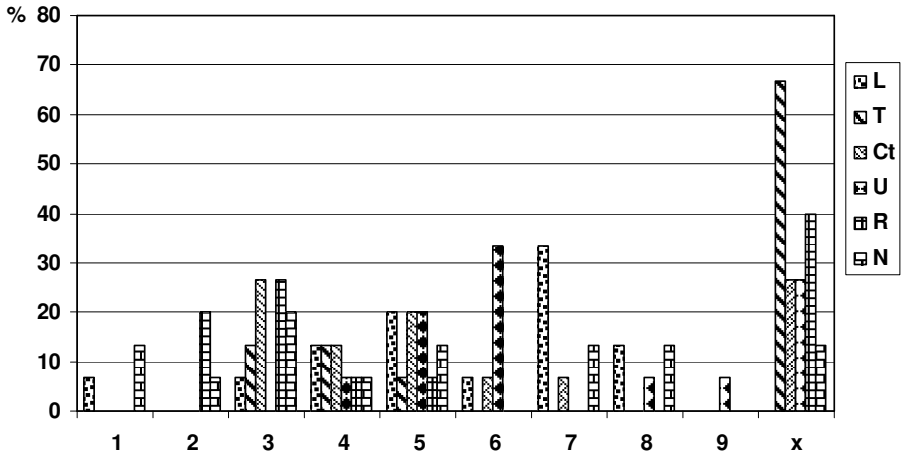

Fig. 3. The ecological indices spectrum – ass. *Vaccinio – Betuletum pubescentis* Libbert 1933
(L – light; T – temperature; Ct – continent; U – humidity; R – soil reaction; N – nitrogen)

Table 1 As. Vaccinio – Betuletum pubescentis Libbert 1933

Relevé number	1	2	3	4	5	
Altitude (m)	902	902	902	902	902	
Covering of tree layer (%)	100	100	100	100	100	
Covering of the herbaceous and sub-tree layer (%)	35	50	30	40	40	
Covering of muscinal layer (%)	40	30	45	30	30	
Surface of relevé (m²)	400	400	400	400	400	
Number of species	15	12	11	14	13	K
Caract. as.						
Betula alba ssp. glutinosa	5	5	5	5	5	V
Betulion pubescentis						
Eriophorum vaginatum	+	-	+	-	+	III
Oxycoccus palustris	+	+	-	+	+	IV
Pinus sylvestris	+	+	-	+	+	IV
Piceetalia excelsae						
Dryopteris dilatata	+	-	+	-	+	III
Calamagrostis arundinacea	+	+	-	+	+	IV
Vaccinio – Piceetea						
Campanula abietina	-	+	-	+	-	II
Equisetum sylvaticum	1	1	1	+	1	V
Lycopodium selago	+	-	+	-	-	II
Oxalis acetosella	-	+	-	+	-	II
Picea abies	+	+	+	+	+	V
Vaccinium myrtillus	2	2	1	3	2	V
Vaccinium vitis – idaea	+	1	1	+	1	V
Variae syntaxa						
Chamaerion angustifolium	+	-	+	+	-	III
Rubus idaeus	+	-	-	+	+	III
Polytrichum sp.	+	+	1	+	+	V
Sphagnum sp.	3	3	2	3	3	V

Place and date of the relevées: 1 – Tinovul Mare (Poiana Stampei), (27.07.2006); 2-5 – Tinovul Mare (Poiana Stampei), (19.08.2006)

Photo 1. Phytocoenoses of the association *Vaccinio – Betuletum pubescentis* Libbert 1933

Photo 2. Phytocoenoses of the association *Vaccinio – Betuletum pubescentis* Libbert 1933

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

CONTRIBUTIONS TO THE STUDY OF FORESTS VEGETATION FROM THE SUPERIOR MOUNTAIN LEVEL OF HĂŞMAŞUL MARE MASSIF (EASTERN CARPATHIANS)

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Abstract: The ecological conditions specific to the researched territory have favoured installation of a wooden vegetation represented by mountain beech forests, beech and resinous mixed forests and pure spruce-fir forests. Locally, on limited areas and superficial soils, relict pine phytocoenosis have been identified. Two plant communities from *Vaccinio – Piceetea* Br.-Bl. 1939 and *Erico – Pinetea* Horv. 1959 classes are presented and analysed in this paper from the bioforms, floristic elements and ecological requests perspectives.

Key words: vegetation, Hăşmaşul Mare.

Introduction

Besides Cheile Bicazului, Lacu Roşu and Cheile Şugăului, Hăşmaşul Mare Massif represents a territory integrated in structure of the national park having the same name, region presenting a great geological and biological importance. It is situated in the central part of the Eastern Carpathians and is constituted in its most part from mezozoic calcareous rocks which are permanently attacked by an active erosion process. This mountain massif presents middle altitudes (1792 – Hăşmaşul Mare peak, 1774 – Hăşmaşul Negru peak, 1587 m – Piatra Singuratică peak) and following ecological conditions (specific to middle and superior mountain vegetation levels): brown eu – mezobazic and brown acid soils, average values of atmospheric precipitations by 800 – 1000 mm/m^2/year and average values of temperature between 4 – 7ºC. All these abiotic factors have contributed to the installation of a wooden vegetation represented by:

- mountain beech forests and mixed beech with fir and spruce-fir forests from **Querco – Fagetea** vegetation class (Symphyto – Fagion alliance): *Symphyto cordati – Fagetum* Vida 1959, *Leucanthemo waldsteinii – Fagetum* (Soó 1964) Tauber 1987 and *Pulmonario rubrae – Fagetum* (Soó 1964) Tauber 1987. Also, from the same vegetation class (Alno – Ulmion alliance) mezohygrophilous phytocoenosis belonging to *Telekio speciosae – Alnetum incanae* Coldea (1986) 1990 have been identified;
- coniferous forests from **Vaccinio – Piceetea** class represented by the most spread association: *Hieracio transsilvanici – Piceetum* Pawl. Et Br.-Bl. 1939;
- relict phytocoenosis edified by Pinus sylvestris from **Erico – Pinetea** class, installed on smaller areas and superficial soils: *Seslerio rigidae – Pinetum sylvestris* (Csürös et Sparchez 1963) Csürös et al. 1988.

Material and methods

The phytosociological study has been made using the classic methods specific to Central Europe Phytosociological School, by realizing phytocoenological releves in field

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(using Braun – Blanquet scale having the abundance – dominance indices from + to 5) and then their ordering and grouping in vegetal associations on the basis of characteristic, dominant and differentiate species [1], [3], [7]. Thus, these two plant communities are subordinated to the next superior coenotaxa:

VACCINIO – PICEETEA Br.-Bl. 1939

VACCINIO – PICEETALIA Br.-Bl. 1939

Piceion abietis Pawl. in Pawl. et al. 1928

Hieracio transsilvanici – Piceetum Pawl. et Br.-Bl. 1939

ERICO-PINETEA Horv. 1959

ERICO-PINETALIA Horv. 1959

Seslerio rigidae – Pinion Coldea 1991

Seslerio rigidae – Pinetum sylvestris (Csűrös et Spârchez 1963) Csűrös et al. 1988

The biological forms and floristic elements for each species are those that have been given by V. Ciocârlan [2] and the values for ecological indices (L–light, T–temperature, C–continentality, U–humidity, R–soil pH and N–the nitrogen content of soil) have been established by H. Ellenberg [4].

Results and discussions

Table nr. 1: *Hieracio transsilvanici – Piceetum* Pawl. et Br.-Bl. 1939

Nr. of relevé	1	2	3	4	5	6	7	8	9	10	11	12
Plot area (m^2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Altitude (m)	920	940	890	1050	1075	1110	990	920	970	1240	1160	1150
Aspect	E	NE	NE	N	SV	N	NE	E	E	NE	NV	N
Slope (°)	15	10	15	20	15	10	5	15	25	20	15	5
Trees height (m)	32	35	30	28	35	35	35	30	27	25	30	35
Trees diameter (cm)	15-75	10-85	10-80	20-70	12-90	10-85	15-90	19-75	15-70	10-65	15-80	9-80
Trees stratum covering (%)	85	80	90	85	90	70	80	75	85	95	75	70
Schrubs and regeneration stratum covering (%)	5	3	5	3	30	25	15	30	5	3	3	12
Herbs stratum covering (%)	25	20	15	20	35	15	7	15	20	15	5	10
Car. ass.												
Hieracium transsilvanicum	+	+	+	+	-	-	-	+	-	+	+	+
Picea abies	4	4	5	4	4	3	4	4	4	5	4	3
Picea abies juv.	+	+	-	+	1	1	+	+	-	+	+	1
Piceion et Piceetalia excelsae												
Dryopteris dilatata	-	+	-	+	-	+	-	-	+	-	+	-
Luzula sylvatica	1	+	-	-	-	-	+	-	1	2	+	-
Melampyrum sylvaticum	+	+	1	-	-	-	-	+	-	-	+	+
Soldanella hungarica	-	-	+	-	-	-	-	-	+	-	-	-
Calamagrostis villosa	-	-	-	-	-	-	+	-	-	-	-	+
Luzula luzuloides	-	-	+	-	+	+	-	-	+	+	-	+
Melampyrum saxosum	-	-	-	+	-	-	-	-	-	-	-	-
Athyrium distentifolium	-	-	+	-	-	-	-	-	-	-	-	-
Deschampsia flexuosa	-	-	-	-	-	-	-	-	-	-	+	-
Clematis alpina	-	-	+	-	-	-	-	-	-	-	-	-
Lonicera coerule	-	-	-	-	-	+	-	-	-	-	-	-
Calamagrostis arundinacea	1	-	+	-	-	+	-	+	1	+	-	-

Ranunculus carpaticus	-	+	-	+	-	-	-	-	-	+	-	-
Abieti – Piceion et Athyrio – Piceetalia												
Athyrium filix-femina	-	+	+	-	+	-	-	+	+	-	-	-
Abies alba	+	1	+	+	+	1	1	+	1	-	+	+
Abies alba juv.	+	+	+	-	+	-	-	-	+	+	-	+
Rosa pendulina	+	-	+	-	+	-	-	+	-	-	+	+
Valeriana tripteris	-	+	+	-	-	-	-	-	+	-	-	+
Fragaria vesca	-	+	-	+	-	+	-	-	-	+	-	+
Vaccinio – Piceetea												
Sorbus aucuparia	+	-	+	-	-	-	+	-	+	+	-	-
Sorbus aucuparia juv.	-	-	+	-	-	-	-	-	+	-	-	-
Pinus sylvestris	-	-	+	-	-	-	-	+	-	-	-	-
Lycopodium selago	+	+	-	+	+	+	-	-	+	+	-	-
Oxalis acetosella	1	2	1	2	+	+	+	+	1	+	+	+
Lycopodium annotinum	-	+	-	-	-	-	-	+	-	-	-	-
Pyrola rotundifolia	-	-	-	-	+	-	-	+	-	+	-	-
Vaccinium myrtillus	-	+	+	-	3	2	1	2	-	+	+	-
Vaccinium vitis-idaea	-	-	-	-	-	+	+	+	-	+	-	-
Orthilia secunda	-	+	-	-	-	+	-	-	-	-	-	-
Campanula abietina	+	+	-	-	-	+	-	+	+	-	+	-
Homogyne alpina	-	+	+	+	+	-	-	+	-	+	-	+
Moneses uniflora	+	-	-	+	-	-	-	+	-	-	-	-
Corallorhiza trifida	+	-	-	-	-	-	-	-	-	-	-	+
Listera cordata	+	-	+	-	-	-	+	-	-	+	-	-
Streptopus amplexifolius	-	-	-	-	-	+	-	-	-	-	-	-
Fagetalia sylvaticae et Querco - Fagetea												
Fagus sylvatica	1	-	-	1	+	1	+	+	-	-	+	1
Fagus sylvatica juv.	+	-	-	-	-	+	+	-	+	-	-	+
Acer pseudoplatanus	-	+	-	-	-	+	-	-	+	-	-	+
Galium odoratum	+	+	-	-	-	-	-	+	-	-	-	+
Mercurialis perennis	-	-	-	+	-	-	-	-	-	-	-	-
Gymnocarpium dryopteris	-	-	-	+	-	-	-	-	-	-	-	-
Anemone ranunculoides	-	+	-	+	-	-	-	-	-	-	-	-
Euphorbia amygdaloides	+	+	-	-	+	-	+	+	-	-	-	+
Maianthemum bifolium	-	-	+	-	-	-	-	-	+	-	-	-
Lathyrus vernus	+	-	-	+	-	-	-	-	-	-	-	-
Dryopteris filix-mas	+	-	+	+	+	-	-	+	+	-	+	-
Hepatica nobilis	+	+	-	-	+	-	-	-	-	-	-	+
Corylus avellana	-	-	+	-	-	-	-	-	-	-	-	+
Pulmonaria rubra	+	-	+	+	+	-	+	-	-	+	-	-
Primula elatior ssp. leucophyla	-	-	-	-	+	-	-	-	-	-	-	-
Dentaria glandulosa	-	-	-	+	-	-	-	+	-	-	-	+
Symphytum cordatum	-	+	-	+	-	-	-	-	+	-	-	+
Polystichum aculeatum	+	-	-	-	-	-	-	-	-	+	-	-
Elyno – Seslerietea												
Juniperus sabina	-	-	+	-	-	-	-	-	-	-	-	-
Asplenietea trichomanis												
Silene nutans ssp. dubia	-	-	+	-	-	-	-	-	-	-	+	-
Hieracium bifidum	-	+	-	-	-	-	-	-	-	-	-	-
Variae syntaxa												
Alnus incana	-	-	+	-	-	-	-	-	-	-	-	-
Betula pendula	+	-	+	-	-	-	-	-	-	+	-	-
Polygonatum verticillatum	-	-	+	-	-	-	+	+	-	-	+	-
Veronica officinalis	-	-	+	-	-	+	+	-	-	+	-	-

Veronica urticifolia	-	+	-	+	+	-	+	-	+	-	-	+
Rubus idaeus	-	+	-	-	+	-	+	-	+	-	+	-
Sambucus racemosa	+	-	-	-	-	+	-	-	-	+	-	-
Euphorbia carniolica	+	-	+	+	-	-	-	-	+	-	-	+
Urtica dioica	+	-	-	-	-	+	-	-	-	-	-	-
Gentiana asclepiadea	+	+	-	+	-	+	-	-	-	+	-	+
Hieracium pojoritense	+	-	-	-	+	-	-	-	-	-	-	-
Ajuga reptans	+	+	-	-	-	-	-	-	+	+	-	-
Impatiens noli-tangere	-	-	-	-	-	-	-	-	-	-	-	+
Aconitum moldavicum	-	+	-	-	-	-	-	-	-	-	-	-

Place and date of relevées: Rel. 1, 2, 4, 7, 11 = Cheile Bicazului: 27-30.07.2005; Rel. 3, 8 = Cheile Şugăului: 27.07.2005; Rel. 10 = Suhardul Mic: 29.07.2005; Rel. 5, 6, 9, 12 = Lacu Roşu: 27-28. 07.2005.

Hieracio transsilvanici – Piceetum association (**Table nr. 1**) includes the spruce-fir forests, wide spread in the researched area, covering mountains versants with varied slopes and expositions, between 900 and 1400 m altitude. The trees stratum is dominated by *Picea abies*, species that realize an average covering degree of 65-85%, reach the 30-35 m height and trunks diameter between 10 and 90 cm. In some phytocoenosis, *Abies alba* (fir) can be present (without becoming co-dominant or sub-dominant) and also *Fagus sylvatica, Sorbus aucuparia, Acer pseudoplatanus, Betula pendula* can be present. Shrubs stratum flora is less rich in plants species, reduced abundance – dominance indices presenting *Sambucus racemosa, Rubus idaeus, Vaccinium myrtillus* etc, while in the herbs stratum *Oxalis acetosella, Hieracium transsilvanicum, Campanula abietina, Gentiana asclepiadea* and other species are present. Besides the characteristic species to the association, alliance, order and *Vaccinio – Piceetea* vegetation class, in the studied areas are also present representative species to *Querco – Fagetea* class (*Gymnocarpium dryopteris, Maianthemum bifolium, Euphorbia amygdaloides, Dryopteris filix-mas, Hepatica nobilis* etc.) or, rarely, to *Elyno-Seslerietea* class (*Juniperus sabina*). The floristic elements spectrum points out the fact that in this vegetal association structure prevails the central – european (mountain) elements (32%) and circumpolar elements (25%) followed by the eurasiatic (21%) and endemic (11%) elements. The life-forms spectrum presents the preponderance of the hemicryptophyte species (47%) followed by phanerophyte (25%) and geophyte (15%) species. Ecological indices spectrum (**Fig. 1**) reveals the presence and preponderance of shadow species, characteristic to a relative cold mountain climate, preferring moist, acid and relative poor in mineral N soils. In some cases, significant values can also present the indifferent species.

Fig. 1 Ecological indices spectrum of *Hieracio transsilvanici - Piceetum* association

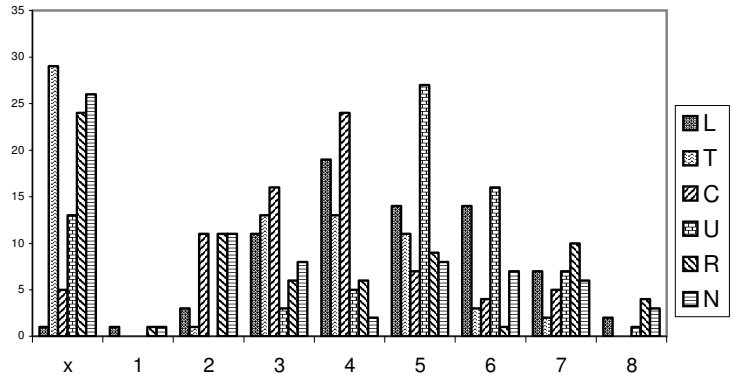


Table nr. 2: *Seslerio rigidae – Pinetum sylvestris* (Csűrös et Spârchez 1963) Csűrös et al. 1988

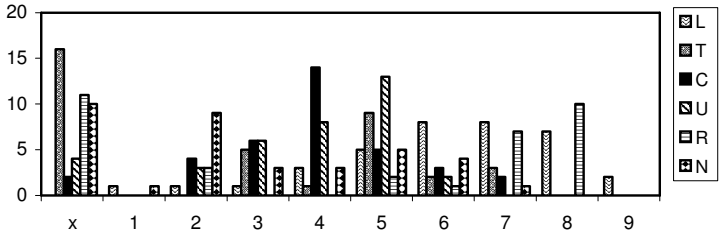
Nr. of relevé	1	2	3	4	5
Altitude (m.s.m.)	1325	1286	1155	1260	1200
Aspect	S	S	SV	SV	SE
Slope (º)	20	35	25	30	20
Herbs stratum covering (%)	30	50	35	40	30
Shrubs stratum covering (%)	5	5	5	10	5
Tree stratum covering (%)	65	55	65	65	70
Plot area	100	100	100	100	100
Car. ass.					
Sesleria rigida	3	2	1	+	+
Pinus sylvestris	3	2	3	3	3
Seslerio rigidae – Pinion					
Juniperus communis	1	-	+	1	+
Cotoneaster integerrimus	+	+	+	+	-
Erico – Pinetalia					
Iris ruthenica	+	+	+	-	-
Cirsium erisithales	+	-	-	+	+
Vaccinio – Piceetea et Vaccinio – Piceetalia					
Picea abies	1	3	1	2	2
Hieracium transsilvanicum	+	+	-	+	-
Vaccinium vitis-idaea	+	-	+	+	-
Orthilia secunda	+	+	-	+	+
Oxalis acetosella	+	-	+	+	-
Melampyrum sylvaticum	+	+	+	+	-
Fagetalia sylvaticae					
Fagus sylvatica (juv.)	+	-	-	+	-
Daphne mezereum	+	+	-	+	+
Carex sylvatica	+	-	-	+	-
Calamagrostis arundinacea	+	1	1	+	1
Stipio pulcherrime – Festucetalia pallentis et Seslerio – Festucion pallentis					
Festuca pallens	1	-	+	-	+
Erysimum odoratum	-	+	-	-	+
Jovibarba heuffelii	-	+	-	-	-
Aliae					
Laserpitium krapfii	+	-	-	-	+
Carex montana	+	-	-	+	-
Bupleurum falcatum	+	+	+	+	+
Scabiosa columbaria	+	+	-	-	+
Carduus glaucinus	+	+	+	+	-
Ranunculus montanus ssp. pseudomontanus	+	+	-	-	+
Daphne cneorum	+	-	+	-	-
Cruciata glabra	-	+	+	+	-
Seseli libanotis	+	+	+	-	+
Campanula carpatica	-	+	-	+	+
Fragaria vesca	+	+	+	-	-
Phyteuma orbiculare	+	+	-	-	+
Silene nutans ssp. dubia	-	+	-	-	-
Thesium dollineri	+	-	-	-	-
Valeriana tripteris	-	+	+	+	+
Gnaphalium sylvaticum	-	+	-	-	-
Galium flavescens	+	-	-	-	-
Laserpitium latifolium	-	+	+	+	-
Pimpinella saxifraga	+	-	-	-	-

Place and date of relevées: Rel. 1-5 = Suhardul Mic: 29.07.2005

Seslerio rigidae – Pinetum sylvestris association (**Table nr. 2**) includes relict *Pinus sylvestris* phytocoenosis installed on calcareous versants (25-30º), on poor and superficial soils having southern and south – western expositions of the Suhardul Mic Mountain (situated in Hăşmaşul Mare – Lacu Roşu – Cheile Bicazului National Park territory). The general covering degree of the vegetation varies between 75 – 85%. The trees stratum is edified by *Pinus sylvestris*, species presenting an average covering degree (about 50 %). Besides this, *Picea abies* species can also be met (sometimes realizing a

significant covering). The shrubs stratum is less developed, reduced values of abundance – dominance indices presenting *Juniperus communis, Cotoneaster integerrimus, Vaccinium vitis-idaea, Daphne mezereum* and *Daphne cneorum*. The herbs stratum includes the characteristic species *Sesleria rigida* and also *Iris ruthenica* and *Cirsium erisithales* (characteristic to superior coenotaxa). As a consequence of the contact of these pine phytocoenosis with the spruce-fir forests, the floristic structure of this association contains also species from *Vaccinio – Piceetea* class (*Hieracium transsilvanicum, Orthilia secunda, Oxalis acetosella, Melampyrum sylvaticum* etc.), *Querco – Fagetea* (*Daphne mezereum, Carex sylvatica, Calamagrostis arundinacea* etc.) and even *Festuco – Brometea* (*Festuca pallens, Erysimum odoratum, Jovibarba heuffelii*). In the floristic composition the hemicryptophytes (65%) are prevalent, yet also the wooden species are significantly represented – 23% phanerophytes and 9% chamaephytes. The floristic elements spectrum reveals the preponderance of eurasiatic (29%) and central - european (26%) elements but also carpatho – balcanic (24%) are well represented. Ecological indices spectrum (**Fig. 2**) reflects the increased proportion of heliosciophytes species, most of them indifferent to temperature, preferring moderate moist and slight alkaline soils.

Fig. 2 Ecological indices spectrum of S*eslerio rigidae - Pinetum sylvestris* association



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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

THE FLORA OF "HERGHELIE MARSH" NATURAL RESERVE (CONSTANȚA COUNTY)

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Abstract: The paper's aim is to present the floristic inventory and the main vegetation types of Herghelie Marsh, a less-known Natural Reserve placed near Mangalia city, in the proximity of the Black Sea shore area. Some considerations about the life forms, phytogeographical elements, ecological categories and rare or threatened taxa within this eutrophic marsh are also presented.

Key words: flora, Herghelie marsh, Natural Reserve, vegetation types, rare and threatened taxa.

Introduction

Herghelie Marsh is situated in the south of the Dobrudja plateau, near Mangalia city, between Venus and Saturn resorts [13] (**Fig. 1**), in the proximity of the Black Sea shore. It is a former maritime gulf, turned into lagoon and subsequently separated from the sea through maritime sands. The actual marsh surface is 98 hectares [13]. This marsh has a Natural Reserve status (botanic and ornithological) beginning with December 8th, 2005.

The specific of this eutrophic marsh flora and vegetation, the diversity of habitats and plant communities have called botanists' attention since ancient times. In spite of this, the floristic and phytocoenological researches are very few. The last detailed study regarding this area is more than thirty years old. In 1977, Pop & Hodisan [8] mentioned 63 vascular plant taxa and 9 plant associations in the marsh area.

In the last thirty years, the flora and vegetation of this area have undergone many changes, as a result of the anthropogenic impact, but also a natural succession of vegetation. That is why, we have proposed to update the floristical knowledge of this recent Natural Reserve.

Material and Methods

The plant species nomenclature follows the "Flora Europaea" [11, 12], "Flora ilustrată a României" [1] and "Flora României" [9]. Field studies have been done in the period 2005-2006, during the entire vegetation season, in order to capture all the phenology stages.

The establish of the life forms, phytogeographic elements and ecological categories - in dependence of moisture (U), temperature (T) and soil reactivity (R), has been made on the basis of "Flora ilustrată a României" [1] and "Conspectul florei cormofitelor spontane din România"[9].

The studied area included the water surface, the marsh banks and the neighboring higher surfaces.

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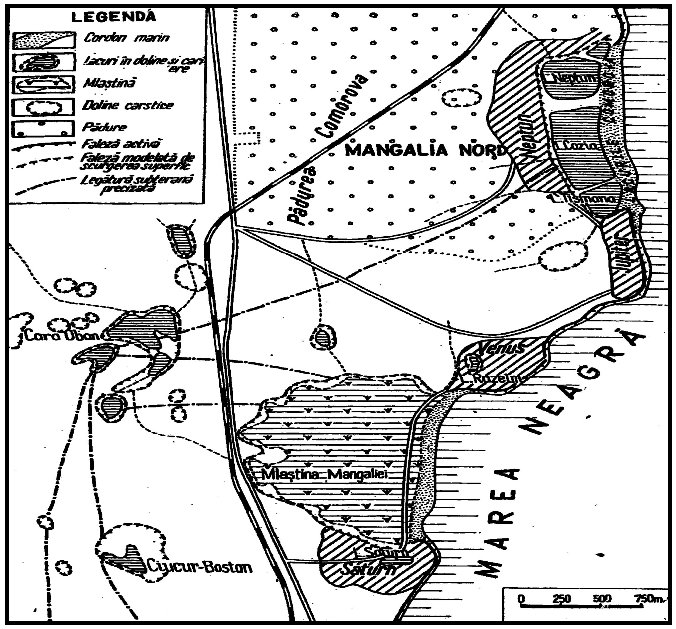

Fig. 1 The detailed map of Herghelie marsh Natural Reserve

Results and discussions

The following vegetation types have been observed within Herghelie Marsh Natural Reserve:

- fixed or floating hydrophylous plant communities;
- paludous vegetation, composed of hygrophilous plants, with a large distribution around the marsh banks or within the islands;
- meso-halophylous plant communities, placed on the lightly salty and moderately wet soils;
- xero-mesophylous vegetation, on the higher surfaces from the marsh proximity, composed especially of xerophylous weeds;

In the studied area we have identified 134 taxa, from which, 132 vascular plants and two macrophytic algae. However, the floristic conspectus contains other 16 plant taxa mentioned by Pop & Hodişan [8], but not recovered by us. These taxa have not been takes into consideration in the drafting of life forms, floristic elements and ecological categories spectrums.

The identified vascular taxa are the follows: *Aegilops cylindrica* Host.– Th, Eua (Cont), U1,5 T3 R0; *Alisma plantago-aquatica* L. – HH (Hd), Circ, U6 T0 R0; *Althaea officinalis* L. ssp. *officinalis* – H, Eua (Cont), U3 T4 R4; *Anagallis arvensis* L. – Th, Cosm, U3 T3,5 R0; *Anthriscus caucalis* Bieb. – Th, Pont-Med, U2 T4 R0; *Anthriscus cerefolium* (L.) Hoffm. – Th, Pont-Med, U2,5 T4 R4; *Apium graveolens* L. – TH, Atl-Med; U1,5 T4

R4,5; *Arctium lappa* L. – TH, Eua (Med), U3,5 T3 R4; *Artemisia absinthium* L. – Ch-H, Eua (med); U2 T3 R4; *Artemisia vulgaris* L. – H, Circ, U2,5 T3 R4; *Aster tripolium* L. ssp. *pannonicus* (Jacq.) Soo – H, Pont-Pan, U5 T0 R5; *Atriplex prostrata* Boucher ex DC. – Th, Circ, U3,5 T0 R0, 2n = 18; *Avena fatua* L. – Th, Eua (Cont), U2,5 T0 R4; *Avena sativa* L. – Th, Eua; *Ballota nigra* L. – H, Med-Euc, U2 T3,5 R4; *Berula erecta* (Huds.) Coville [8] – H (HH), Circ, U6 T3 R0; *Bidens tripartita* L. – Th, Eua, U4,5 T3 R0; 2n = 48; *Scirpus maritimus* L. – G (HH), Cosm, U4,5 T3 R5; *Bromus squarrosus* L. – Th, Eua (Cont), U1,5 T4 R4; *Bromus sterilis* L. – Th, Eua (Med), U2 T4 R4; *Calamagrostis epigeios* (L.) Roth – G, Eua (Med), U2 T3 R0; *Carduus nutans* L. – TH, Eua (Med), U1,5 T3 R3; *Carex acuta* L. [8] – G (HH), Circ, U5 T3 R0; *Carex distans* L. – H, Eua (Med), U4 T3 R4; *Carex extensa* Good. – H, Atl-Med, U4 T3 R4,5; R [2, 5]; *Carex riparia* Curtis [8] – G (HH), Eua, U5 T4 R4; *Carthamus lanatus* L. – Th, Pont-Med; U2,5 T4 R0; *Centaurea solstitialis* L. – TH, Med, U2 T4 R0; *Ceratophyllum demersum* L. – HH (Hd), Cosm, U6 T3 R0; *Ceratophyllum submersum* L – HH, Eua (med); U6 T3,5 R0; *Epilobium angustifolium* L. – H, Circ; U4 T1,5 R0; *Cichorium intybus* L. – H, Eua, U3 T0 R3; *Cicuta virosa* L. – HH, Eua; U5 T0 R3; *Cirsium arvense* (L.) Scop. – G, Eua (Med), U2,5 T3 R0; *Cladium mariscus* (L.) Pohl – HH, Cosm, U6 T0 R5; *Conium maculatum* L. – Th-TH, Eua, U3 T3 R3; *Convolvulus arvensis* L. – H (G), Cosm, U2,5 T3,5 R3,5; *Conyza canadensis* (L.) Cronq. – Th, Adv (Am. N.), U2,5 T0 R0; *Coronilla varia* L. – H, Euc (Med), U2 T3 R4; *Crepis foetida* L. ssp. *rhoeadifolia* (Bieb.) Celak. – Th, Pont-Med, U2,5 T3,5 R3; *Cuscuta campestris* Yuncker ssp. *campestris* – Th, Adv (Am N.), U3 T3 R0; *Cynodon dactylon* (L.) Pers. – G (H), Cosm, U2 T3,5 R0; *Daucus carota* L. ssp. *carota* – TH, Eua (Med), U2,5 T3 R0; *Descurainia sophia* (L.) Webb ex Prantl – Th, Eua, U2,5 T4 R4; *Diplotaxis muralis* (L.) DC. – Th, Med, U2,5 T4,5 R4,5; *Echinochloa crus-galli* (L.) Beauv. – Th, Cosm, U4 T0 R3; *Echinochloa crus-galli* f. *oryzoides* – Th, Cosm, U4 T0 R3; *Elaeagnus angustifolia* L. – Ph (arbore), As. temp; *Elymus elongatus* (Host.) Runemark ssp. *elongatus* – H, Pont-Med, U3 T4 R4,5; *Elymus hispidus* (Opiz) Melderis ssp. *hispidus* – G, Eua (Cont), U2 T4,5 R4; *Elymus repens* (L.) Gould – G, Circ, U0 T0 R0; *Epilobium hirsutum* L. [8]– H, Eua (Med), U4 T3 R3; *Epilobium parviflorum* Schreber – H, Eua, U5 T3 R4,5; *Epilobium tetragonum* L. ssp. *tetragonum* – H, Eua (Med), U4,5 T3 R0; *Erodium cicutarium* (L.) L Her. – Th, Cosm, U2,5 T0 R0; *Eupatorium cannabinum* L. – H, Eua, U4 T3 R3; *Festuca arundinacea* Schreber ssp. *arundinacea* – H, Euc, U4 T3 R4; *Galega officinalis* L. – H, Pont-Med, U4,5 T3 R4; *Galium palustre* L. – H, Circ, U5 T3 R0; *Glyceria maxima* (Hartman) Holmberg – H (HH), Circ, U5 T3 R4; *Gypsophyla perfoliata* L. [8] – Ch, Pont, U1,5 T4 R5; *Heraclerum sphondylium* L. [8] - H, Eua; U3 T2,5 R5; *Hordeum murinum* L. ssp. *murinum* – Th, Eua (Med), U2,5 T4 R0; *Hypericum perforatum* L. – H, Eua, U3 T3 R0; *Iris pseudacorus* L. [8] – G, Eur; U5,5 T0 R0; *Juncus gerardi* Loisel – G, Circ, U4,5 T3 R5; *Lactuca aurea* (Sch.) Stebbins [8] – H, Balc; U2 T4 R4,5; *Lactuca tatarica* (L.) C.A.Mey – H, Eua (Cont), U0 T4 R4,5; *Lathyrus pratensis* L. – H, Eua; U3 T0 R4; *Lathyrus tuberosus* L. – H, Eua (Med), U2 T4 R4; *Lemna minor* L. – HH (Hd), Cosm, U6 T3 R0; *Lemna trisulca* L. – HH (Hd), Cosm, U6 T3 R4; *Linaria genistifolia* (L.) Miller ssp. *genistifolia* – H, Eua (Cont), U1 T3,5 R5; *Lolium perenne* L. – H, Cosm, U3 T3 R0; 2n = 14; *Lotus corniculatus* L. – H, Eua, U2,5 T0 R0; *L. glaber* Miller – H, Eua (Med), U3,5 T3 R4; *Lycopus europaeus* L. – H (HH), Eua, U5 T3 R0; *Lycopus exaltatus* L. fil. [8] – H (HH), Eua (Cont), U5 T3 R0; *Lysimachia vulgaris* L. [8] – H (HH), Eua, U5 T2 R0; *Lythrum salicaria* L. – H, Circ; U4 T2,5 R0; *Lythrum virgatum* L. – H, Eua (Cont), U4,5 T3,5 R4; *Malva sylvestris* L. ssp. *sylvestris* – TH (H), Eua (Cosm), U3 T3 R0; *Matricaria chamomilla* L. – Th, Eua (Med), U2,5 T3,5 R5; *Medicago lupulina* L. – TH(H), Eua, U2,5 T3 R4; *Medicago minima* (L.) L. – Th, Eua (Med), U1,5 T4 R4; *Medicago sativa* L. – Ch-

H, Eua (cont); U2 T3 R5; *Melilotus alba* Medik. – Th, Eua, U2,5 T3 R0; *Melilotus officinalis* Lam. – Th, Eua, U2,5 T3,5 R0; *Mentha aquatica* L..– H (HH), Eur, U5 T3 R0; *Miosoton aquaticum* (L.) Moench. [8] – Th (TH), Eua (Med), U4 T3 R0; *Myosotis scorpioides* L. – H, Eua, U5 T3 R0; *Myriophyllum spicatum* L. – HH (Hd), Circ, U6 T0 R4,5; *Najas marina* L. – HH, Cosm; U6 T4,5 R4,5; *Oenanthe aquatica* (L.) Poiret – HH (Hd), Eua, U6 T3 R0; *Oenothera biennis* L. – TH, Adv (Am N.), U2 T4 R0; *Onopordum acanthium* L. – TH, Eua (Med), U2,5 T4 R4; *Papaver rhoeas* L. - Th, Cosm, U3 T3,5 R4; *Pastinaca sativa* L. [8] – TH-H, Eua; U3 T4 R4; *Phragmites australis* (Cav.) Steudel ssp. *australis* var. *australis* – HH, Cosm, U6 T0 R4; *Plantago lanceolata* L. – H, Eua, U3 T0 R0; *Plantago major* L. ssp. *major* – H, Eua, U3 T0 R0; *Plantago media* L. – H, Eua, U2,5 T0 R4,5; *Poa palustris* L. – H, Circ, U5 T4 R2; *Polygonum amphibium* L. - HH, Cosm, U6 T3 R0; *Polygonum aviculare* L. – Th, Cosm, U2,5 T0 R3; *Polygonum hydropiper* L. – Th, Circ, U5 T3 R4; *Polygonum lapathifolium* L. ssp. *lapathifolium* - Th, Cosm, U4 T0 R3; *Polygonum maritimum* L. [8] – H, Med, U2 T4,5 R5; *Polygonum mit*e Schrank – Th, Eur (Med), U5 T3 R4; *Polypogon monspeliensis* (L.) Desf. – Th, Med, U4 T4 R5; R [2, 6]; *Populus x canadensis* Moench s.l. (*P. deltoides* x *P. nigra*) – Ph, Canada; *Populus nigra* L. – Ph, Eua; U4 T3 R4; *Potamogeton pectinatus* L. – HH, Cosm; U6 T3 R4,5; *Puccinellia distans* (L.) Parl. ssp. *distans* – H, Eua (Cont), U0 T0 R4; *Puccinellia gigantea* Grossh. – H, Pont-Med, U0 T4 R5; *Pulicaria dysenterica* (L.) Bernh. – H, Euc, U3,5 T3 R4; *Ranunculus aquatilis* L. ssp. *aquatilis* [8] - HH (Hd), Cosm, U6 T4 R0; *Rorippa amphibia* (L.) Besser [8] – HH, Eua (Med); *Rubus caesius* L. – Ph, Eur, U4,5 T3 R4; *Rumex conglomeratus* Murray [8] – H, Eua (med); U4 T4 R4; *Rumex crispus* L. – H, Eua, U4 T3 R0, 2n = 60; U4 T3 R0; *Rumex obtusifolius* L. ssp. *obtusifolius* – H, Eur.; U4 T0 R3; *Rumex palustris* Sm. – Th -TH, Eua, U5 T3 R4; *Ruppia maritima* L. – HH (Hd), Cosm, U6 T3 R4,5; V/R [6]; *Salix fragilis* L. – Ph, Eua; U5 T3 R4; *Scabiosa ochroleuca* L. – H, Eua (Cont), U2 T4 R4; 2n = 16; *Scirpus lacustris* L. – HH, Cosm, U6 T3 R4; *Scirpus tabernaemontani* C. Gmel. – G (HH), Eua, U5 T3 R4; *Senecio vernalis* Waldst. et Kit. – Th, Eua (Cont), U2,5 T4 R0; *Sium latifolium* L. – HH, Eua, U6 T0 R4; *Solanum dulcamara* L. – Ch, Eua (Med), U4,5 T3 R4; *Sonchus arvensis* L. ssp. *arvensis* – G, Cosm, U3 T0 R0; *Stachys palustris* L. – H, Circ, U4 T3 R4; *Stellaria media* (L.) Vill. – Th, Cosm, U3 T0 R0; *Tamarix tetrandra* Pallas ex Bieb. – Ph, Eur SE şi As SV; *Taraxacum officinale* Weber et Wiggers – H, Eua (Cosm), U3 T0 R0; *Torilis arvensis* ssp. *arvensis* (Huds.) Link. – Th, Euc (Med), U2,5 T3,5 R4; *Trifolium angustifolium* L. – Th, Med; U1,5 4,5 R4; R [5], I/E [2]; *Trifolium fragiferum* L. ssp. *fragiferum* – H, Eua, U3 T3 R5; *Trifolium hybridum* L. ssp. *hybridum* – H, Eur; U3,5 T3 R4; *Trifolium pratense* L. ssp. *pratense* – H, Eua, U3 T0 R0; *Trifolium repens* L. ssp. *repens* – H, Eua, U3,5 T0 R0; *Tripleurospermum inodorum* (L.) Sch. Bip. – Th-TH, Eua; U0 T0 R3,5; *Typha angustifolia* L. – G (HH), Cosm, U6 T4 R0; 2n = 30; *Typha latifolia* L. – G (HH), Cosm, U6 T3,5 R0; *Typha laxmanni* Lepechin – G (HH), Eua (Cont), U5 T4 R0; *Vicia cracca* L. – H, Eua, U3 T0 R3; *Xanthium strumarium* ssp. *italicum* (Moretti) D.Love – Th, Adv, U3,5 T4 R0; *Zannichellia palustris* L. ssp. *palustris* – HH, Cosm; U6 T0 R4. The following macrophytic algae species have been found : *Cladophora glomerata* and *Spyrogyra communis.*

The life forms spectrum (**Fig. 2**) shows the high percentages of hemicryptophytes (33,33%), hydro-helophytes (19,04%) and geophytes (8,16%), biological forms which confer the general aspect of the marsh vegetation. The terophytes (26,53%) and hemitherophytes (6,80%) which totalize 33,33%, fill in the gapped spaces between the perennial plant communities. The phanerophytes (4,08%) and chamaephytes (2,04%) are represented by some tree and bush species, planted in the eastern part of the marsh, within the recreational area.

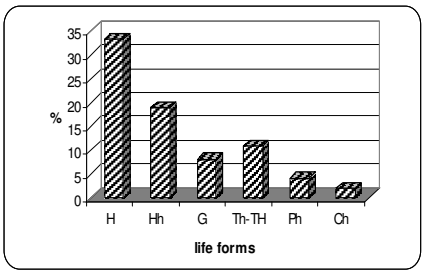

Fig. 2 The life forms spectrum

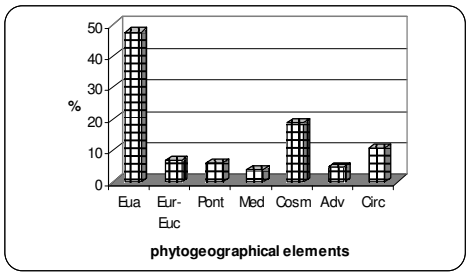

Fig. 3 The phytogeographical elements spectrum

Among the phytogeographical elements, the Eurasian species (47,71%), Cosmopolite ones (18,93%) and Circumpolar elements (10,60%) are prevalent. Other categories (Pontic – 6,06%, Adventive – 4,54%, European – 3,78%, Central-European – 3,03%, Mediteranean – 3,78% and Atlantic-Mediteranean – 1,51%) have lower percentages (**Fig. 3**). The numerous Cosmopolite, Circumpolar and Adventive species are due to the homogenous microclimate of the hygrophilous and hydrophilous plant communities and to the human influences within the marsh area as well.

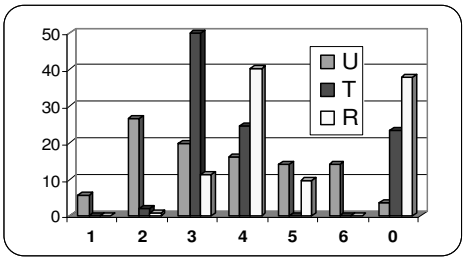

Fig. 4 The ecological categories spectrum

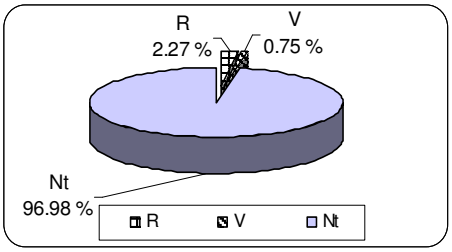

Fig. 5 The rate of rare and threatened taxa

The ecological categories spectrum (**Fig. 4**) show the high total percentages of mesophylous (19,71%), hygrophilous (14,08%) and hydrophilous plants (14,08%), higher than the xero-mesophylous (26,76%) and xerophylous plants (5,63%), spreading especially on the dry surfaces from marsh purlieus. Remarkable are also the mesotherme (50%) and light acid-neutrophile species (**Fig. 4**).

Herghelie marsh flora is remarkable especially through its high diversity and not so much through conservation value of flora. In the studied area we have identified only four rare or vulnerable taxa, in accordance with the Romanian Red lists [2, 5, 6]*: Carex extensa* (R), *Polypogon monspeliensis* (R) , *Trifolium angustifolium* (R) and *Ruppia maritima* (V/R); the rate of these taxa (3,03%) is presented in **Fig. 5**. The rest of plant species (96,98 %) are not threatened (Nt).

Conclusions

- As a result of the field studies, we have identified 132 vascular taxa and two macrophytic algae within Herghelie Marsh area. Compared to the floristic inventory made by Pop & Hodişan, we described 69 more plant taxa from the studied area.
- Among the biological forms, the hemicryptophytes, hydro-helophytes and geophytes are prevalent (60,53%), in comparison with yearly species (therophytes and hemitherophytes) and tree or bush species (phanerophytes and chamaephytes).
- The numerous Cosmopolite, Circumpolar and Adventive plants, may be explained through the specific microclimate of marsh biotopes and also through pregnant anthropogenic influences within the marsh area, placed in the proximity of the sea, between two well-known resorts.
- In comparison with older bibliographical data, we have observed a pronounced ruderalization process of the vegetation, most likely due to the anthropogenic influences from this touristic zone. These negative influences will probably be diminished in the future, because of the new Natural Reserve status of this swampy area.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

CONTRIBUTIONS TO THE STUDY OF THE VASCULAR FLORA FROM THE NEAGRA ŞARULUI RIVER'S AREA

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Abstract: As a result of the studies made in the Neagra Şarului river basin during 2005 and 2006, were identified 547 species and 22 subspecies of vascular plants.

Key words: vascular flora, Neagra Şarului river basin, Călimani Mountains

Introduction

Neagra Şarului river basin is situated in the north-east side of central groupe from Oriental Carpathians, in the Dornelor Depression, ascending the higher peaks of the Călimani Mountains in its south side. The valley of Neagra Şarului river forms in the north side the Şarului Depression where dominate the crystaline formations and is ascending in the south side from the higest peaks of Călimani Mountains, which is corresponding whith the Neogene volcanic area, where the andesite rocks are predominant.

The average heights over 800 m, with a frequency of 900-1000 m altitudinal landing, induce a specific climate of cold and humid depressions, with frequently thermal inversions, located to the superior step of the morphoclimatical level of medium or low altitude. The climate's characteristics from river's basin are determinated and increased by a high mountain frame surrounding it, a frame detached with 600-900 m by the middle and inferior flow's area and pendent to 1500-2000 m, represented by Călimani – Bistriţa mountains. In this way, the annual average of temperature is -0,4°C on top of the surrounding mountains and 5,1°C in the depression, and annually, the quantity of precipitations is variable between 650-700 mm in the depression, increasing gradually with the altitude and reaching over 750-800 mm, even 900-1100 mm. [7].

The researches about vascular flora, regarding the investigated area are relatively reduced; a series of mentions appears in papers which offer a general view on the Dornelor Depression, Călimani Mountains or Suceava county [1, 11, 12, 16, 18] or in papers concerning the area's vegetation.

Material and method

The floristic epitome includes only the species identified on the field-research made between 2005 and 2006, respective the species not quoted before, and also the species that have been quoted before by the speciality literature and confirmed in our field-research. The taxa not quoted before in Neagra Şarului river basin are emphasized in the following enumeration by bold letters. For the taxa identification were used papers having the following authors: Flora R. P. R. – R. S. R. (1952-1976) [19], Beldie Al. (1977, 1979) [1], Ciocârlan V. (1988-1990, 2000) [8, 9], Sârbu I. and colaborators (2001) [17]. In this

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epitome, the species are grouped by botanical families in systematic order (was used the classification system adopted by Ciocârlan V. [9]), within the families was used the alphabetical order. For each species is specified the area within it was found, the locality's name being coded as following: 1 – 12 Apostoli (1780 m); 2 – Bradu Ciont (1899 m); 3 – Buciniş rivulet; 4 – Buza Şerbii (1530 m); 5 – Calu rivulet; 6 – Căliman Izvor (2032 m); 7 – Călimănel rivulet; 8 – Călimanul Cerbului (2013 m); 9 – Coverca; 10 – Deluganu rivulet; 11 – exploitation Negoiul Românesc; 12 – Gura Haitii; 13 – Gura Negrei; 14 – Haita river; 15 – Hârla; 16 – Lucaciu (1770 m); 17 – Măieriş (1885 m); 18 – Neagra river; 19 – Neagra Şarului; 20 – Negoiul Românesc (1889 m); 21 – Negoiul Unguresc (2049 m); 22 – Negru rivulet (Coverca); 23 – Panaci; 24 – Piatra Tăieturii; 25 – Piciorul Hârlei; 26 – Piciorul Iancului; 27 – Pietrele Roşii (1705 m); 28 – Pietricelu (1993 m); 29 – Pietrosul (2100 m); 30 – Plaiul Şarului; 31 – Reţiţiş (2021 m); 32 – Runc; 33 – Sărişor; 34 – Sărişoru Mare; 35 – Şaru Bucovinei; 36 – Şaru Dornei; 37 – Şeştină (1017 m); 38 – Tamău (1862 m); 39 – Tinovul Mare Şaru Dornei; 40 – Ţiganului rivulet; 41 – Voivodeasa (1825 m).

Results and discussions

Fam. Lycopodiaceae: Lycopodium alpinum L.: 31; *L. annotinum* L.: 10, 19, 22, 23; *L. clavatum* L.: 1, 19, 23, 32, 37; *L. selago* L. : 1, 6, 8, 16, 17, 20, 21, 28, 29, 31, 38 ; *Fam. Equisetaceae* : ***Equisetum arvense*** L. : 3, 12, 22, 36 ; *E. fluviatile* L.: 36; ***E. hyemale*** L.: 19; *E. palustre* L.: 19, 23, 30 ; *E. sylvaticum* L.: 3, 19, 23, 34, 35 ; *E. telmateia* Ehrh.: 36 ; *Fam. Ophioglossaceae* : *Botrychium lunaria* (L.) Swartz : 12 ; *B. multifidum* (S. G. Gmelin) Rupr.: 10 ; *Fam. Polypodiaceae*: *Polypodium vulgare* L.: 27, 32; *Fam. Dennstaedtiaceae*: *Pteridium aquilinum* (L.) Kuhn : 9, 19, 23, 24, 33, 35, 36 ; *Fam. Aspleniaceae* : ***Asplenium adulterinum*** Milde: 35, 37; ***A. trichomanes*** L. : 35 ; *Athyrium filix-femina* (L.) Roth.: 12, 19, 22, 23; *Cystopteris fragilis* (L.) Bernh.: 14; ***C. sudetica*** A. Br. et Milde: 32 ; *Dryopteris carthusiana* (Vill.) H. P. Fuchs: 23, 40 ; *D. cristata* (L.) A. Gray: 23 ; *D. dilatata* (Hoffm.) A. Gray: 21, 24, 31 ; *D. filix-mas* (L.) Schott: 9, 10, 19, 22, 23, 24, 30, 34, 35; *Gymnocarpium dryopteris* (L.) Newman: 10, 22, 23, 24 ; *G. robertianum* (Hoffm.) Newman: 29 ; *Matteuccia struthiopteris* (L.) Tod.: 13, 30; *Phegopteris connectilis* (Michx.) Watt : 23 ; ***Polystichum aculeatum*** (L.) Roth: 9, 10, 24, 35; *Woodsia ilvensis* (L.) R. Br.: 1; *Fam. Pinaceae*: *Abies alba* Miller: 35; *Larix decidua* Miller ssp. *carpatica* (Domin) Šiman : 9, 19, 31, 36; *Picea abies* (L.) Karsten: 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 16, 17, 18, 19, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 35, 36, 38, 39, 41 ; *Pinus cembra* L.: 26, 28, 31 ; *P. mugo* Turra: 2, 6, 8, 17, 20, 21, 28, 29, 31, 41; *P. sylvestris* L.: 12, 19, 23, 30, 36, 39 ; *Fam. Cupressaceae*: *Juniperus communis* L. var. *communis* : 12, 23 ; *J. sibirica* Lodd. in Burgsd.: 1, 2, 4, 6, 8, 16, 17, 20, 21, 26, 27, 28, 29, 31, 38, 41; *Fam. Ranunculaceae*: *Aconitum anthora* L.: 37; *A. degenii* Gayer: 12, 22, 24; *A. firmum* Reichenb.: 11, 36 ; *A. moldavicum* Hacq.: 35; *Actaea spicata* L.: 14 ; *Anemone nemorosa* L.: 1, 8, 16, 17, 19, 23, 36; *A. ranunculoides* L.: 36 ; ***Aquilegia nigricans*** Baumg. ssp. ***nigricans*** : 19, 36 ; ***A. vulgaris*** L.: 13, 19, 23; *Caltha palustris* L.: 3, 9, 10, 12, 13, 19, 22, 30, 32, 35, 36 ; *Clematis alpina* (L.) Miller: 10, 19, 23, 24, 35 ; *Isopyrum thalictroides* L.: 35 ; *Pulsatilla alba* Reichenb.: 1, 6, 8, 16, 17, 20, 21, 27, 28, 29, 31, 38 ; *Ranunculus acris* L.: 9, 10, 19, 23, 34, 36, 37; ***R. auricomus*** L.: 19 ; *R. carpaticus* Herbich: 1, 12, 14, 18, 19, 23, 29, 31; *R. crenatus* Waldst. et Kit.: 29; *R. flammula* L.: 22, 39; *R. fluitans* Lam.: 23; *R. platanifolius* L.: 10, 19 ; *R. polyanthemos* L.: 9, 19, 23 ; *R. repens* L.: 9, 13, 19, 22, 30, 34, 35, 36; *R. sardous* Crantz: 9, 19, 36 ; *R. sceleratus* L.: 23, 36; ***Thalictrum aquilegiifolium*** L.: 10, 13, 30, 31, 36; *Trollius europaeus* L.: 9, 10, 12, 19, 23, 24, 25, 34, 36; *Fam. Papaveraceae*: *Chelidonium majus* L.: 19, 22, 23, 30, 33, 35; *Fam. Fumariaceae*: *Corydalis capnoides* (L.) Pers.: 23 ; *Fam. Urticaceae*: *Urtica dioica* L.: 9, 10, 13, 14, 19, 23, 24, 30, 34, 35, 36; *Urtica urens* L.: 36 ; *Fam. Fagaceae*: *Fagus sylvatica* L.: 35; *Fam. Betulaceae*: *Alnus alnobetula* (Ehrh.) C. Koch: 20, 21, 28, 29, 31; *A. incana* (L.) Moench: 9, 12, 13, 19, 23, 30, 33, 34, 35, 36, 40; *Betula pendula* Roth: 9, 10, 18, 19, 23, 32, 33, 35, 39; *Fam. Corylaceae*: ***Corylus avellana*** L.: 10; *Fam. Caryophyllaceae*: *Arenaria serpyllifolia* L.: 24; *Cerastium alpinum* L. ssp. *lanatum* (Lam.) Cesati: 21, 29 ; *C. arvense* L.: 12; ***C. holosteoides*** Fries: 10, 11, 24, 34 ; *C. semidecandrum* Waldst. et Kit.: 11, 23 ; *Dianthus barbatus* L. ssp. *compactus* (Kit.) Heuffel: 12; *D. carthusianorum* L. ssp. *carthosianorum*: 19, 36; *Lychnis flos-cuculi* L.: 9, 10, 19, 23, 34, 36; *L. viscaria* L. ssp. *viscaria*: 12, 19, 23, 34; *Minuartia verna* (L.) Hiern. ssp. *verna*: 22, 31, ssp. *gerardii* (Willd.) Graebner.: 31; *Moehringia trinervia* (L.) Clairv.: 35; *Sagina procumbens* L.: 19; *Scleranthus uncinatus* Schur: 23, 31; *Silene alba* (Miller) E. H. L. Krause: 23, 35; *S. dioica* (L.) Clairv.: 9, 13, 22, 23, 24, 30, 35, 36 ; *S. nutans* L. ssp. *dubia* (Herbich) Zapal.: 12, 19, 24 ; *S. vulgaris* (Moench) Garche ssp. *vulgaris*: 23; *Spergula arvensis* L.: 36; *Stellaria graminea* L.: 9, 23, 34, 36; ***S. holostea*** L.: 23, 24, 35; *S. media* (L.) Vill.: 9, 19, 23; ***S. neglecta*** Weihe: 23; *S. nemorum* L.: 9, 11, 13, 23, 24, 30; *S. uliginosa* Murray: 12; *Fam. Amaranthaceae*: *Amaranthus albus* L.: 23, 35; *Fam. Chenopodiaceae*: *Chenopodium album* L.: 35; *C. bonus-henricus* L.: 12, 19; *C. polyspermum* L.: 36; *Fam. Polygonaceae*: *Polygonum aviculare* L.: 13, 19; *P. bistorta* L.:

9, 19, 23, 36; *P. convolvulus* L.: 23, 36; *P. hydropiper* L.: 22, 23, 36; *P. lapathifolium* L.: 23, 36; *P. mite* Schrank: 35; *P. persicaria* L.: 19, 34, 35; *Rumex acetosa* L.: 9, 13, 19, 23, 30, 34; *R. acetosella* L.: 23, 24, 28, 33, 35, 36, ssp. *acetoselloides* (Balansa) den Nijs: 23; *R. alpestris* Jacq.: 28, 31; *R. alpinus* L.: 1, 11, 17, 24, 27, 29, 38; ***R. crispus*** L.: 9, 10, 13, 19, 30, 36; *R. obtusifolius* L.: 19, 36; *Fam. Grossulariaceae*: *Ribes petraeum* Wulfen in Jacq.: 19, 35; *R. uva-crispa* L. ssp. *uva-crispa*: 9, 10, 19, 23, 24, 35; *Fam. Crassulaceae*: *Rhodiola rosea* L.: 6, 29; *Sedum alpestre* Vill.: 6 ; *S. annuum* L.: 12, 23; *S. atratum* L.: 31; *S. maximum* (L.) Hoffm.: 13, 23; *S. telephium* L.: 21; *Fam. Saxifragaceae*: *Chrysosplenium alternifolium* L.: 9, 12, 19, 23, 34, 36; *Parnassia palustris* L.: 9, 12, 19, 24, 34, 36; *Saxifraga paniculata* Miller.: 6, 21, 29; ***S. stellaris*** L. ssp. ***robusta*** (Engler) Gremli: 29, 31; *Fam. Rosaceae*: ***Agrimonia eupatoria*** L. ssp. *eupatoria*: 22, 30; *Alchemilla colorata* Buser: 23; *A. glaucescens* Wallr.: 23, 25; ***A. monticola*** Opiz: 11, 19; *A. subcrenata* Buser: 11; ***A. vulgaris*** L. em. Fröhner: 3, 9, 10, 19, 23, 30, 32, 34, 36, 37; *A. xanthochlora* Rothm.: 9, 12, 19; ***Aruncus dioicus*** (Walter) Fernald: 19, 23; *Crataegus monogyna* Jacq.: 36; *Filipendula ulmaria* (L.) Maxim.: 3, 9, 10, 12, 13, 19, 22, 23, 30, 34, 36 ; *F. vulgaris* Moench: 12, 19; *Fragaria vesca* L.: 9, 10, 13, 14, 15, 18, 19, 22, 23, 24, 30, 33, 35, 36; *Geum rivale* L.: 3, 9, 10, 14, 19, 22, 23, 36, 37; ***G. urbanum*** L.: 13, 19, 30, 34; *Padus avium* Miller: 9, 13, 19, 22, 23, 30, 36; *Potentilla anserina* L.: 13, 30, 34, 35; *P. argentea* L.: 34; *P. aurea* L.: 6, 8, 21, 29, 31, 32; ***P. chrysantha*** Trev.: 1, 19, 23, 32; *P. erecta* (L.) Rausch: 3, 9, 10, 12, 19, 23, 24, 30, 34, 35, 36, 37; *P. ternata* C. Koch: 1, 17, 21, 27, 28, 29, 31, 38; *Rosa canina* L.: 35; *R. pendulina* L.: 9, 12, 14, 19, 23, 24, 35, 36; *Rubus hirtus* Waldst. et Kit.: 24; *R. idaeus* L.: 5, 9, 10, 13, 14, 18, 19, 23, 24, 26, 28, 30, 32, 34, 35, 36; *Sorbus aucuparia* L.: 9, 10, 13, 14, 18, 19, 23, 24, 26, 28, 30, 31, 35; *Spiraea chamaedrifolia* L.: 3, 9, 10, 13, 14, 18, 19, 22, 23, 24, 30, 34, 36; *Fam. Fabaceae*: *Anthyllis vulneraria* L. ssp. *vulneraria*: 9, 12, 19, 23, 36; ***Astragalus glycyphyllos*** L.: 35; ***Genista tinctoria*** L. ssp. ***tinctoria***: 12, 35; *Lathyrus pratensis* L.: 19; ***L. vernus*** (L.) Bernh.: 37; *Lotus corniculatus* L.: 9, 15, 19, 23, 24, 34, 35, 36, 37; *Medicago falcata* L.: 23; ***M. lupulina*** L.: 19, 35; *Melilotus officinalis* Lam.: 9, 23, 24; *Ononis arvensis* L.: 35; *Trifolium alpestre* L.: 12, 15; *T. aureum* Pollich: 34; *T. badium* Schreber: 31; *T. campestre* Schreber: 9, 19, 23, 36; *T. hybridum* L.: 13, 19, 22, 23, 35, 36; *T. medium* L.: 9, 23; *T. montanum* L.: 9, 23, 34; *T. pannonicum* Jacq.: 12, 19, 34; *T. pratense* L.: 9, 10, 11, 13, 19, 23, 24, 30, 32, 34, 36, 37; *Trifolium repens* L.: 10, 13, 23, 30, 32, 34, 35, 36, 37; *T. spadiceum* L.: 11; *Vicia villosa* Roth.: 36 ; *Fam. Lythraceae*: *Lythrum salicaria* L.: 36; *Fam. Onagraceae*: *Chamerion angustifolium* (L.) Hollub: 9, 12, 19, 23, 24, 28, 34, 36; *Circaea alpina* L.: 19, 24, 35; *Epilobium hirsutum* L.: 23; *E. montanum* L.: 9, 11, 19, 24, 34; *E. palustre* L.: 19, 36, 39; *E. parviflorum* Schreber: 11 ; *Fam. Thymeleaceae*: *Daphne mezereum* L.: 10, 35; *Fam. 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Apiaceae*: *Aegopodium podagraria* L.: 13, 19, 33; *Angelica sylvestris* L.: 9, 33; *Astrantia major* L.: 9, 22, 24; *Carum carvi* L.: 19, 23; ***Chaerophyllum aromaticum*** L.: 9, 10, 19, 22, 23, 34, 36, 37; *C. hirsutum* L.: 9, 13, 19, 23, 30, 34, 36; ***Cicuta virosa*** L.: 7; ***Conium maculatum*** L.: 9; *Daucus carota* L.: 23; *Heracleum sphondylium* L.: 19, 23; *Laserpitium latifolium* L.: 12, 15; *Ligusticum mutellina* (L.) Crantz: 6, 8, 21, 28, 29, 31, 38; *Pimpinella major* (L.) Hudson: 9, 12, 19; *P. saxifraga* L.: 19, 23, 24, 34, 36; *Sanicula europaea* L.: 30, 33; *Fam. Hypericaeae*: *Hypericum hirsutum* L.: 35, 36; *H. maculatum* Crantz: 9, 10, 19, 22, 23, 24, 30, 32; *H. montanum* L.: 19, 30, 36; *H. perforatum* L.: 3, 10, 19, 34, 36; *H. richeri* Vill. ssp. *grisebachii* (Boiss) Nyman: 29, 31; *Fam. Droseraceae*: *Drosera rotundifolia* L.: 19; *Fam. Violaceae*: *Viola biflora* L.: 6, 29, 31; ***V. canina*** L. ssp. ***canina***: 34; *V. declinata* Waldst. et Kit.: 1, 16; ***V. mirabilis*** L.: 24; *V. reichenbachiana* Jordan ex Boreau: 14, 23, 33; ***V. suavis*** Bieb.: 12; *V. tricolor* L.: 1, 9, 10, 12, 23, 32, 34, 36; *Fam. Brassicaceae*: *Alliaria petiolata* (Bieb.) Cavara et Grande: 36; *Arabis alpina* L.: 23; *Armoracia rusticana* P. Gaertn., B. Meyer et Scherb.: 9, 23; *Barbarea vulgaris* R. Br.: 23, 36; *Brassica rapa* L. ssp. *sylvestris* (L.) Janchen: 11; *Capsella bursa-pastoris* (L.) Medik: 9, 23, 30, 36 ; *Cardamine amara* L.: 12; ***C. pratensis*** L.: 19, 23, 25, 36; *Cardaminopsis halleri* (L.) Hayek ssp. *halleri*: 11, 23; *Dentaria glandulosa* Waldst. et Kit.: 10, 12, 22, 23, 24; *Draba nemorosa* L.: 11; ***Rorippa palustris*** (L.) Besser: 36; *R. sylvestris* (L.) Besser: 19, 23, 30; *Sinapis arvensis* L.: 30, 36; *Sisymbrium officinale* (L.) Scop.: 9, 23; ***Thlaspi kovatsii*** Heuffel: 12; *Fam. Salicaceae*: *Populus alba* L.: 36; *P. tremula* L.: 9, 12, 19, 23, 24, 33, 34, 35; *Salix alba* L.: 36; *S. caprea* L.: 23, 34, 35; *S. cinerea* L.: 9, 19, 23; *S. herbacea* L.: 31; ***S. kitaibeliana*** Willd: 31; *S. pentandra* L.: 23; *S. silesiaca* Willd.: 28, 29, 31; *S. triandra* L. emend. Ser.: 23; *Fam. Ericaceae*: *Andromeda polifolia* L.: 39; *Oxycoccus palustris* Pers.: 39; *Rhododendron myrtifolium* Schott et Kotschy: 2, 6, 8, 20, 21, 28, 29, 31, 41; *Vaccinium gaultherioides* Bigelow: 21, 31; *V. myrtillus* L.: 1, 2, 4, 8, 10, 11, 12, 14, 16, 17, 19, 23, 24, 29, 31, 32, 36, 38, 39, 41; *V. uliginosum* L.: 29, 31; *V. vitis-idaea* L.: 1, 4, 10, 16, 19, 22, 23, 32, 35, 36, 39; *Fam. Empetraceae*: *Empetrum nigrum* L. ssp. *hermaphroditicum* (Hagerup) Böcher: 21, 29, 31; *Fam. Pyrolaceae*: *Moneses uniflora* (L.) A. Gray: 10, 14, 18, 19, 22, 23, 25, 26, 28, 29, 31, 36; *Orthilia secunda* (L.) House: 22, 34, 35; *Pyrola rotundifolia* L.: 9, 22; *Fam. 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Schmidt: 31; *M. scorpioides* L.: 3, 13, 19, 22, 23, 30, 34, 36; *M. sylvatica* Ehrh. ex Hoffm.: 23; *Pulmonaria rubra* Schott.: 23, 32; *Symphytum cordatum* Waldst. et Kit.: 10, 23, 24, 32, 35; *S. officinale* L.: 3, 9, 23; *Fam. Lamiaceae*: *Acinos alpinus* (L.) Moench: 23; *Ajuga genevensis* L.: 19, 23; ***A. reptans*** L.: 9, 12, 13, 23, 24, 30, 35; *Clinopodium vulgare* L.: 9, 19, 23, 24, 30, 35, 36; *Galeopsis pubescens* Besser: 10, 19, 23; *G. speciosa* Miller: 9, 10, 13, 24, 30, 35; *G. tetrahit* L.: 13, 19, 23, 24, 30, 35, 36; *Glechoma hederacea* L.: 9, 10, 13, 19, 23, 24, 30, 36; *G. hirsuta* Waldst. et Kit.: 12; *Lamium album* L: 23, 36; *L. galeobdolon* (L.) L.: 9, 23; ***L. maculatum*** L.: 23; *L. purpureum* L.: 19, 23; *Lycopus europaeus* L.: 9, 10, 13, 19, 23, 30, 36; ***Melissa officinalis*** L.: 34; *Mentha arvensis* L.: 9, 10, 30, 34; *M. longifolia* (L.) Hudson: 3, 9, 10, 12, 13, 19, 23, 30, 33, 34, 35, 36; *M. pulegium* L.: 30, 36; *Origanum vulgare* L.: 9, 19, 23, 35, 36; *Prunella vulgaris* L.: 3, 9, 10, 12, 13, 19, 22, 23, 24, 30, 34, 35, 36, 37; *Salvia glutinosa* L.: 10, 24, 30, 35; *S. verticillata* L. ssp. *verticillata*: 35; *Scutellaria galericulata* L.: 9, 23; *Stachys officinalis* (L.) Trev.: 9, 19, 23, 36, 37; *S. sylvatica* L.: 13, 19, 30, 35, 36; *Thymus alpestris* Tausch ex A. Kerner: 12, 31, 32; *T. pulegioides* L.: 9, 10, 12, 19, 23, 24, 34, 35, 36, 37; *Fam. Callitrichaceae*: *Callitriche cophocarpa* Sendtner: 35; *Fam. Plantaginaceae*: *Plantago lanceolata* L.: 9, 19, 23, 24, 34, 37; *P. major* L.: 30, 35; *P. media* L.: 9, 10, 12, 13, 15, 19, 23, 24, 30, 34, 36, 37; *Fam. Scrophulariaceae*: *Digitalis grandiflora* Miller: 12, 22, 23, 24, 35; *Euphrasia minima* Jacq. ex Lam. et D. C. ssp. *minima*: 31; *E. officinalis* L. ssp. *pratensis* Schübler et Martens: 9, 10, 12, 19, 32; *E. stricta* D. Wolff ex J. F. Lehm. ssp *stricta*: 9, 19, 23, 33, 36; *Linaria vulgaris* Miller: 3, 35; ***Melampyrum bihariense*** A. Kerner: 23, 34; *M. saxosum* Baumg.: 24, 28, 31; *M. sylvaticum* L.: 8, 23, 24; ***Pedicularis sylvatica*** L.: 19, 34; *Rhinanthus alpinus* Baumg.: 12; *R. minor* L.: 9, 10, 19, 23, 34, 35, 36, 37; *Scrophularia nodosa* L.: 19, 23; *S. scopolii* Hoppe: 9, 13; ***Verbascum lychnitis*** L.: 23; *V. nigrum* L.: 33; *V. phoeniceum* L.: 36; *V. thapsus* L.: 12; *Veronica anagallis-aquatica* L.: 9; *V. baumgartenii* Roemer et Schultes: 21, 28, 29, 31; *V. beccabunga* L.: 9, 12; *V. chamaedrys* L.: 10, 12, 15, 23, 24, 34; *V. officinalis* L.: 9, 10, 12, 19, 22, 23, 24, 32, 33, 35, 39; *V. serpyllifolia* L.: 23, 32, *ssp. humifusa* (Dickson) Syme: 31; *V. urticifolia* Jacq.: 3, 10, 12; *Fam. Orobanchaceae*: ***Orobanche caryophyllacea*** Sm.: 37; *O. teucrii* Holandre: 25; *Fam. Campanulaceae*: *Campanula abietina* Griseb.: 11, 12, 17, 22, 31; *C. alpina* Jacq.: 1, 6, 8, 16, 17, 21, 27, 29, 31, 38; *C. cervicaria* L.: 19, 22; *C. glomerata* L.: 9, 19, 23, 30, 34, 35; *C. patula* L.: 9, 10, 13, 19, 23, 24, 30, 35, 36, 37; *C. persicifolia* L.: 9, 12, 19, 33, 35; ***C. rapunculoides*** L.: 13, 30, 35; *C. rotundifolia* L. ssp. *rotundifoloia*: 9, 12, 19, 23, ssp. *polymorpha* (Witašek) Tacik: 1, 29, 31; *C. serrata* (Kit.) Hendrych: 9, 10, 19, 23, 24, 35, 36, 37; ***C. trachelium*** L.: 19, 35; *Phyteuma orbiculare* L.: 21; *P. tetramerum* Schur: 10; *P. wagneri* A. Kerner: 28; *Fam. Rubiaceae*: *Cruciata glabra* (L.) Ehrend.: 9, 10, 12, 15, 19, 23, 24, 34, 35; ***Galium album*** Miller: 34; *G. aparine* L.: 9; *G. odoratum* (L.) Scop.: 23; *G. palustre* L.: 3, 9, 19, 22, 23; *G. schultesii* Vest: 9, 24, 35; *G. verum* L.: 9, 23, 34, 35, 36; *Fam. Caprifoliaceae*: *Lonicera nigra* L.: 35, 36; *L. xylosteum* L.: 35; *Sambucus racemosa* L.: 23, 24, 35; *Fam. Valerianaceae*: ***Valeriana dioica*** L.: 9; ***V. montana*** L.: 19; *V. officinalis* L.: 3, 19; ***V. simplicifolia*** (Reichenb.) Kabath: 19; *V. tripteris* L.: 22, 24, 32, 35; *Fam. Dipsacaceae*: ***Knautia arvensis*** (L.) Coulter ssp. ***arvensis***: 9, 10, 24, 32, 34; *K. longifolia* (Waldst. et Kit) Koch: 24, 32; *Scabiosa lucida* Vill. ssp. *barbata* E. I. Nyárády: 15; *Succisa pratensis* Moench: 9, 19, 34, 37; *Fam. Asteraceae*: *Achillea distans* Waldst et Kit ex Willd.: 12, 19, 23; *A. millefolium* L.: 9, 10, 19, 23, 24, 30, 31, 34, 36, 37; *A. stricta* (Koch) Scheicher ex Gremli: 24, 32; *Adenostyles alliariae* (Gouan) A. Kerner: 27, 28, 31; *Antennaria dioica* (L.) Gaertner: 12, 15, 19, 23, 32, 34, 35; *Anthemis tinctoria* L.: 23, 33; *Arctium tomentosum* Miller: 12, 13, 19, 34, 36; *Arnica montana* L.: 10, 12, 19, 23, 31, 32, 34, 37; ***Artemisia absinthium*** L.: 35; *A. petrosa* (Baumg.) Fritsch: 29; ***A. vulgaris*** L.: 30; *Bellis perennis* L.: 10, 12, 19, 34, 36; *Bidens cernua* L.: 3, 9, 35; *B. tripartita* L.: 23; *Carduus personatus* (L.) Jacq.: 9, 23, 36; *Carlina acaulis* ssp. *acaulis*: 9, 19, 23, ssp. *caulescens* (Lam.) Schübl et Martens: 9, 10, 24, 35; *C. biebersteinii* Bernh. ex Hornem ssp. *brevibracteata* (Andrae) Werner: 10, 24; *C. vulgaris* L.: 9; ***Carpesium cernuum*** L.: 3, 9, 35; *Centaurea jacea* L.: 9, 19, 23, 30, 36, 37; *C. phrygia* L.: 9, 10, 19, 23, 24, 34, 35, 36, 37; *Cicerbita alpina* (L.) Wallr.: 31; *Cichorium intybus* L.: 13; *Cirsium arvense* (L.) Scop.: 30; *C. erisithales* (Jacq.) Scop.: 10, 13, 35; *C. heterophyllum* (L.) Hill: 12, 19, 23, 34; *C. oleraceum* (L.) Scop.: 9, 13, 19, 24, 30, 34, 36; *C. palustre* (L.) Scop.: 10, 22, 30, 32; *C. vulgare* (Savi) Ten.: 13; *Conyza canadensis* (L.) Cronq.: 35; *Crepis biennis* L.: 36; *C. mollis* (Jacq.) Ascherson: 36; *C. paludosa* (L.) Moench: 23, 24; *Doronicum austriacum* Jacq.: 10; *Erigeron acris* L.: 19, 23; *Filago arvensis* L.: 23, 36; *Gnaphalium supinum* L.: 31; *G. sylvaticum* L.: 10, 24, 31, 35; *G. uliginosum* L.: 31; *Hieracium alpinum* L.: 6, 8, 16, 29, 31, 38; *H. aurantiacum* L.: 10, 23, 31; *H. bifidum* Kit. ex Hornem. ssp. *bifidum*: 23; *H. caespitosum* Dumort. ssp. *caespitosum*: 31; *H. lactucella* Wallr.: 23, 32; *H. murorum* L.: 10, 24; *H. pilosella* L.: 9, 15, 19, 23, 24, 31, 34, 37; *H. transsylvanicum* Heuffel: 5, 10, 12, 22, 24; *H. umbellatum* L.: 19, 34, 37; *Homogyne alpina* (L.) Cass.: 6, 21, 23, 24, 26, 28, 29, 31, 32; *Hypochoeris uniflora* Vill.: 19, 23, 24, 34; ***Inula hirta*** L.: 35; *Leontodon autumnalis* L.: 9, 19, 23, 24, 34, 35, 36, 37; *Leucanthemum vulgare* Lam.: 9, 10, 19, 23, 24, 34, 36, 37; *L. waldsteinii* (Schultz Bip) Pouzar: 10, 19, 22, 24, 35; *Ligularia sibirica* (L.) Cass.: 34, 36; *Matricaria discoidea*

DC.: 13, 23, 30, 35; *Mycelis muralis* (L.) Dumort.: 5, 10, 14, 22, 24, 30, 35; *Onopordum acanthium* L.: 36; *Petasites albus* (L.) Gaertner: 34; *P. hybridus* (L.) P. Gaertner: 13, 19, 30, 34, 36; *Scorzonera rosea* Waldst. et Kit.: 23, 32; *Senecio glaberrimus* (Rochel) Simonkai: 28; *S. jacobea* L.: 33; *S. ovatus* (P. Gaertner, B. Meyer et Schreb.) Willd.: 9, 10, 13, 19, 24, 34, 35; *S. squalidus* L.: 11; *S. subalpinus* Koch: 24; *Solidago virgaurea* L. ssp. *virgaurea*: 27, 31, ssp. *minuta* (L.) Arcangeli: 28, 31; *Sonchus oleraceus* L.: 30; *Tanacetum corymbosum* (L.) Schultz Bip.: 35; *T. vulgare* L.: 13, 35; *Taraxacum nigricans* (Kit.) Reichenb.: 31; *T. officinale* Weber ex Wiggers: 3, 12, 13, 19, 23, 30, 32, 34, 36; *Tragopogon pratensis* L. ssp. *orientalis* (L.) Čelak.: 9, 35; *Tussilago farfara* L.: 9, 10, 19, 23, 24, 30, 32, 35; *Fam. Alismataceae*: *Alisma plantago-aquatica* L.: 10; *Fam. Trilliaceae*: *Paris quadrifolia* L.: 10, 22, 24, 31, 35; *Fam. Liliaceae*: *Colchicum autumnale* L.: 12, 19; *Lilium martagon* L.: 12, 19, 24; *Maianthemum bifolium* (L.) F. W. Schmidt: 10, 12, 19, 23, 24, 35; *Polygonatum verticillatum* (L.) All.: 10, 22, 23, 24, 35; *Streptopus amplexifolius* (L.) DC.: 10, 24, 35; *Veratrum album* L. ssp. *album*: 1, 10, 11, 20, 21, 23, 28, 29, 31, 32, 38; *Fam. Iridaceae*: *Crocus vernus* (L.) Hill: 1, 12; ***Sisyrinchium montanum*** E. L. Greene: 19, 34; *Fam. Orchidaceae*: ***Dactylorhiza fistulosa*** (Moench) H. Baumann et Künkele: 12, 19, 23, 25; *D. incarnata* (L.) Soó *ssp. incarnata*: 12; *D. maculata* (L.) Soo ssp. *maculata*: 19, *ssp. transsilvanica* (Schur) Soó: 19; *D. saccifera* (Brongn.) Soó: 23; ***Epipactis atrorubens*** (Hoffm.) Besser: 37; *E. helleborine* (L.) Crantz: 10, 35; ***Goodyera repens*** (L.) R. Br.: 10; *Gymnadenia conopsea* (L.) R. Br.: 9, 12, 15, 19, 23, 24, 25, 34, 37; ***Listera ovata*** (L.) R. Br.: 10, 12, 19, 24, 34, 37; *Nigritella rubra* (Wettst.) K. Richter: 25; *Orchis mascula* ssp. *signifera* (Vest.) Soó: 33; ***Pseudorchis albida*** (L.) A. et D. Löve: 6, 20, 21; *Traunsteinera globosa* (L.) Reichenb.: 10, 12, 23; *Fam. Juncaceae*: *Juncus bufonius* L.: 9, 10, 34; *J. conglomeratus* L.: 9, 10, 19, 22, 34, 36; *J. effusus* L.: 3, 9, 10, 19, 22, 23, 32, 34, 36; ***J. gerardi*** Loisel.: 36; *J. trifidus* L.: 20, 21, 28, 29, 31; *Luzula alpinopilosa* (Chaix) Beistr.: 21; *L. campestris* (L.) DC.: 9, 12, 19, 34, 36; *L. luzuloides* (Lam.) Dandy et Wilmott: 12, 23, 31, 32, *ssp. rubella* (Hoppe ex Mert. et Koch) Holub: 23; *L. multiflora* (Ehrh.) Lej. *ssp. multiflora*: 23; ***L. pilosa*** (L.) Willd.: 23; *L. sudetica* (Willd.) Schultes: 31; *L. sylvatica* (Hudson) Gaudin: 10, 20, 22, 23, 24, 29, 31, 32, 34, 35; *Fam. Cyperaceae*: *Carex acuta* L.: 19, 36; *C. appropinquata* Schumacher: 36; *C. atrata* L.: 1, 6, 8, 16, 21, 27, 28, 29, 31, 38; *C. brunnescens* (Pers.) Poiret: 31; *C. echinata* Murray: 23, 39; *C. flava* L.: 12; *C. hirta* L.: 12; *C. nigra* (L.) Reichard.: 9, 10, 19, 34, 37, 39; *C. ovalis* Good.: 9. 10, 19; *C. pairae* F. W. Schultz: 9, 33; *C. pallescens* L.: 25, 39; *C. rostrata* Stokes: 19, 36; *C. spicata* Hudson: 9; *C. umbrosa* Host.: 36; *C. vesicaria* L.: 9, 23; *Eleocharis palustris* (L.) Roemer et Schultes: 9, 19, 23; *Eriophorum angustifolium* Honck.: 19, 36; *E. vaginatum* L.: 39; *Scirpus sylvaticus* L.: 9, 10, 13, 19, 22, 30, 34; *Fam. Poaceae*: *Agrostis capillaris* L.: 9, 10, 19, 23, 24, 32, 34, 36, 37; *A. stolonifera* L.: 3, 10, 19, 22; *Alopecurus aequalis* Sobol.: 23; *A. geniculatus* L.: 23; ***A. pratensis*** L. ssp. ***pratensis***: 36; *Anthoxanthum odoratum* L.: 1, 3, 6, 9, 10, 15, 19, 23, 24, 27, 31, 32, 34, 36, 37; *Arrhenatherum elatius* (L.) Beauv. ex. J. et C. Presl: 12; *Brachypodium sylvaticum* (Hudson) Beauv.: 9, 13, 19, 30; *Briza media* L.: 9, 10, 15, 19, 23, 24, 34, 37; *Calamagrostis arundinacea* (L.) Roth: 10, 24, 35; *C. epigeios* (L.) Roth: 23; *C. villosa* (Chaix) J. F. Gmelin: 28, 31; *Catabrosa aquatica* (L.) Beauv.: 13, 30; *Cynosurus cristatus* L.: 3, 9, 10, 19, 24, 34, 36, 37; *Dactylis glomerata* L.: 3, 9, 19, 35, 37; *Deschampsia caespitosa* (L.) Beauv.: 9, 11, 19, 24, 30, 32, 36, 37; *D. flexuosa* (L.) Trin.: 21, 28, 29, 31; *Festuca arundinacea* Schreber: 33, 35; *F. nigrescens* Lam.: 12, 19; *F. pratensis* Hudson: 10, 19, 36; *F. rubra* L.: 9, 10, 19, 23, 24, 32, 34, 36, 37; *F. supina* Schur: 31; *Glyceria notata* Chevall.: 10, 13, 19, 30, 36; *Holcus lanatus* L.: 9, 19, 23, 36, 37; *Lolium perenne* L.: 13, 19, 30, 34; *Milium effusum* L.: 33; *Molinia caerulea* (L.) Moench ssp. *caerulea* var. *caerulea*: 39; *Nardus stricta* L.: 1, 9, 17, 19, 23, 24, 32, 34, 37; *Phleum alpinum* L.: 31, 32; *P. pratense* L.: 9, 19, 23, 34, 36; *Poa alpina* L.: 32; *P. annua* L.: 9, 12, 19; *P. nemoralis* L.: 14, 28, 36; *P. pratensis* L.: 9, 19, 30, 36; *Setaria viridis* (L.) Beauv.: 9; *Fam. Typhaceae*: ***Typha latifolia*** L.: 30; ***T. schuttlewortii*** Koch et Sonder: 35.

Conclusions

As a result of the floristical research during 2005 and 2006 in the territory of the Neagra Şarului river basin, were identified 547 species and 22 subspecies, included in 71 botanical families. There are 73 taxa quoted for the first time for Neagra Şarului river basin, which are emphasized in the enumeration by bold letters.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

THE *POTENTILLO MICRANTHAE-QUERCETUM DALECHAMPII* ASSOCIATION IN THE LOWER BASIN OF THE MOTRU RIVER - ROMANIA

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Abstract: From the geographical point of view, the Lower Basin of the Motru River lies in the western part of the Getic Piedmont, with the coordinates: $44^0 55'$ north latitude and $23^0 45'$ east longitude. The studied area covers 691 Km^2. The physical-geographical position and the pedo-climatic particularities specific to the territory under research confer the vegetation a mosaic nature with a particular specificity, determined by the quite strong Balkan and sub-Mediterranean influences. With the territory under research located just on the line between the nemoral area (of the oak forests) and the floor of the hilly common oak (up to the sub-Carpathian Hills), we cannot talk about the presence of the acidophilus common oak forests, which is characteristic to the sub-Carpathian region. In this transition area, between the altitudes (200) 250 and 380 (402) m, we have identified mixed common oak forests, associated with Hungarian oak and Turkey oak, belonging to the association *Potentillo micranthae-Quercetum dalechampii* A.O.Horvát 1981 (Syn.: *Potentillo micranthae-Quercetum* (*petraeae* resp. *dalechampii-cerris*) A.O.Horvát (1956) 1959). The affiliation of these phytocoenoses to the above mentioned association is done according to its transition association nature, between the silvosteppe forests and the mesophyle, acidophilus forests in the sub-Carpathian area of Oltenia.

Key words: association, *Potentillo micranthae-Quercetum dalechampii*, Basin, Motru, Romania, transition.

Introduction

From the geographical point of view, the Lower Basin of the Motru River is located in the western part of the Getic Piedmont, with the coordinates: 44^0 $55'$ north latitude and 23^0 $45'$ east longitude. The investigated territory covers 691 Km^2. From the administrative-territorial point of view, the territory under research is at the border between the counties of Mehedinţi and Gorj, which starts from the eastern part of the Negoeşti Hills (Comăneşti-Mehedinţi, alt. 388 m) and reaches the Jiu Valley near the locality of Gura Motrului (alt. 110 m). Being situated in the southwestern part of the country and of the Getic Piedmont, the territory under research has a central-European climate with Mediterranean influences. The valleys are not so deep, and the crests more matured; nevertheless, the slope processes are active, with a maximum intensity on deforested slopes. The slope processes developed due to the rock nature, favorable to denudation, quick withdrawal of the gradients to the axis of the interfluves. This fact contributed to wider valleys and extended river meadows.

Between the eastern limit of the Mehedinţi Plateau, the western passage of the Jiu river and especially to the long valley of the Huşniţa River (in South), stands out the Motru Piedmont (with a surface of about 1837 Km^2), within its territory being separated, westward to Motru, the lower region of the Coşuştei Hills.

The *Coşuştei Hills* appear as a prolonged chain of summits, separated by large valleys, generally a more evolved relief, relatively more gently, that from the eastern side of

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the Jiu River. The prolonged summits dominate, in some sections, the valley, like the northern and southern ones, of about 150m, the Motru valley, for example, is dominated by the hilled summit of the Comăneşti (388m) and the Şovarna valley dominated by a hill with the same name (402m) and others [35].

The Coştuştei and the Ohabei Hills (on the right side of the Motru till the Ohabei Valley) and the Bujornescu-Runcurel (between Cămueşti and Motru) are considered to be hills of transition between Strehaia Platform and the SubCarpathian Hills [19]. Within the Strehaia Platform stands out: the Huşniţei Platform, bordered by the Ohaba Valley (Ohaba place) and Huşniţei Valley (Strehaia) and Bălăciţei Platform bordered between the Huşniţei Valley and the Jiu Valley, as well as the Gruiuirile Arginteştilor (between Motru and Arginteşti) which are considered piedmont relic units.

The Bălăciţei Plateau (or Bălăciţei Platform), within whose territory the researched area also belongs, between the Huşniţei Valley (Strehaia) and Gura Motrului, is a mild high piedmont villafranchin plain in the researched area (over 300 m, in contrast to those southward of little over 200 m), fragmented (northwards and northeastern) by the smaller tributaries (Slătincul Mare, Brezniţa), with inferior flow.

Method of research

In the study on vegetation, the association was considered the main coenotaxonomic unit, comprehended in the central-European school spirit; however, we have also taken into account the new orientation to define the association as a "fundamental unit of phytosociology, an abstract concept, which is reflected in an ensemble of association individuals who have in common almost the same floral, statistical, ecological, dynamic, chronologic and historical characters" [11]. The study of the phytocoenoses and the vegetal associations has been performed by using the phytocoenologic survey method, based on the methodology foreseen by Braun-Blanquet and adapted to the vegetation's particularities in our country [7, 17]. The nomenclature of the superior sintaxons was adopted after Rodwell & al. [30], taking into considerations other scientific papers [1, 2, 7, 11, 20].

Results and discussion

QUERCETEA PUBESCENTIS Doing-Kraft ex Scamoni & Passarge 1959

The class subordinates the thermoxerophyle-mesoxerophyle forests of the temperate zone, which define the belt position between the mesophyle and acidophyle forests from the Class of *Querco-Fageta* and the ultra-xerophyle, Mediterranean ones of the *Quercetea ilicis* Class [7, 30]. Initially, the coenotaxomic classification was made after [1, 2, 20], from the Class of *Quercetea pubescenti-petraeae* (Oberd. 1948) Jakucs 1960 [6].

QUERCETALIA PUBESCENTI-PETRAEAE Klika 1933

The affiliation to this alliance is made according to the presence of the central-European and the eastern elements from the described associations, which show the specific character of the zone [7, 30].

The approach of the forests classification in Oltenia and in the south of the Mehedinţi Plateau [31], was made according to Jakucs 1960, 1961 [4, 23, 27, 28]; the approach was justified by the descriptions. The affiliation of these types of forests was made differently throughout the time. Therefore, Jakucs 1960 groups these forests within the alliance *Orno-Cotinetalia* on the account of the central and eastern under Mediterranean element, approach that is made also by Soó [36] and Borhidi [1, 2] grouping these forests in the *Quercetalia cerris* alliance, based on the subcontinental – SubMediterranean elements.

In Oltenia as well as in the whole country, all the studies of the wooden associations are based on the silvic descriptions [12, 13, 14, 15, 21].

Pop & Cristea [26], as a result of the comparative study of the enlightened associations of Turkey oak and Hungarian oak at national level, emphasizes the same identified meridional elements in the Inferior Basin of the river Motru as well, but they subordinate these elements according to the descriptions made by Klika 1933, based on the latest chronological data regarding the SubMediterranean species *Quercus cerris* and *Q. frainetto*, as well as the informational data of Oberdorfer (1992). Both classifications are justified and fair, but, in Motru Basin, the tasks of subordinating these associations derive from its geographical position and the multiple Mediterranean influences that differ from the descriptions made. However, within the analysis of the associations' characteristics from the point of view of the phytogeographic element, one could notice that on the background of the European elements' domination, central-European and the eastward ones occupy a percentage of 12%, where as the Subcontinental elements (SubMediterranean, Mediterranean), about 20%, being also present elements from Central and Western Europe. There can also be encountered Balkan, Pontic, and Panonic influences, which determine a specific character of the associations, and the difficulty of their affiliation.

Quercion farnetto I. Horvat 1954

The classification within the alliance is made on the account of the characteristic species encountered in the researched area, some of these are rare and were not mentioned in surveys: *Campanula sphaerothrix, Silene viridiflora, Acanthus balcanicus, Crocus flavus* etc.

Mesoxerophyle, mesothermophyle-subtermophyle Forests

Potentillo micranthae-Quercetum dalechampii A. O. Horvát 1981

(Syn.: *Potentillo micranthae-Quercetum* (*petraeae* resp. *dalechampii-cerris*) A.O.Horvát (1956) 1959)

The phytocoenoses, emphasized by the oak species (*Quercus petraea, Q. dalechampii, Q. polycarpa)*, seldom with Turkey oak and rarely Hungarian oak, were included in the above mentioned association., because the separation of these on the account of their composition and sublayer led to no clear result; in all the approached variants the floristic composition is generally the same. This situation can be explained taking into account the above mentioned general characteristics of the area. On the other hand, the narrow surfaces where the mixed common oak forests are, the mosaic of the phytocoenoses, which crosses them, explain the presence of the transgressive species from the Hungarian oak and hornbeam forests. The microclimate characteristic to this zone determines vegetation inversions (small groups of common oaks at 180-200 m altitude, on northern exposure, which moves further with the Hungarian-Turkey oak forests at 200-275 m altitude), this situation being frequently encountered (the place Mitulani-Buiceşti from Bălăciței Platform).

Such vegetation inversions are located also by Maloş in the Superior Basin of the river Motru.

The mixed common oak forest from the transition hills is in an advanced stage of degradation, on the interflow Crainici (The Hills Coştuştei and Ohabei, the places Negoeşti, Pistrița, Bala (Comăneşti, Valea Mare, Molani, Brativoeşti, Crainici, Lupca etc.), towards Ciovârnăşani - Mehedinți; and on the left side of the Motru River, the Hills Bujorăscu-Runcurel, between Glogova and the Perilor Valey), between the SubCarpathian Hills and Strehaia Platform), the substrate is represented by rendzinic soil.

In these areas, the mixed common oak forest is located only on the summit of the hills and on south exposure where they come into contact, especially with the Turkey oak, because on the north exposure the hills are populated with moesic beech trees. This can be also noticed from the analysis of *Tab. 1*; in all surveys, the semiparasite epiphyte *Loranthus europaeus* indicates a strong attack that leads to the destruction of the common oak forest.

Therefore, the hundred acres surfaces are replaced by acacia plantations, while the common oak forest becomes very rare. In this area, one can also notice the more progressive invasion of the juniper tree *Juniperus communis var. communis* (Groza [16], described by the juniper tree communities in the Craiului Mountains Forest, belongs to *Prunion spinosae*), which forms in the glades of the common oak forest facies, *juniperosum communis* fac. nov. (**Tab. 1**, relevé no. **2, 9**). Holotypus hoc loco: **Tab. 1**, relevé no. **2**. The large ground-surfaces are young forests for regeneration, without limit, without a bushy and grassy layer.

As Roman [31] mentioned in the south of the Mehedinți Plateau, the dominant species is *Quercus daleschampii*, characteristic for this south-western part of Oltenia and Banat.

Quercus polycarpa is less abundant on the skeletal soils, rocky, southern exposure, on the transition hills, (characteristic, generally speaking, to the descriptions made by Popescu [28], in the *Quercetum polycarpae-cerris* association, which is also cited in the case of Strehaia).

Quercus petraea (with small AD indices) stands out on plateaus, northward exposure, north-western, crossing the hornbeam grove and the beech tree forest.

This combination is presented by Roman as well, in the south of the Mehedinți Plateau, and because of this he does not describe any association of these forests; Maloș [18] cites from the Upper Basin of the Motru River and includes the common oak forest in *Carpino-Quercetum petraeae* Borza 1941, in the Jurassic and Cretacic limestone, crystalline schists (alt. 400-800 m) at Ponoarele; Zaharia [37] in the Gilort Basin, describes the common oak forest within the association *Quercetum petraeae-cerris subas. Quercetosum polycarpae* Borza 1931; Păun [22, 23] describes the *Quercetum medio-europaeum mixtum dacicum* association Borza 1931 from the region Balș; Ciocârlan [5], in the Subcarpatic Basin of the Slătinicului by Buzău; Sanda & al. [9] incorporates the common oak forest from the region between Motru and Negoeşti to the large vegetation unit of the moesiaca oak forests (G12 - *Quercus polycarpa, Q. dalechampii* with *Helleborus odorus*, *Digitalis grandiflora, D. lanata*) and Balcanic-Carpathian forests of oak, Turkey oak and Hungarian oak (G13- *Quercus polycarpa, Quercus cerris, Q. frainetto, Q. dalechampii* with *Lathyrus niger*, local *Ruscus aculeatus*, without mentioning the presence of the *Q. petraea species*, which he incorporates to the same unit for Banat and Crișana.

In The Babadag Plateau [8] and in The Cernei, Țarcu and Godeanu Mountains [3], the authors describe the emphasized associations of *Q. dalechampii.*

From the comparative analysis of the floristic composition, of the phytocoenoses that have been studied in the Lower Basin of the Motru River and from the many descriptions according to the above mentioned authors, one can notice the same elements that define the association. That is, the presence of a large group of species related to the characteristics of the southern microclimate generated by the SubMediterranean, Balkan, Pontic, and Panonic influences.

Therefore, I considered that the presence of the characteristic species of *Quercetalia pubescenti-petraeae* order: *Fraxinus ornus, Helleborus odorus, Sorbus domestica, Acanthus balcanicus* etc., define the characteristics of the area. The species: *Quercus cerris,*

Q. frainetto, Ruscus aculeatus, Lychnis coronaria etc., define the alliance, and *Potentilla micrantha*, the central European-Mediterranean species, present the spreading-geographic relations between these mixed common oak forests and the Hungarian oak groves, in the context of the microclimate that appears in this region of the country, because of the Carpathians.

The phytocoenoses of the association were identified on the eastern and south-eastern exposure, on plateaus and slopes of the Ohabei and Comăneşti Hills and of the Lupşei Hills, at heights of 330-380 m.

The predominant soils are erodisoils and regosoils, with unconsolidated rocks, poor in humus and white-acid, and also the brown soils of forest at different podzolized stages.

The level of coverage within the layer of trees is 80-90 (100) %. Within the layer of trees, beside the three species of oak, we can encounter: *Tilia tomentosa, Sorbus domestica, Fraxinus ornus, Acer pseudoplatanus, Cerasus avium var. avium* (valuable taxon, which is also of high interest for the culture "'in vitro", topic carried out within the C.N.C.S.I.S. Grant Bucharest: *"Reproduction in vitro of some valuable wooden species"*, coordinated by Dr. Mihaela Corneanu) etc.

The bushy layer is absent, and within the grassy layer there are present: *Poa nemoralis* (most frequent, sometimes with high abundance-dominance as well), accompanied by small groups of *Festuca drymeja, F. pseudodalmatica* (rarely bushes), *Asparagus tenuifolius, Potentilla micrantha, Helleborus odorus, Polygonatum latifolium, P. odoratum, Geum urbanum, Viola reichenbachiana, Melica uniflora, Hieracium murorum, Galium schultesii, Lathyrus niger, L. vernus, Luzula forsteri, Lapsana communis subsp. adenophora* etc.

The transition character of the association is emphasized by the presence of the xero-xeromesophyle (typical for the silvosteppe zone) and mesophyle elements (typical for the under- Carpathian Hills), imposing therefore the mesophyle character of these forest; by the thermophile elements on the one hand, and by the microtherm one on the other hand, towards north, emphasizing the meso-thermophyle-subthermophyle character.

The soil's reaction indicates the moderate reaction of the acid-neutrophyles; but the geoelemets specter highlights the central European character, with a important participation of meridional elements, the circumpolar element being also present on a eurasiatic dominance.

Conclusions

The paper presents, in detail and for first date in Oltenia region and otherwise in Romania, the **Potentillo micranthae-Quercetum dalechampii** A. O. Horvát 1981 association, emphasizing the transition character of the mixed common oak forest from the Lower Basin of Motru River.

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Tab. 1

Potentillo micranthae-Quercetum dalechampii A.O. Horvát 1981

(Syn.: *Potentillo micranthae-Quercetum (petraeae resp. dalechampii-cerris)* A.O.Horvát (1956) 1959)

juniperosum communis fac. nov.

Relevé no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Altitude (m.s.m.)	350	300	337	290	337	250	250	370	400	380	380	350	300	250	350	380	200	230
Slope (degrees) (^{0})	15-25	15-25	-	15-25	10-20	5-10	10-15	20-30	25-30	20-30	25-30	20-30	15-20	20-30	20-30	20-30	10	10
Aspect	N	V-SV	-	S-SE	N-NE	NE	N-NV	N-NV	SV	N-NV	SV	NE-S	N	S	E-NE	N-NV	V-NV	N
Surface (m^2)	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Covering (%)	100	100	90	90	90	90	85	85	85	85	85	85	85	85	85	85	85	85

Geoelem.	**Relevé no.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	
	Characteristic's species of association																			
Centr. eur.-submedit.	Potentilla micrantha	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**V**
E. medit.-carp.-balc.	Quercus dalechampii	4	4	4	4	4	4	3	3	3	3	4	4	4	3	3	4	4	4	**V**
	Quercion farnetto																			
Medit.	Quercus cerris	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**V**
Balc.	Quercus frainetto	-	-	+	+	+	-	-	+	-	+	-	-	-	+	-	+	+	-	**IV**
Pont.-medit.	Ruscus aculeatus	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	1	+	**II**
Medit.	Lychnis coronaria	-	-	-	-	-	-	+	-	-	-	-	-	+	-	+	-	-	-	**I**
	Quercetalia pubescenti-petraeae																			
Carp.-balc.-cauc.	Quercus polycarpa	1	1	+	1	1	1	1	1	+	1	1	+	2	2	+	+	+	**V**
Eur. centr. and by E.	Festuca pseudodalmatica	-	+	+	-	+	-	+	+	-	+	-	-	+	-	+	-	+	+	**III**
Balc.	Helleborus odorus	-	-	+	+	+	-	+	-	-	-	-	-	-	-	-	-	+	+	**II**
Atl.-medit.	Sorbus domestica	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	**I**
Centr. eur.-submedit.	Limodorum abortivum	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	**I**
Centr. eur.-submedit.	Festuca heterophylla	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	**I**
	Quercetea pubescentis																			
Submedit.	Fraxinus ornus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**V**
Eur.	Quercus petraea	+	+	+	-	-	+	+	+	+	+	+	+	-	-	+	+	-	+	**IV**
Eur. centr. and by S.	Rosa micrantha	-	-	-	+	+	-	+	+	+	+	+	+	-	+	-	+	-	-	**III**
Eur., As. V.	Genista tinctoria subsp. elatior	-	+	-	+	+	-	+	+	+	+	+	-	-	-	-	+	-	-	**III**
Eur. centr.-submedit.	Lithospermum purpurocaeruleum	-	+	+	+	1	-	-	-	-	-	-	+	+	+	+	-	-	-	**III**
Euras.	Campanula persicifolia	+	+	+	+	+	-	-	-	+	-	+	-	-	-	-	-	-	-	**II**
Balc.-pan.	Tilia tomentosa	+	1	1	+	+	+	1	-	-	-	-	-	-	-	-	-	-	-	**II**
Euras. cont.	Vincetoxicum hirundinaria	+	+	-	+	+	-	+	-	-	-	-	-	+	-	-	-	-	-	**II**
Submedit.	Tamus communis	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	**II**
Euras.	Viola hirta	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	**I**
Eur. centr. and by S.	Hieracium racemosum	-	-	-	-	+	-	+	-	+	-	+	-	-	-	-	-	-	-	**I**

Centr. eur. *Sorbus torminalis* **+/I** (**2,7,18**); Euras. (submedit.) *Platanthera chlorantha* **+/I** (**3, 17, 18**); Pont.-medit. *Cornus mas*, Euras. *Tanacetum corymbosum* **+/I** (**4,5**); Medit. *Sedum cepaea*, Eur. centr. *Silene viridiflora* **+/I** (**9,11**).

		Querco-Fagetea																		
Circ.	Poa nemoralis	+	1	1	2	+	2	+	3	2	3	2	2	1	2	1	3	1	1	**V**
Eur.	Pulmonaria officinalis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**V**
Euras.	Fragaria vesca	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**V**
Euras.	Viola reichenbachiana	+	+	1	1	1	+	+	+	+	+	+	+	+	+	+	+	1	1	**V**
Pont-medit.	Lathyrus venetus	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	**V**
Eur.	Hieracium murorum	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	**V**
Euras.	Veronica chamaedrys	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	**V**
Pont.-medit.-centr. eur.	Glechoma hirsuta	-	-	1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**V**
Eur. centr.	Lathyrus niger	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	**V**
Eur.	Mycelis muralis	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	-	+	**V**
Carp.-balc.	Galium pseudaristatum	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**V**
Centr. eur.-submedit.	Melica uniflora	+	+	+	+	+	-	-	-	+	-	+	+	+	+	+	-	+	+	**IV**
Trans. Balc.	Lapsana communis subsp. adenophora	+	+	+	+	+	-	-	+	+	-	+	-	-	-	-	+	+	+	**IV**
Eur. centr.	Carpinus betulus	+	-	+	-	+	-	+	+	-	-	+	-	+	+	+	-	+	+	**III**
Eur.	Loranthus europaeus	-	-	+	-	-	-	-	1	1	1	1	1	1	1	1	1	-	-	**III**
Centr. eur.	Dactylis polygama	-	-	1	+	+	-	+	-	+	-	+	+	+	+	1	-	-	-	**III**
Euras.	Campanula rapunculoides	-	-	+	+	+	-	-	-	+	-	+	+	+	+	+	-	-	-	**III**
Euras.	Galium odoratum	-	+	+	1	+	-	1	-	-	-	-	+	-	+	+	-	-	-	**III**
Centr. eur.	Rubus schleicheri	+	+	-	-	-	-	+	+	+	+	+	-	-	-	-	+	-	-	**III**
Eur. centr. and by SE.	Festuca drymeja	+	-	-	-	-	-	1	-	+	-	+	+	+	+	+	-	-	-	**III**
Centr.-eur., subatl., submedit.	Euphorbia amygdaloides	-	-	+	+	+	-	+	-	+	-	+	-	-	-	-	-	+	+	**III**
Eur. centr. and by V.	Rubus apiculatus	+	+	-	-	+	+	-	-	+	-	+	-	-	-	-	-	+	1	**III**
Centr. eur.	Carex pilosa	-	-	+	-	+	-	+	-	+	-	+	-	+	-	-	-	-	2	**II**
Centr. eur.	Dentaria bulbifera	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	**II**
Euras.	Carex digitata	-	-	-	-	-	-	-	+	+	+	+	+	-	+	-	+	-	-	**II**
Euras	Lathyrus vernus	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	**II**
Euras.	Cruciata glabra	-	-	+	+	+	-	+	-	+	-	+	-	+	-	-	-	-	-	**II**
Pont.-medit.	Asparagus tenuifolius	-	-	+	+	+	-	+	-	-	-	-	-	-	-	-	-	+	+	**II**
Pont.-pan.-balc.	Polygonatum latifolium	-	+	+	+	+	-		-	-	-	-	-	-	-	-	-	+	+	**II**
Euras.	Viola riviniana	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	**II**
Eur.	Hieracium sabaudum	-	-	-	-	-	-	+	+	-	+	-	-	-	-	-	+	+	+	**II**
Euras. (submedit.)	Brachypodium sylvaticum	-	-	1	1	1	-	2	-	+	-	+	-	-	-	-	-	-	-	**II**
Pont.-pan.-balc.	Crataegus pentagyna	-	-	+	+	+	-	+	-	+	-	+	-	-	-	-	-	-	-	**II**
Submedit.	Cerasus avium var. avium	+	-	-	-	-	-	+	-	-	-	-	-	+	-	+	-	+	+	**II**
Eur. centr. and by SE.	Genista ovata	-	+	-	-	-	-	-	+	+	+	+	-	-	-	-	+	-	-	**II**
Centr. eur.-atl.-medit.	Luzula forsteri	+	+	-	-	-	-	-	-	+	-	+	-	-	-	-	-	+	+	**II**
Euras.	Dryopteris filix-mas	-	-	-	-	-	-	+	-	+	-	+	+	-	+	-	-	-	-	**II**
Carp.-balc.	Chamaecytisus glaber	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	+	-	-	**II**
Eur. centr	Galium schultesii	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	**II**
Euras. (submedit.)	Campanula trachelium	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	**II**

Eur.	Pyrus pyraster	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**II**
Eur.	Corydalis solida	-	-	+	+	1	-	-	-	-	-	-	-	-	-	-	-	-	+	+	**II**
Eur. centr. and by south.	Scilla bifolia subsp. drunensis	-	-	+	+	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	**II**
Eur.	Ajuga reptans	-	-	+	+	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	**II**
Eur. centr.	Lamium galeobdolon	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	**II**
Eur. centr.	Digitalis grandiflora	-	+	-	-	-	-	-	-	+	-	+	-	+	-	+	-	-	-	-	**II**
Centr. eur.	Crataegus rhipidophylla var. rhipidophylla	-	-	+	-	-	-	1	-	+	-	+	-	-	-	-	-	-	-	-	**II**
Circ.	Carex divulsa	+	-	+	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**I**
Eur. centr. and by south. *Scilla bifolia* subsp. *subtriphylla* **1/I**, Euras. *Melittis melissophyllum* **+/I** (**3, 4, 5**); Eur. centr. and by V. *Cephalanthera longifolia* **+/I** (**3, 12, 14**); Euras. *Lamium maculatum* **+/I** (**17, 18**); Euras. *Geranium lucidum*, Euras. *Moehringia trinervia* **+/I** (**9, 11**); Euras. *Stachys sylvatica* **+/I** (**3, 7**).																					
Molinio-Arrhenatheretea																					
Euras.	Dactylis glomerata			+	1	1	+	-	+	+	+	+	-	-	-	-	+	+	+	**III**
Eur. centr.	Chamaecytisus hirsutus	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	-	-	**III**
Balc.-pan.	**Chamaecytisus hirsutus subsp. leucotrichus**	+	-	-	-	-	-	-	+	+	+	-	+	-	+	-	+	-	-	**II**
Carp.-balc.-Pan.	Thymus pulegioides subsp. montanus	-	-	+	-	-	-	+	+	-	+	-	-	-	-	-	+	-	-	**II**
Festuco-Brometea																					
Eur. de S	**Inula salicina subsp. aspera**	-	+	+	-	-	-	+	+	+	+	+	+	-	+	-	+	-	-	**III**
Euras.	Poa angustifolia	-	-	+	+	+	+	-	+	1	+	1	-	-	-	-	+	-	-	**III**
Cont. euras.	Festuca rupicola	-	-	-	-	-	+	+	+	+	+	+	+	-	+	-	+	-	-	**III**
Centr. eur. and by E.	Hieracium bauhinii subsp. thaumasium	-	-	-	-	-	+	-	+	+	+	+	+	-	+	-	+	-	-	**III**
Euras. (submedit.)	**Pimpinella saxifraga**	-	-	-	-	-	-	+	+	+	+	+	+	-	+	-	+	-	-	**III**
Pont.-pan.-balc.	**Veronica orchidea**			-	-	-	-	+	+	+	+	+	+	-	+	-	+	-	-	**III**
Eur. centr. (submedit.)	**Teucrium chamaedrys**	-	-	-	-	-	-	+	+	+	+	+	+	-	+	-	+	-	-	**III**
Eur. centr. and by SE.	**Dorycnium herbaceum**	-	-	-	-	-	-	-	+	+	+	+	+	-	+	-	+	-	-	**II**
Trifolio -Geranietea																					
Circ.	Clinopodium vulgare	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	-	-	**III**
Eur. centr.	Inula conyza	-	-	+	-	-	-	+	+		+	-	-	-	-	-	+	-	-	**II**
Euras.	Trifolium medium	-	-	-	-	-	-	-	-	+	-	+	+	-	-	-	-	+	+	**II**
Prunetalia spinosae																					
Eur. centr.	Cornus sanguinea	-	+	+	+	+	-	1	+	+	+	+	+	-	+	-	+	+	+	**IV**
Eur. centr. and by SV.	Rubus candicans	-	-	+	+	+	-	-	+	+	+	+	-	+	+	+	+	-	-	**III**
Eur.	Rosa subcanina	-	-	+	+	+	+	-	+	-	+	-	-	-	-	-	+	+	+	**III**
Eur.	Rosa canina	-	-	+	+	+	-	+	-	+	-	+	+	-	+	-	-	-	-	**III**
Circ.	Juniperus communis var. communis	-	4	-	-	-	-	-	+	3	+	1	+	-	+	-	+	-	-	**III**
Eur. (submedit.)	Ligustrum vulgare	-	-	+	+	+	-	+	-	+	-	+	-	-	-	-	-	-	-	**II**
Eur.	Rosa dumalis	-	-	-	+	+	-	+	-	+	-	+	+	-	+	-	-	-	-	**II**
Medit.	Crataegus monogyna subsp. azarella	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	+	-	-	**II**
Eur. centr.	Clematis vitalba	-	-	-	-	-	-	+	-	+	-	+					-	+	+	**II**
Centr. eur.-medit. *Rubus canescens* **+/I** (**9,11**).																					
Variasyntaxa																					
Euras.	Alliaria petiolata	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	**II**

Circ.	Galium aparine	-	-	+	+	+	-	-	-	+	-	+	-	-	-	-	-	-	-	**II**
Cosm. *Geranium robertianum* **+/I** (**3, 4, 5**); Am. de N. *Robinia pseudoacacia*, Medit. *Cynosurus echinatus* **+/I** (**9,11**).																				
	Bryophyta																			
	Hypnum cupressiforme	2	2	2	2	2	2	2	2	+	2	+	+	2	2	2	2	3	3	**V**
	Atrichum undulatum	1	1	1	+	+	+	+	+	-	+	-	-	+	+	+	+	+	+	**V**
	Dicranum scoparium	1	1	1	-	+	+	+	+	-	+	-	-	+	1	+	+	+	+	**V**
	Polytrichastrum formosum	1	1	1	-	1	1	1	-	1	1	1	1	1	1	1	-	-	-	**IV**
	Racomitrium canescens	+	+	-	-	+	+	+	-	2	-	2	2	-	-	-	+	-	+	**III**
	Plagiomnium undulatum	+	+	1	+	-	+	-	+	-	+	-	-	+	1	+	-	+	-	**III**
	Plagiothecium undulatum	-	+	+	-	+	-	+	+	-	+	-	-	+	-	+	-	+	+	**III**
	Scleropodium purum	-	+	-	+	-	-	-	+	1	+	1	+	-	+	-	-	+	-	**III**
	Plagiomnium affine	+	-	-	-	-	+	-	+	-	+	-	1	+	1	+	-	+	-	**III**
	Hypnum cupressiforme var. filiforme	+	-	-	+	-	+	+	-	-	-	-	+	-	-	+	-	+	+	**III**
	Bryum argenteum	+	-	+	-	-	-	+	+	-	-	-	-	+	+	-	-	+	+	**III**
	Ceratodon purpureus	-	+	-	+	-	+	-	-	+	-	+		-	-	+	-	+	-	**II**
	Brachythecium salebrosum	+	-	-	+	+	-	+	-	-	-	-	-	-	-	-	+	+	+	**II**

Species presents in a single relevé (+/I): Euras. *Epipactis helleborine,* Centr. eur.-subatl. *Epipactis purpurata*, Balc. *Euphorbia jacquinii,* Eur. *Euonymus europaea,* Centr. eur. *Luzula luzuloides,* Eur. *Ulmus minor,* Euras. **Pinus sylvestris,* Euras. *Stachys sylvatica* (**1**); V, centr. eur.-medit. *Arum orientale,* Euras. *Actaea spicata,* Balc. *Digitalis ferruginea,* Eur. *Rumex sanguineus, Salvia glutinosa,* Cosm. *Pteridium aquilinum* (**2**); Centr. eur.-medit. *Aremonia agrimonioides,* Balc. *Fagus sylvatica* subsp. *moesiaca*, Eur. centr. and by south. *Scilla bifolia*, Eur. centr. *Pulmonaria mollis*, Pont.-medit. *Scutellaria altissim*, Eur. *Malus sylvestris* (**3**); Eur. centr. *Tilia platyphyllos* subsp. *cordifolia* (**4**); Submedit. *Primula acaulis*, Eur. centr. (submedit.) *Viburnum lantana,* Pont.-balc.-pan. *Ruscus hypoglossum,* Submedit. *Agrimonia eupatoria* subsp. *grandis* (**7**).

Place and date of the relevées: 1. Glogova Hill, Glogova (on the left side of the area Motru-Gorj, by the limit area with Mehedinți), 04. VI. 2000, 03.V.2003; **2.** Culmea Motrului Hill, Comăneştilor-Mehedinți, on the same hill with Hill Glogovei, 04. VI. 2000, 22.VIII. 2002, 27.VI.2004; **3.** Cerângani Hill, on the plateau, between Ogaşul Lepreşului and Ogaşului Ştubeiu (51, 52, 53, N-V by Strehaia), 17. IV.2000, 30. V. 2000; **4.** Between Lepreşului, Lupoaiei, 09.VII 2003; **5.** Ogaşului Ştubeiu, Cerângani, 09.VII 2003; **6.** Ciochiuța Hill (Ciochiuța-Strehaia), 01.VII.2003; **7.** Pârvuleştilor Hills, between Codrun and Pârvuleşti (Corcova), the interflow Coşuştei, 21.IX.2003; **8, 9.** Pestriței Hills, Călugăriței, village Pestrita (Bala), rocky surface 11. IX. 2002, 27.VI.2004; **10.** Brativoeşti Hill (Bala), 11. IX. 2002, 27.VI.2004; **11.** Interflow Crainici, Crainici (Bala), 11. IX. 2002, 27.VI.2004; **12.** Cracul Priporului, Iormăneşti (Glogova-Gorj), 09.VII.2002; **13.** Priba Mică Hill, Olteanu (Glogova), 09.VII.2002; **14.** Bălțatului Hill, Cătunele, 09.VII.2002; **15.** Râpa lui Gulie, between Câmpu Mare and Sărdăneşti, 21.VIII.2002; **16.** Interflow Valea Mare, village Valea Mare (Bala), 23.VII.2004; **17.** Piscul lui Busan, Buiceşti, 17.IV.2004; **18.** Dosul Culmii Hill, Gura Motrului, 30.IV.2004.

Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

RARE DENDROTAXONS CULTIVATED IN THE UNIVERSITY BOTANIC GARDEN MACEA (ARAD COUNTY)

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Abstract: The Macea University Botanical Garden, which covers a surface of 21.5 hectares, represents a scientific collection of 2.200 woody taxons. We presents 11 rarities of the Romanian cultivated dendroflora, these are: *Callicarpa cathayana* Chang, *Chimonanthus nitens* Oliver, *Davidia involucrata* Baill., *Euonymus carnosus* Hemsl., *Forestiera neomexicana* A. Gray., *Paliurus hemsleyanus* Rehder, *Pistacia chinensis* Bunge, *Platycarya strobilacea* Sieb. et Zucc., *Quercus shumardii* Buckl., *Sinojackia rehderiana* Hu, *Sorbus caloneura* Rehder.
The dendrotaxons adaptation and acclimatization confers a permanent preoccupation to the garden specialists.

Keywords: rare dendrotaxons

Introduction

The Botanical Garden of the Western University "Vasile Goldiş" is situated in the Macea locality, in the district Arad, 23 km from Arad, has a surface of 21.5ha.

Under a bio-pedo-climatic report, we are mentioning that the territory of the garden is plane, the level of ground-water is at 3-4m, the soil is of the type levigated chernozem, with a useful thickness of 95cm, with a good stucture, a clay-sand texture and a pH between 6.8 and 7.2. The annual average temperature is of 11.3 ºC, the absolute maxima is of 39 ºC, and the absolute minima of -25 ºC. The precipitations are situated around the average annual value of 550mm. These particularities have created large opportunities for the development of some rich collections in dendrotaxons, which are containing not only protected and rare species from the Romanian flora, but also from other geographical regions.

If in 1968, at the inventory realized with the occasion of putting this territory under protection, the collection counted 68 tree and shrubs taxons, in 1987 it counted 1,439 taxons, and now days the number of taxons surpasses the number of 2,200. The introduction of wooden species with the purpose of adapting them to the conditions characteristic for the region and respectively for their acclimatization, this constitutes an priority objective for the garden personnel. The collaboration and mutual change relationships of seed material have extended a lot, the Botanical Garden Macea being in the last year the partner of 179 institutions.

Rare dendrotaxons:

In the work "Flora lemnoasă spontană şi cultivată din România"("The wooden spontaneous and cultivated flora in Romania") appeared in Iaşi, there are numerous rare dendrotaxons mentioned only from within Macea.

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As it follows, we will introduce 11 wooden species cultivated in Macea, which are considered by us as rarities for the cultivated dendroflora of Romania (**Tab. 1**).

Callicarpa cathayana Chang (Fam. *Verbenaceae*) – Shrub, 1,5-3m high; branchlets slender, slightly stellate tomentose when young, grabrescent; simple, opposite, deciduous leaves, elliptic to ovate, 4-8cm long, 1.5-3cm wide; purple flowers and fruits, globular fruits of 2 mm in diameter. It is native to China, where it grows in mixed forests on mountain slopes or in valleys, below 1,2000m altitude.

The 4 specimens in Macea are in the Dendrologic collection, in the sector called Asia, they are vegetating very well, and they are blooming and fructifying abundantly, yearly.

Chimonanthus nitens Oliver (Fam. *Calycanthaceae*) – Evergreen shrub or treelets, 1-6 m high, with erect port; young twigs quadrangular, older twigs sub-terete, puberulous, glabrous with age; leaves is simple, opposite, smooth, papery to sub-coriaceous, elliptic, elliptic-lanceolate, 2-18cm long, 1.5-8cm wide; solitary flowers, axillary, minor, 7-28mm in diameter, yellow or yellowish-white. The species is of Chinese origin, where it is to be found in rare forests in the mountain area, in stations with calcareous substratum.

The specimen cultivated at Macea, received like the *Chimonanthus zhejiangensis* M.C.Liu, is in the collection of Thermophile plants in the garden, it vegetates well, it blooms but it doesn't fructify. The low temperatures during winter, affects their leafage and the apex of the sprouts. It is ornamental both through its flowers which are scented and its leafage.

Davidia involucrata Baill. (Fam. *Davidiaceae*) – Arborescent species, it can surpass 20m in height in its natural area; native to China; the bright to dark green leaves are cordate, tomentose underneath, similar to Tilia species. This tree is most conspicuous in May when draped with its 2 large, white bracts, which are not equal and surround the flower; the fruit is a 3cm big drupe.

In the year 2006, the specimen cultivated at Macea has bloomed for the first time. It endured well the low temperatures that were registered in the last winters, being more sensitive to droughts.

Euonymus carnosus Hemsl. (Fam. *Celastraceae*) – Native to China, it is erect shrub or small tree, 5-6m high; the leaves are opposite, glossy on the superior side, sub-coriaceous, 5-15cm long, and 2-7cm wide; the fruit is a pink capsule which turns deep blood crimson.

The 3 specimens cultivated in Macea, are placed in a shady spot, they are vegetating very good, they fructify annually. The apex of the sprouts is affected in some of the winters by the low temperatures.

Forestiera neomexicana A. Gray. (Fam. *Oleaceae*) – Shrub, 1-3m high; deciduous, simple leaves, opposite, 2-5cm long; white-yellowish flowers inconspicuous, followed by black, egg-shaped fruits covered with a blue bloom. Native to S.W. United States, it prefers the well drained soils and sunny stations.

The specimen in the Botanical Garden Macea is cultivated in the Dendrological collection, in the so-called North America sector, sadly in the shade of some ash trees. It vegetates weakly, and it doesn't fructify. We will try to increase the number of specimens on a vegetative way, and the obtained seedling plants will be planted in sunny spots.

Paliurus hemsleyanus Rehder (Fam. *Rhamnaceae*) – Deciduous shrub, native to China; it has greenish-red young stems, pubescent; the long thin stems armed with innumerable pairs of inequal, hard and straight thorns, the one on the upper side a little longer; the leaves alternate, they are relatively symmetrical, glabrous, glossy on both sides.

The species is sensitive to the low temperatures during winter. One of the two specimens the garden had, were lost because of the could winter of 1994-1995, the remaining one looses each winter approximately 2/3^{rds} from the branchs, which it regenerate relatively easy, after the cleaning cut in spring.

Pistacia chinensis Bunge (Fam. *Anacardiaceae)* – Shrub or tree of small size (8m), even pinnate leaves, in autumn they get different overtones of yellow, orange and flaming red, deciduous. Dioic species, native to China.

Also cultivated in the collection of Thermophile plants in the garden, it vegetates well, it never bloomed, and it never has been affected by the local climatic extremes.

Platycarya strobilacea Sieb. et Zucc. (Fam. *Juglandaceae*) – Tree of small size, native to China, Japan, Korea; pinnate leaves composed of 7 to 15 sessile, lanceolate toothed folioles; flowers small, monoecious, the males in cylindrical catkins, the females in erect, green, cone-like clusters.

The two specimens have fructified in the last years, the more vigorous one vegetates well, the other one being severely affected by the frost of the last winter.

Quercus shumardii Buckl. (Fam. *Fagaceae*) – Tree of big size, native to S. W. United States; leaves are deeply lobated, in autumn they are colored in purple-red; the acorn is of 2.5cm, the maturation is biannual. They prefer warm climates, but they also resist in stations with humid soils.

Cultivated in the Dendrologic collection, in the North-America section. The 4 specimens we own, vegetate very well and fructify abundantly.

Sinojackia rehderiana Hu (fam. *Styracaceae*) – Deciduous shrub or small tree, in wild (E. China) up to 5m; leaves alternate, glabrous, elliptic to elliptic-obovate, 4-12cm long, 2-6cm wide; flowering in May; flowers are white, 2 to 6 in axillary leafy racemes; fruit is cylindric-oblong, brown, of 2-2.5cm in length, with an acuminate apical beak.

In Macea it vegetates well, it fructifies annually, and it is to be found in the Dendrologic collection, the filogenetic section. The bad weather in winter, affect the apexes of the sprouts.

Sorbus caloneura Rehder (fam. *Rosaceae*) – A large shrub or small tree with erect steams; simple leaves, oval-oblonge, double toothed and boldly marked by 9-16 pairs parallel veins; small fruits, brown, globular, with a flattened apex; rare species and in its natural habitat (C. China).

It has been recently introduced in the Macea collection, and it vegetates well.

Conclusions

- Most majority of the taxa presented in this paper are native to China, all of them having ornamental features.
- This study complete our anterior data concerning the scientific inventory of the cultivated trees and shrubs in Macea Arboretum.
- This study emphasize a permanent care of the Botanic Garden staff in introducing new taxa, having in mind their adaptation and acclimatization to the local climate conditions.

Tab. 1 Rare dendrotaxons cultivated in the University Botanic Garden Macea

No. crt.	Scientific name	Origin	Source	Intr. year	No. of spec.	Height -m-
1	*Callicarpa cathayana* Chang	China	Arb. Waasland, Belgie	2001	6	1,5
2	*Chimonanthus nitens* Oliver	China	B. G.Hangzhou, China	1989	1	1,5
3	*Davidia involucrata* Baill.	China	?	1994	1	6
4	*Euonymus carnosus* Hemsl.	China	B. G. Hangzhou, China	1989	3	2
5	*Forestiera neomexicana* A.Gray.	S.W. U.S.A.	Arb. Simeria, Romania	1978	1	3
6	*Paliurus hemsleyanus* Rehder	China	H.B. Hangzhou, China	1989	1	2
7	*Pistacia chinensis* Bunge	W. China	?	1992	1	4
8	*Platycarya strobilacea* Sieb. et Zucc.	China, Japan, Korea	H.B. Hangzhou, China	1988	2	5
9	*Quercus shumardii* Buckl.	S.W U.S.A.	Arb. Morton, Lisle, U.S.A.	1987	4	10-12
10	*Sinojackia rehderiana* Hu	E. China	B. G. Strasbourg, France	1993	1	1,5
11	*Sorbus caloneura* Rehder	C. China	N. B. G. Meise, Belgie	2004	4	1

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

GROWTH RATE TESTS FOR MATERNAL DESCENDENTS OF PEDUNCULATE OAK (*QUERCUS ROBUR* L)

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Summary: The growth rate of *Quercus robur* L. saplings obtained from the germinated acorns sowed in the autumn and spring was investigated. The growth rate of descendents obtained from the spring sowed acorns was revealed to be much higher than those obtained from the autumn sowing. The differences of their growth rate were significant and therefore those differences have a certain practical value. It was also demonstrated the importance of collecting the acorns formed in conditions that assure cross-pollination of trees (from polymorphic population). Saplings obtained from this population grew much faster than those obtained after self-pollination (in consanguine population). This phenomenon could be a consequence of partial splitting of heterozygote and accumulation of homozygote in posterity after self-pollination, factor that influence the growth of obtained genotypes. In consanguine population was observed the high level of genotypes variation, accompanied with a low level of some part of saplings viability and vigor. Slow growing of oak saplings determines the difficulties of their maintenance, especially during the first years of life. Thus, cross-pollination and spring sowing of the obtained acorns are the two factors that are important to take into account when we want to r obtain viable and vigor descendents of pedunculate oak.

Key words: pedunculate oak, maternal descendents, polymorphic population, consanguine population, growth rate.

Introduction

One of the major specific events in biological science of XX century was the theoretical formulation of the concept of population. Now the population is considered as basic unit of existence, duplication and adaptation of the related genotypes, containing a group of similar individuals, with the common origin; which occupy a uniform area, have a specific combination of hereditary attributes and determined genotypic structure; assure appearance of multiple copies, constantly panmictic [12]. The population is elementary and the lowest form of specie collective existence [13]. It is laboratory the natural selection takes place [11], with the set of coadaptation genes inside it [4]. At the beginning the behavior and properties of natural populations were studied [8] that allowed the studying and comparison of processes that occur at the level of different populations. Admitting the fact that the population is a ecologic-genetic structure, biologists and mathematics used various mathematical methods for description of its behavior of attributes of descendents in conformity with the principles of Gr. Mendel.

The specific scientific interest represents the populations of pedunculate oak (*Quercus robur* L.) in order to determine the amplitude of geographical and biotopical variability of populations; revealing the character of sapling growth in dependence of origin; inheritance of phenological attributes, taxonomic purposes et al. The contemporary researches [9] have shown, that inside the specie of pedunculate oak there are only two categories of group variability: populations and groups of populations. Specific biological features of this species and ecological mosaic area of its distribution influence the

* The Nature Reserve „Plaiul Fagului”, Moldova

differentiation of populations at different territories [1]. Special value in this process has the effective distance of distribution of pollen and acorn. The distribution of pollen from the individual oak tree achieves about 70-100 meters [10]. Insignificant distribution of acorn is the consequence of his size. Mature acorn fall directly under a crone of a parent tree or are rolled on a small distance. Discrepancy of the period of pollination of trees within the limits of a large forest, absence of air circulation necessary for caring up of pollen on the large distances create obstacles for panmicthy and result in isolation of populations of an oak on small distances.

The present work represents the results of researches the descendents from two populations of pedunculate oak (*Quercus robur* L) incorporated in Scientific Reservation "Plaiul Fagului" influenced by the polymorphic or consanguine origin of acorn.

Material and methods

In half sib seed plantation are tested saplings a pedunculate oak occurred from acorns of 64 trees that represent sample of a natural population, and sapling, brought up from acorns collected from 6 trees, which are growing isolate on the margin of the forest.

Collecting of acorns was carried out from each tree separately. The half sib plantation has been created by seeding the acorns in the autumn 2001 and spring of 2002 on square sites, with the lateral party length of 7 meters. Acorns were seeded in rows at the depth of 6-7 cm and distances between saplings 1x1 in meters. The experiments were plotted in 4 variants with 5 repetitions each. Variants are differentiated one from another by the sites of acorn collection. The circuit of a skilled site is shown in [2]. The experimental population was modeled from the 64 different genotypes on one site that has received the name a *polymorphic population*. The other experiment has been incorporated on the basis of acorns collected from isolated trees, named the *consanguine population*.

Researches at the level of populations have been lead, and the influence of period of sowing on the speed of the sapling growth has been appreciated. Two statistic-mathematical methods have been applied for estimation of authentic distinctions between average values of investigated attributes. With the help of Student pair criterion the importance of distinctions between population average values was revealed by comparing all possible combinations between variants [14]. Also the dispersive analysis with equal numbers for each class has been lead [15]. The mathematical model of the dispersion analysis was provided by the equation:

$$x_{ij} = m + \mu_i + \beta_j + \varepsilon_{ij}$$

where:

m – general average;

μ_i – a component i populations (i = 1 … n);

β_j – a component j repetitions (j = 1 … r);

ε_{ij} – the mistake which deforms ij a site with $\varepsilon_{ij.}$

Making dispersions of investigated attributes can be calculated, using the information of the table:

The statistical parameters used for dispersive the analysis of experimental results

Source of variability	Number of degrees of freedom	The sum of squares	An average square	Values F
Populations	n-1	$H\text{-}C_t = K$	K/n-1 = N	N/P = N
Repetitions	r-1	$I\text{-}C_t = L$	L/r-1 = O	O/P = R
Mistake	(n-1)(r-1)	M	M/Nr-1 = P	
In total	Nr-1	$G\text{-}C_t = J$		

The results received by using of two methods are considerably different. The dispersion analysis (the first method) calculates integrated differences between all populations comparing with general average. By the second method a comparison between the average values of all pairs of populations is made, that increase the probability of significant differences. The dispersion analysis causes more strict level of an estimation of differences between variants.

Results and discussions

Supervision over the growth by 896 descendants of a pedunculate oak has been provided during the first 3 years of their life. The generalized statistical data regarding the rate of sapling growth in height and on diameter are introduced in (**Tab. 1**, **Tab. 2**)

Table 1

Average values and factor variability of parameters describing the height of oak sapling

Population	The period of sowing	Height after 1-st year		Height after 2-nd year		Height after 3-it year	
		$\overline{X}$,sm	C, %	$\overline{X}$,sm	C, %	$\overline{X}$,sm	C, %
Polymorphic	Autumn	19,7	33,5	43,7	29,8	112,2	22,2
	Spring	21,6	28,6	50,4	28,7	123,9	25,9
Consanguine	Autumn	17,0	35,8	44,3	30,8	101,8	32,8
	Spring	20,7	26,4	46,4	26,0	113,0	23,7

Data included in the table1 demonstrated that the largest growth of height during the first year was realized by sapling of polymorphic population seeded in the spring. The average height of plants in this variant was achieved 21,6 cm. The difference from the consanguine sapling of autumn sowing regarding this parameter was at high reliability (P = 99,9 %; $t_{calc.}$ = 7,775). The tendency of faster growth of saplings diameters in polymorphic populations was also revealed. Consanguine sapling from the autumn and spring sowing had a diameters on 75,0 and 87,5% less in comparison with sapling the polymorphic population created by autumn sowing (**Tab. 2**).

Appreciable influence on energy of sapling growth was observed after spring sowing. For example, in a polymorphic population sapling, incorporated by spring sowing, exceed on 9,6 % on height that are brought up from autumn sowing, and in consanguine populations sapling created by autumn sowing grew on 82,1 %.

Table 2

Average values and factor variability of parameters describing the diameter of oak sapling

Population	The period of sowing	Diameter after 1-st year		Diameter after 2-nd year		Diameter after 3-it year	
		$\overline{X}$, mm	C, %	$\overline{X}$, mm	C, %	$\overline{X}$, mm	C, %
Polymorphic	Autumn	4,8	25,4	8,9	23,0	17,9	33,4
	Spring	4,6	25,1	10,5	24,3	20,0	22,3
Consanguine	Autumn	3,6	26,4	8,7	25,5	17,4	28,1
	Spring	4,2	25,6	9,6	21,3	18,8	19,0

The mentioned yearly tendency of stronger growth in height and diameter of sapling obtained from spring sowed polymorphic population was kept after 2-nd year of a life. So, this population surpassed on 13,8 % in height and on 20,7 % in diameter the consanguine a population obtained after autumn sowing. The revealed higer average values of height and diameter at sapling of polymorphic population is confirmed by the values of correlations. The factor of correlation achieved values r = 0,72 ($p < 0,001$) (**Tab. 5**). Irrespective of genotype structure sapling created by spring sowing had stronger energy of growth in comparison with sapling obtained after autumn sowing. For example, sapling of polymorphic population obtained after spring sowing have found out average height authentically higher (P = 99,9 %; $t_{calc.} = 5,134$) in comparison of that has been revealed at descendent after autumn sowing. The similar differences were observed also in diameter.

The highly authentic distinctions between populations were observed also for 3 year old plants (**Tab. 3, Tab. 4**).

Table 3

Matrix of t_{calc} values and reliability of differences between growths of 3 year sapling of different populations

Population	Population			
	1	2	3	4
1. Polymorphic population, autumn sowing	-	4,306***	3,684***	0,262
2. Polymorphic population, spring sowing	4,306***	-	7,186***	3,349***
3. Consanguine a population, autumn sowing	3,684***	7,186***	-	3,342***
4. Consanguine a population, spring sowing	0,262	3,349***	3,342***	-

Note: the reliability on 0,01 %.

The greatest average heights have been found for spring sowed polymorphic population where average height sapling has registered 123,9 cm, when for sapling of consanguine populations was only 113,0 cm. Ranging the populations according to the investigated parameters has revealed, that to population with higher average heights of sapling has accordingly the higher diameters. It means, that there are correlating growth of his parts, that in our case can be confirmed by revealing of significant correlations between the investigated parameters in polymorphic population ($r = 0,55$; $p < 0,001$) (**Tab. 5**). From this follows, that in the period of individual development the data received about average diameter, can serve for estimation of sapling growth in height and on the contrary.

Table 4

The dispersion analysis of growth in height of oak sapling in hereditary plantation

Source of variability	Number of degrees of freedom	The sum of squares	An average square	Values $F_{calc.}$	P
Height sapling after 1-st year of a life					
Populations	2	40,24	20,12	6,418	
Repetitions	3	2,02	0,673	0,215	
Mistake	6	18,81	3,135		
In total	11	61,07			
Height sapling after 2-nd year of a life					
Populations	2	104,8	52,4	14,348	<0,05
Repetitions	3	41,12	13,707	3,753	
Mistake	6	21,91	3,652		
In total	11	167,83			
Height sapling after 3-rd year of a life					
Populations	2	876,8	438,4	25,12	<0,05
Repetitions	3	141,87	47,29	2,71	
Mistake	6	104,71	17,452		
In total	11	1123,38			

The tendency of the better growth of sapling from polymorphic population in comparison with consanguine was observed within first years of life. This phenomenon can be explained by the energy of growth that depends on a method of crossing of adult trees. Oak, being a species with air pollination can demonstrate deviations from accidental crossing when small size of populations form and when trees are on a margin of a large forest [6]. In our case parent trees of a pedunculate oak are pollinated by casual image, however the number of trees, donors of pollen, is smaller than that occurs inside a large forest. Therefore closely related crossings between trees of an oak are possible also. Feature of crossing parent trees results to the descendent negative consequences consanguine. Splitting heterozygote in posterity, accumulation of harmful recessive genes that influence growth, lead to a slow down of consanguine saplings growth. Weak growth of consanguine sapling is in certain measure caused by this phenomenon. Therefore, for realization of economic activities in forest areas is important to collect acorns from population of oaks and to exclude the isolated trees. Sapling, brought up from acorns produced by isolated tree will have weaker growth in comparison with saplings, received from acorns collected in high productive forest stands.

Spring sowing has influenced favorably the speed of sapling growth in populations during 3-rd year of a life. For example, the height of sapling received by spring sowing of polymorphic population was at 10,4 % above than that of autumn sowed. Such situation was observed and for diameters: the diameter growth of autumn sowed saplings was on 89,5-92,6 % more slowly that of spring sowed (**Tab. 1-2**). The establishment of the better saplings growth after spring sowing has the certain practical value. It is known [7] that oak has specific biological feature to grow slowly during the first years of a life, however forming in this period powerful root system. Therefore for obtaining of viable forest stands it is necessary to protect saplings from tall weeds during the first 5-7 years after sowing. Obviously, that such care demands financial expenses. In this connection, transition to creation of wood cultures by carrying out of spring sowing will lower term of translation of cultures in the area covered with a wood and will reduce labor and monetary expenses for their cares.

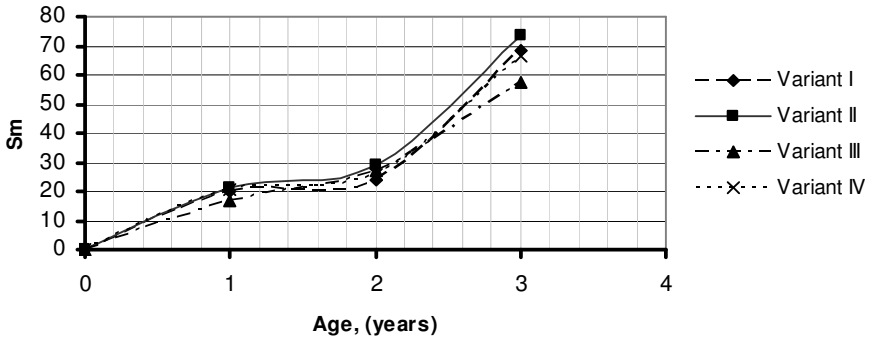
Table 5

Matrix of factors of correlation *r* between investigated parameters and their importance

Attribute	Attribute				
	2	**3**	**4**	**5**	**6**
1. Height after 1-st year of a life	0,62***	0,13	0,17	0,17	– 0,10
2. Diameter after 1-st year of a life	-	0,22	0,28*	0,27	0,12
3. Height after 2-nd year of a life	-	-	0,72***	0,68***	0,49***
4. Diameter after 2-nd year of a life	-	-	-	0,60***	0,61***
5. Height after 3-rd year of a life	-	-	-	-	0,55***
6. Diameter after 3-rd year of a life	-	-	-	-	-

The analysis of pedunculate oak saplings growth during first 2-th years has shown high similarity. Values of the current saplings gain variatied from 17,0 to 21,6 cm after 1-th year of a life and from 24,0 to 27,3 cm after 2-th year of life. From the relation of the sums of average values of the current gain of sapling in populations in 2-th year to corresponding parameter of 1-th year of a life have received an index which testifies, that the promoter of 2-th year of a life sapling growth was in 1,3 times more than the last year. During 3-it year of a life has considerably increased growth rate of sapling height in all researched populations. In comparison with 1-th year, in 3rd year the current gain sapling in height has sharply increased. From the schedule it is clear, that during 3-it year of a life the highest energy of sapling growth has been revealed in polymorphic populations of the created by autumn and spring sowing. From the above-stated follows, that during the first two years of a life the growth rate sapling in populations was insignificant, and parameters of the current gain had almost identical values. During 3-it year of a life growth sapling height has considerably increased.

Schedule. Dynamic of gain of oak sapling in different populations



Variant I – polymorphic population, autumn sowing;
Variant II – polymorphic population, spring sowing;
Variant III – consanguine a population, autumn sowing;
Variant IV – consanguine a population, spring sowing.

The analysis of a course of oak saplings growth in height during first 3rd years of a life has revealed, that in comparison with previous year the growth rate sapling has increased in 1,3 times, and after 3-it year of a life in comparison with 1-th year – 3,4 times. Insignificant growth of saplings during the first years of a life is consequence of specific

features of this species to form developed root system. This biological feature of an oak to grow insignificantly in the first years of a life is not attractive for syvilcultorist that work in forestation. The constant attention which needs to be rendered sapling dings during 5-7 years (that is before translation of wood cultures) has as result frequent refuse by syvilcultorists to enter the oak into structure of wood cultures. Are worthy economically less valuable, but fast-growing exotic wood as, for example white acacia (*Robinia pseudoacacia*) in view of that the period and expenses for itscultivation are lower. The carried out scientific researches have revealed, that the white acacia in inappropriate ecological conditions grows quickly up to age of 10-12 years. After that growth in height starts to be reduced considerably and the kind gradually dries out. This process is shown in acacias plantations at the south of Republic Moldova [3]. The oak on the contrary, grows more slowly during the first 5-10 years period, during which the root system shows strong annual growth. In the subsequent, growth in height increases, can annually reach 1-1,5 meters in length, being active during 150-200 years [7]. These statements are rather convincing argument for cultivation the pedunculate oak in corresponding ecological conditions. This species has been named Professor M. Drăcea [5] „the *aristocrat* of woods and *diamond* wood". This specie in recent times occupied extensive territories in the south of Moldova. At the same time, the activity of actual sylvilcultors results in decreases of oak forest stands.

Conclusions

1. Variability in height and diameter in populations of pedunculate oak saplings decreases with the age. The high variability of one-two year saplings is a consequence of their high sensitivity to negative influence of harmful factors. With age the saplings become more viable and less dependent from fluctuation of local and time factors of environment. The lower viability of saplings received by autumn sowing has also caused increase in residual variability of their length and diameter.
2. Consanguinization promotes the decrease of sapling growth in height and diameter. From this follows for initiation of new oak plantation it is necessary to avoid collecting the acorns from isolated oak trees.
3. Saplings appeared after spring sowing is higher in the height and larger in diameter than those obtained from autumn sowing. It is necessary to recommend spring sowing of stratified acorns in forestry activity.
4. In the first two years of a life oak saplings demonstrated a\slow growth and its increase begin during the third year of saplings life.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

THE MOLDOVA VEGETATION EXPOSITION FROM THE BOTANICAL GARDEN OF THE ACADEMY OF SCIENCES OF MOLDOVA

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Abstract: Construction phases of the Moldova Vegetation Exposition from the Botanical Garden of Chişinău are presented. Twelve forest micro-expositions, one steppe vegetation exposition, one grassland micro-exposition and an area of rare plants have been created during last 35 year on an area of 14 ha. The Moldova Vegetation Exposition includes 400 species of vascular plants.

Key words: gene pool mobilization, micro-exposition, forest vegetation, steppe, grassland.

Introduction

In accordance with the general construction plan of the Botanical Garden from Chişinău there has been assigned an area of 14 ha for the establishment of the Moldova Vegetation Exposition (**Fig. 1**). At the beginning the concept of the Moldova Vegetation Exposition has been created and then the draft project was made and the area was set up. As a concept to organize the Moldova Vegetation Exposition was to create areas (described next as *micro-expositions*) of forest plant communities, steppe vegetation, grassland vegetation and different types of forests that are representative for the Republic of Moldova. The first activities of planting have been started in 1972.

Throughout many years 20 thousands trees and 12 thousands shrubs have been planted. Also furrows with grass layers brought from forests have been placed into micro-expositions. There have been planted in micro-expositions 32 forest tree species, 18 forest shrub species and more than 350 grass species. More than five thousand trees have been removed during conservations works. As a result twelve forest micro-expositions, steppe exposition and grassland exposition have been created. Also there have been attempts to create aquatic and wetland micro-expositions. All created micro-expositions have been established according to fitocenotic structure principles by using methods from forestry and landscaping.

The Moldova Vegetation Exposition was created also for *ex situ conservation* of rare plant species from the Republic of Moldova. Also it is used in educational programs. Hence students from different universities and faculties such as biology, forestry and geography realize their practical lessons and projects.

Materials and methods

The Moldova Vegetation Exposition is situated at the eastern part of the Botanical Garden of Chişinău and is located on a slope with northeastern exposition, which is crossed by two valleys. Valleys with different expositions create certain varieties of relief, which

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give the possibility to establish different types of forests specific for the Republic of Moldova.

It was conceive to establish main forest types such as: beech forests *(Fagus sylvatica),* sessile oak forests *(Quercus petraea),* pedunculate oak forests *(Quercus robur),* pubescent oak forests *(Quercus pubescens),* white poplar forests *(Populus alba)* and willow forests *(Salix alba, Salix fragilis).*

The trees and shrubs have been planted irregularly but with the endeavor that the composition would be more close to the structure of natural forests. Trees and shrubs have been transported from each type of natural forests and were planted in each type of micro-exposition. The grass layer has been made by transplanting furrows with grass layers (30x30 cm) brought from natural forests that have been placed in micro-expositions. Cleaning and conservation cuttings have been carried out each five years.

The steppe micro-exposition has been created by using next two methods: the method of furrows with grass layer and the second method by sowing seeds previously collected. The seeds of next species have been collected (*Stipa capilata, S lesingiana,S. pulcherima, Festuca valesiaca* etc.) from the Bujac steppe. These methods have been also used to realize areas with grass vegetation in St.Petesburg (Tanfiliev,1901), Moscow (Sorokina, 1960), Stavropol (Skripcinski, 1973; Dudari,1977; Dzăbov 1977), Donețk (Ziman, Ivaşin,Ciuprina,1975), Chişinău (Postolache, 1984,2004). Works of creation the Moldova Vegetation Exposition commence in 1972 and continue in present time.

Results and discussions

Moldova forests and establishment of forests micro-expositions

The spontaneous forests in Moldova consist of broadleaved formations of Central Europe type. The main components in the forest formations are the pedunculate oak (*Quercus robur*), the sessile oak (*Quercus petraea*), the pubescent oak (*Quercus pubescens*) and the beech (*Fagus sylvatica*). Their spread on the territory of the Republic of Moldova depends on the hypsometric levels, on the exposition and the degree of slope inclination, on the soil and other conditions [1, 2, 3]. These and other factors determined the formation of different types of forests and associations.

The pedunculate oak is the principal species in the forest stands from the northern zone. Ninety percent of natural forests in the northern part of Moldova belong to the forest type “forest oak with cherry” (*Prunus avium*).

The Central Zone of the Republic of Moldova is a more compact forest massif and is comparable to the broadleaf forest of the central zone of Europe. The dominant tree species are *Fagus sylvatica, Quercus petraea and Quercus robur.* The favourable ecological conditions lead to the formation of highly productive forest stands. Hornbeam (*Carpinus betulus*) is abundant in forest stands.

The Southern Zone is the driest, and is characterized by oak at the higher elevations and by pedunculate oak mixed with blackthorn at lower elevations. Fluffy oak forests (*Quercus pubescens*) are found on south and south-western slopes at lower elevations.

The territory of the Botanical Garden allocated for the establishment of the Moldova Vegetation Exposition includes plateau and hills with different expositions, variety of soil types and hydrological conditions. The presence of a variety of conditions at the Botanical Garden permitted establishment of major types of forests that have been carried out by taking into considerations local conditions.

Beech micro-exposition

Beech forests *(Fagus sylvatica)* are spread only in northwestern part of Codrii Reserve from Central part of Moldova. Beech in Moldova is situated at the eastern border of the distribution area. Besides beech other tree species are scatter distributed such as: *Tilia cordata, T. tomentosa, Acer pseudoplatanus, Acer platanoides.* Hornbeam *(Carpinus betulus)* dominates the second tree layer in beech forests.

In order to establish ***beech micro-exposition*** an area of 0,54ha have been allocated, on a hill with northwestern exposition, 6-8 degrees slope inclination and with sandy-clay soil.

The area had been ploughed and prepared for planting works. There have been brought 1050 beech trees (3-4 years old) from Codrii Reserve and Sadova forest. Scattered accompanying forest species have been planted, during the period of 1976-1978, such as *Quercus petraea*, *Tilia tomentosa*, *Acer pseudoplatanus*, *Acer platanoides.* Also solitary exemplars of *Viburnum lantana*, *Swida sanguinea* and *Cornus mass* have been planted. Simultaneously with brought planted materials have been transported herb species such as *Polygonatum latifolia*, *Carex brevicollis, C. pilosa, Epipactis heleborine* and *Allium ursinum.*

Nowadays in beech micro-exposition there could be identified next plant species *Anemonoides ranunculoides, Isopyrum thalictroides, Tulipa bibersteinana,, Scopolia carniolica, Glechoma hirsuta, Hedera helix, Viola reichenbachiana.* Next tree species are present also: *Carpinus betulus, Acer platanoides, Acer pseudoplatanus, Quercus petraea, Tilia cordata, Fraxinus excelsior, Acer campestre, Morus nigra, Cerasus avium, Tilia tomentosa*. The cover degree of grassy layer constitutes 5%. Crown cover is 0,9 and beech trees reach 15 meters height.

Sessile oak micro-exposition

Sessile oak forests are dominant in the Central part of Moldova and are spread on an area of 56,5 thousands ha. In sessile oak forests are present next tree species: hornbeam (*Carpinus betulus*), white lime (*Tilia tomentosa*), ash tree (*Fraxinus excelsior*), cherry (*Cerasus avium*), sycamore (*Acer pseudoplatanus*), norway maple (*Acer platanoides*) and wild service tree (*Sorbus torminalis*).

Four different sessile oak micro-expositions have been created in the Botanical Garden of Chişinău: sessile oak with beech tree, sessile oak with smoke tree *(Cotinus coggygria)*, sessile oak with lime and common ash *(Fraxinus excelsior)* and *s*essile oak with hornbeam.

The ***sessile oak with beech tree micro-exposition*** was established in 1975 on two slopes with different expositions. At the beginning only beech trees have been introduced and after next tree species have been planted: *Carpinus betulus*, *Fraxinus excelsior*, *Acer pseudoplatanus*, *Acer platanoides*, *Quercus petraea*, *Tilia tomentosa, T.cordata*, *Cerasus avium*, *Acer campestre*, *Malus sylvestris*, *Pyrus pyraster* and *Sorbus torminalis*.

Bush species such as *Swida sanguinea*, *Crataegus monogyna*, *Euonymus europaea*, *Euonymus verrucosa*, *Cornus mass* and *Viburnum lantana* have been planted in 1978.

Next plant species are present in sessile oak with beech tree micro-exposition: *Carex brevicollis, C.pilosa*, *Convalaria majalis, Scilla bifolia, Corydalis solida, Isopyrum thalictroides, Vinca minor, Viola ambigua, Geum urbanum, Chelidonium majus, Ballota nigra, Hedera helix*.

Pedunculate oak micro-exposition

The pedunculate oak is the principal species in the forest stands from northern zone. Ninety percent of natural forests in the northern part of Moldova belong to the forest

type “forest oak with cherry” (*Prunus avium*). Pedunculate oak with hornbeam forests type are spread in the central part of Moldova and pedunculate oak with fluffy oak forests type are situated in the southern part of Moldova.

The ***micro-exposition of pedunculate oak with hornbeam*** was established in 1972. At the beginning seedling of pedunculate oak of two years old have been planted and after in 1975 next forest tree species have been planted: *Tilia cordata, T.tomentosa*, *Fraxinus excelsior*, *Acer platanoides*, *Acer pseudoplatanus*, *Cerasus avium*, *Populus tremula*, *Acer campestre*, *Malus sylvestris*, *Pyrus pyraster* and also some bushy species have been introduced, such as *Swida sanguinea*, *Crataegus monogyna*, *Viburnum lantana*, *Euonymus verucosa*, *Ligustrum vulgare* and *Euonymus europaea.*

Currently in the micro-exposition of pedunculate oak with hornbeam are present 15 tree species, 11 bushy species and approximately 37 plant species, among which next species are typical for pedunculate oak with hornbeam forest type (*Quercus robur, Carpinus betulus, Tilia cordata, Acer campestre, Ficaria verna, Tulipa bibersteiniana, Carex brevicollis, C.pilosa*).

The ***micro-exposition of pedunculate oak with cherry*** was established in 1972 on an area of 1,1 ha and on a slope with northern exposition. Ground water is at the depth of 13m on the top of the slope and at the depth of 5m at the bottom of slope. Grey forest soil with different depth is present.

At the beginning *Cerasus avium*, *Rhamnus tinctoria*, *Frangula alnus* have been carried from northern part of Moldova and planted. During the period 1975-1982 next tree species and bushy species have been planted: *Acer platanoides*, *Acer pseudoplatanus*, *Acer campestre, Acer tataricum, Swida sanguinea*, *Crataegus monogyna*, *Viburnum lantana.*

At present time next vascular plant species are spread in the micro-exposition of pedunculate oak with cherry: *Pulmonaria mollis, Veratrum nigrum, Vinca minor, Lilium martagon, Fritilaria meleagroides, Poa nemoralis, Galium molugo, Cephalanthera longifolia, Dentaria bulbifera, Corydalis solida, Corydalis cava, Anemonoides ranunculoides, Anemonoides nemorosa, Galeobdolon luteum, Glechoma hirsuta, Arum orientale, Allium ursinum, Ranunculus auricomus, Gagea lutea, Adoxa moshatelina, Ficaria verna, Galium apparine, Galium odoratum, Nectaroscordum dioscoridis, Geranium phaeum, Stellaria holostea, Isopyrum thalictroides, Asarum europaeum, Polygonatum latifolium, Polygonatum multiflorum, Polystychum aculeatum, Galanthus nivalis, Lunaria annua.*

As the result of carried work plantation, currently in the micro-exposition of pedunculate oak with cherry are present 9 forest tree species, 5 bushy species and 33 plant species, among which next species (*Quercus robur, Cerasus avium, Rhamnus tinctoria, Frangula alnus, Veratrum nigrum, Pulmonaria mollis*) are characteristic for pedunculate oak with cherry forest type. A remarkable oak tree of 30 years old reaches 20m height and 50cm in diameter. Oak trees produced seeds in the year 2000 and plantlets have been observed in 2001.

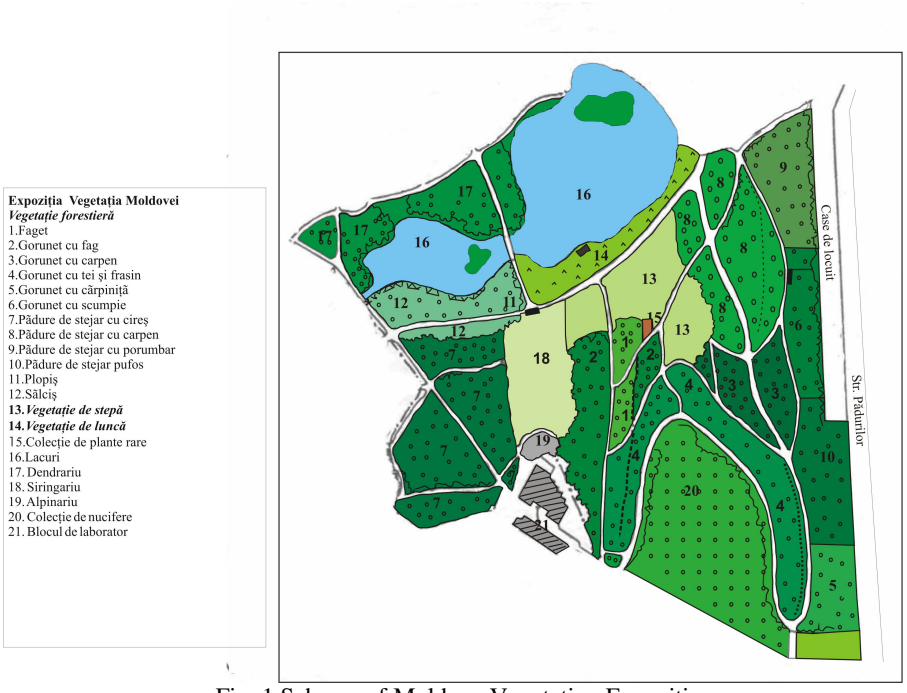

Fig. 1 Scheme of Moldova Vegetation Exposition

Conclusions

In the Botanical Garden from Chişinău has been established during last 35 years the "Moldova Vegetation Exposition" that includes 12 forest micro-expositions, steppe micro-exposition, grassland micro-exposition and a sector with rare plant species. 400 vascular plants species are the genofond of Moldova Vegetation Exposition.

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

TAXONOMIC RESEARCHES CARRIED OUT IN THE HERBARIUM OF EGE UNIVERSITY BOTANICAL GARDEN

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Abstract: The autors made a survey over the herbarium of the Ege University Botanical Garden. Over there are 33,000 herbarium sheets, gathered in 42 years of field studies over the entire area of Aegean Region. There are showed some data over the flora and vegetation of Turkey, as well as some examples of endemic plant species which are represented as holotypus, isotypus and topotypus in the herbarium.

Key words: flora, vegetation, herbarium, endemic plant species Turkey.

Introduction

Botanical Garden & Herbarium Research and Application Center of the Ege University was founded in 1964. The center is a two-story building covering an area of 300 m^2 and has a collection of 33,000 herbarium samples. During this 42 years period, several floristic studies have been performed in the center. Studies mainly started in 1976 and since then have continued with new ones. Thirty two studies on postgraduate and doctorate levels have been achieved, as a result of which the number of the taxa and the endemism conditions have been shown on maps (**Fig 2.**). Within these activities, the flora and the vegetation of higher mountains of the Aegean Region were documented. The completion of ongoing studies will greatly contribute to the herbarium collection.

The general vegetation of Ege region

The richness of the flora and vegetation of Turkey is related to the wide range of different habitats in different phytogeographical regions. That is why Turkey harbours a total of 9,222 vascular plant species, of which 8988 are native (Güner & al. 2000).

Turkey covers a total area of 780,580 km^2, 23,764 km^2 of which lie on the European continent. The Aegean region covers an area of 140,230 km^2 and underlies a typical Mediterranean climate with dry, hot, rainless summers, and mild and wet winters. Precipitation in the form of snow occurs mainly in the inner parts of the region. The Aegean coastline is quite irregular because the mountains in the area fall precipitously into the Aegean Sea. As a result, the length of the Aegean Sea coast is over 2,800 kilometers. Alternating plains run forests to west, formed by the Rivers Gediz, Küçük Menderes and Bakırçay (Atalay 1994).

The vegetation of the Aegean region shows great variation and complexity. It typically ranges from the sub-alpine plant communities of the high mountain peaks like Bozdağ, Muratdağı, Nif Dağı, Spil Dağı and Akdağ, through dense forests of black and red pine down to evergreen maquis and dry phrygana at sea level. The sub-alpine zone is dominated by species of *Astragalus* and *Acantholimon.* These are mixed with species such as *Thymus sipyleus, Festuca valesiaca, Festuca pinifolia, Dianthus erinaceus, Minuartia*

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juniperina, Daphne oleoides and *Euphorbia anacampseros.* Coniferous forests are dominated mainly by two species, *Pinus nigra* subsp. *pallasiana* (black pine), and *Pinus brutia* (red pine). The former ranges from approximately 900 to 1900 m and the latter from 0-900 m. However, two other tree species are important at two peaks in the area, i.e., *Abies nordmanniana* ssp. *equi-trojani* at Kazdağı (1700 m) and *Pinus sylvestris* at Murat Dağı (2150 m). Very few species are able to grow under the canopy of these forest trees, while in more open places, shrubs such as *Crateagns monogyna, Rosa canina, Prunus divaricata, Genista lydia, Berberis cretica, Juniperns oxycedrus* subsp. *oxycedrus, Rubus canascens, Quercus cerris* can be found. The herbaceous layer of these coniferous forests is mainly represented by *Dryopteris pallida, Lathyrus laxiflorus* subsp. *laxiflorus, Doronicum orientale, Fragaria vesca, Digitalis ferruginea, Vicia cracca* subsp. *stenophylla* and *Geum urbanum.* Forests dominated by *Juniperus excelsa* and *Juniperus foetidissima* occur in places where black pine forests have been destroyed, but their extent is very limited. *Juniperus oxycedrus* subsp. *macrocarpa* occurs mainly in the coastal Çesme peninsula (İzmir).

Dense scrub of schlerophyllous, 2-3 m tall, evergreen shrubs, represents the maquis vegetation of the region that is widespread from the coast up to an altitude of 750 m. This vegetation type is dominated by *Quercus coccifera* with species such as *Phillyrea latifolia, Olea europaea, Arbutus unedo, A. andrachne, Pistacia lentiscus, P. terebinthus, Jasminum fruticans, Lonicera etrusca, Laurus nobilis, Calicotome villosa, Cistus creticus, C. salviifolius, C. parviflorus, Anthyllis hermanniae, Genista acanthoclada, Erica arborea, Pyrus spinosa* and *Juniperus phoenica. Quercus infectoria* subsp. *boissieri* is also widely distributed in the region, particularly in its north-western and internal parts. Scattered trees of *Quercus ithaburensis* subsp. *macrolepis* occur in the cultivated fields in this area.

The phrygana vegetation is represented by low thickets of often spiny, xerophytic and aromatic dwarf shrubs, with small leathery leaves. It ranges from sea level to 500 m and is dominated by *Sarcopoterium spinosum.* Characteristic species of this formation are *Origanum onites, Ballota acetabulosa, Coridothymus capitatus, Thymbra spicata, Micromeria graeca, M. juliana, M. myrtifolia, Satureja thymbra, Asphodelus aestivus* and *Prasium majus.*

The major cultivated plants in the Aegean region are tobacco, cotton, potato, rice, various vegetables, grapes, oranges, cherries, figs and peaches. Other fruit trees commonly met within the region are pomegranates, apples, almonds, pears and mulberry (Öztürk & al., 1994).

Cyclamen coum
(ENDEMIC)

Hyacinthella lineata
(ENDEMIC)

Fritillaria carica subsp. carica
(ENDEMIC)

Alkanna areolata
(ENDEMIC)

Crocus biflorus sub.sp. nubigena
(ENDEMIC)

Galium aretioides
(ENDEMIC)

Pterocephalus pinardii
(ENDEMIC)

Trigonella carica
(ENDEMIC)

Chionodoxa luciliae
(ENDEMIC)

Chionodoxa sardensis
(ENDEMIC)

Sternbergia candida
(ENDEMIC)

Fig. 1 Some endemic plant species of Turkey

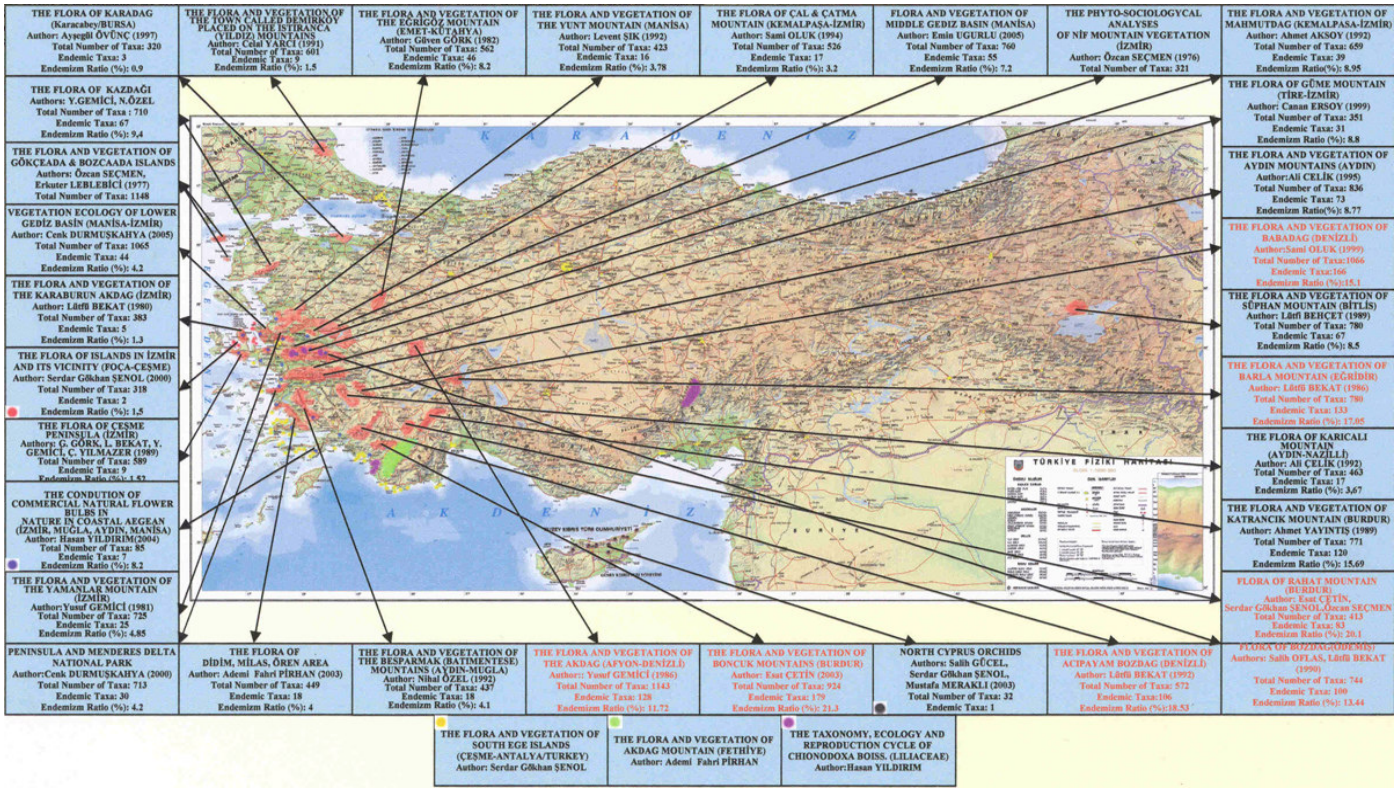


Fig. 2 Map of Taxonomic Researches Carried Out in the Herbarium of Ege University Botanical Garden in Turkey

Results

33,000 vascular plant taxa were recorded in Ege University Herbarium as a result of twenty-eight studies conducted between 1976 and 2005 and several floristic activities carried out within several projects at certain periods. 941 of these samples are endemic on the basis of species (**Fig. 1**). In addition, there are 28 holotypus, isotypus and topotypus sample available. The list including these samples is given below. (**Tab. 1**) (**Fig. 3**)

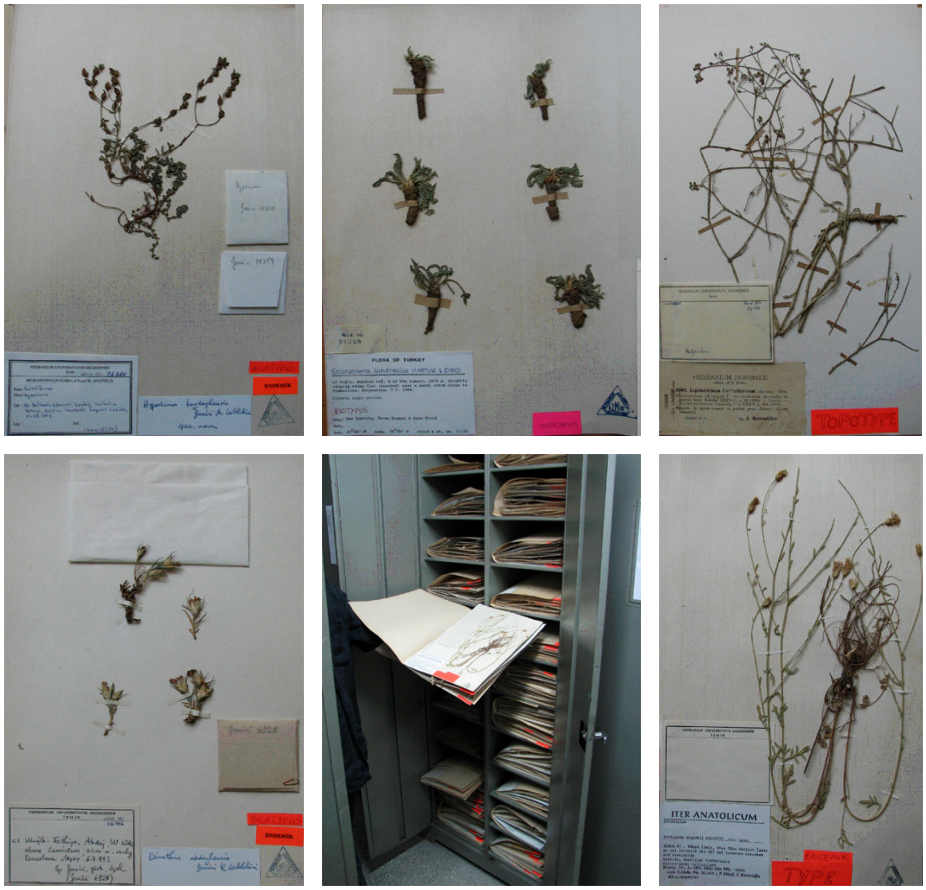


Fig. 3 Some specimens of Aegean Herbarium

Tab. 1 The list of herbarium samples

Asteraceae	**Geraniaceae**
İsotypus: *Pilosella sandrasica* Hartvig et Strid	Holotypus: *Erodium somanum* Peşmen
İsotypus: *Scorzonera sandrasica* Hartvig et Strid	Holotypus: *Erodium olympicum* Gemici & Leblebici
Holotypus: *Centaurea zeybekii* Wagenitz	**Guttiferae**
Topotypus: *Centaurea polyclada* DC.	Isotypus: *Hypericum malatyanum* Peşmen
Brassicaceae	Topotypus: *Hypericum morathii* Rabson
Holotypus: *Aethionema acarii* Gemici & Leblebici	**Lamiaceae**
Holotypus: *Thlaspi leblebici* Gemici & Görk	Holotypus: *Ballota sechmenii* Gemici & Leblebici
Topotypus: *Aurinia uechtritziana* (Bornm.) Cullen et Dudley	Holotypus: *Nepeta anamurensis* Gemici & Leblebici
Caryophllaceae	Sintypus: *Cyclotrichium longiflorum* Leblebici
Topotypus: *Arenaria eliasiana* Kit Tan	**Linaceae**
Holotypus: *Dianthus akdaghensis* Gemici & Leblebici	Topotypus: *Linum tmoleum* Boiss.
Chenopodiaceae	**Polygonaceae**
Isotypus: *Kalidiopsis wagenitzii* Aellen	Holotypus: *Polygonum ekimianum* Leblebici, Duman &Aytaç
Ericaceae	Holotypus: *Polygonum afyonicum* Leblebici & Gemici
Holotypus: *Erica bocquetii* (Peşmen) P. F. Stevens	Isotypus: *Polygonum samsunicum* Yıldırımlı & Leblebici
Fabaceae	**Rosaceae**
Holotypus: *Astragalus yilmazii* Aytaç & Ekici	Holotypus: *Potentilla aladaghensis* Leblebici
Isotypus: *Thermopsis turcica* Kit Tan,Vural & Küçüködük	**Scrophulariaceae**
Isotypus: *Genista sandrasica* Hartvig & Strid.	Holotypus: *Scrophularia scopolii* (Hoppe ex) Pers. var. burdurensis (Peflmen) RRMill.
	Isotypus: *Veronica cetikii* Özturk

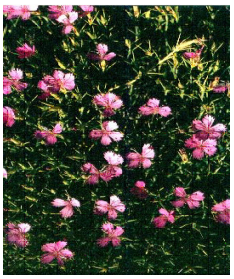
When the studies shown on the map are evaluated in terms of endemism;

- The Flora And Vegetation of Boncuk Mountains (Burdur)- Endemism Ratio (%): 21.3
- The Flora of Rahat Mountain (Burdur)- Endemism Ratio (%): 20.1
- The Flora And Vegetation of Acıpayam Bozdağ (Denizli)- Endemism Ratio (%) :18.53
- The Flora And Vegetation of Barla Mountain (Eğridir)- Endemism Ratio (%): 17.05
- The Flora And Vegetation of Babadağ (Denizli)- Endemism Ratio (%): 15.1
- Flora of Bozdağ (Ödemis)- Endemizm Ratio (%): 13.44
- The Flora And Vegetation of The Akdağ (Afyon-Denizli)- Endemism Ratio (%): 11.72

Especially in these areas have a high endemism ratio. For this reason in-situ protection studies must be started on these areas (**Fig. 4**).

Since the Botanical Garden & Herbarium Research and Application Center of the Ege University is located close to the mountains mentioned above, it has shifted its studies from plant conservation biology to the protection of the critical endemic species in these regions(**Tab. 2**). It continues its researches in the light of the projects provided by the Scientific and Technological Research Council of Turkey (TUBİTAK) and research funds of Ege University. Plants worked on within these projects are as follows:

Linum aretioides (ENDEMIC)



Dianthus erinaceus var. *erinaceus* (ENDEMIC)

Anthemis xylopoda (ENDEMIC)

Fig. 4 The protection of the critical endemic species

Tab. 2 The risk category of critical endemic species

Family	**Taxon**	**Risk Category (IUCN 2001)**
Linaceae	*Linum aretioides* Boiss	VU
Caryophyllaceae	*Minuartia nifensis* McNeill	EN
Caryophyllaceae	*Dianthus erinaceus* var.*erinaceus* Boiss	VU
Rubiaceae	*Asperula daphneola* O.Schwartz	VU
Asteraceae	*Anthemis xylopoda* O. Schwarz	CR

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Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

FEW THOUGHTS ABOUT THE CONSERVATION OF CRYPTOGAMIC PLANTS WORLDWIDE AND IN ROMANIA (a review)

TAMÁS PÓCS*

Abstract: A short account on the history of cryptogamic plant conservation in Romania and worldwide is given. Four points of its importance are enumerated, as indicators of air pollution, their role in the composition of plant communities, their part in the biodiversity and in the monitoring of climate changes (global warming). 11 tusks for cryptogamic conservation are proposed.

Key words: biodiversity, bryophytes, conservation, lichens, pollution.

The beginning of cryptogamic conservation in Romania and in Europe

The first attempts were to save cryptogamic habitats during the XXth century, by creations of protected areas and national parks. In this respect, Romania was among the firsts countries in south-east Europe (Retezat National Park, 1928). The intensive work to explore the cryptogamic floras, checklists (Péterfi 1908 [11], Papp 1970 [10], Dihoru 1994 [1], Mohan 1998 [9], Plămadă 1998 [13], Ştefănuţ 2002 [16]), preparation of vegetational monographs, all helped to reach this goal and others in important periodicals, as "*Ocrotirea Naturii*" (= "*Nature and Conservation*"), the "*Buletinul Ştiinţific*", both edited by the Romanian Academy of Sciences, the "*Contribuţii Botanice*" of the Botanic Garden of "Babeş-Bolyai" University in Cluj-Napoca or the "*Scripta Botanica Musei Transsilvanici*". There were many books published on the vegetation of national parks or protected areas, some of the aiming direct to the description of cryptogamic vegetation, like the study of Pop 1960 [15], Ştefureac 1969 [18], on some moss communities (summary by Goia [7]). In addition, the numerous works describing cryptogamic floras of protected areas, yielded important basis to establish their protection in Romania (e.g. Goia & Schumacker 2006 [6]), as well as in other countries of Europe.

The first legal step to protect bryophytes in Europe was their inclusion among the protected plants. The "*Bern Convention*" in 1979 [2] enumerated only 22 bryophytes, as officially protected. The European Community later edited the "*Habitats Directive*", then the Uppsala Symposium (1990) established an European Committee for the Conservation of Bryophytes. Its principles were applied in Romania by the Law 13/1993. The Conference on the Conservation of Bryophytes in Europe, Zürich (1994) decided the edition of a "*Red Data Book of European Bryophytes*" (1995), which enlisted already 469 threatened and 5 extinct bryophytes. This was followed in many countries by the publication of red lists at national level.

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Cryptogamic conservation at a global scale

The International Union of Natural Conservation (IUCN) established a Global Committee for the Conservation of Bryophytes in (1990). Koponen called the attention to the global threat of extinction even in the field of bryophytes (Koponen 1992). A Status Survey and Conservation Action Plan was initiated (Hallingbäck & Hodgetts 2000 [8]) and as a result, an IUCN World Red List of Bryophytes (2000) was created, which at that time includes only 92 species of bryophytes protected at worldwide level.

Why is the protection of cryptogams and their communities so important?

Nowadays, several authors dealt with this question (Koponen 1992, Ştefănuț 2004 [16]). There are more then one reason:

- Cryptogams are much more sensitive indicators for environmental changes, especially for air pollution, than higher plants, absorbing moisture and air carried pollutants during the whole surface of their body. This is, why popularly they are used for the indication of pollutants (SO_2, heavy metals, cement dust, etc.). There are hundreds of publications in this topic. I wish just to mention for example Aceto et al. (2003), Gombert et al. (2003), Nash (1976), Plămadă (1986) [12], and so on.
- Due to the increasing habitat destruction, lichens and mosses, important components of communities, being sensitive for environmental changes, disappear earlier than many other phanerogams.
- Our knowledge is still very incomplete on the cryptogamic floras of the tropics. The alarming level of forest destruction, overgrazing and bush fires there cause serious damage in cryptogam diversity. Many species become extinct before we even know them.
- Cryptogams are good indicators also of climatic changes. Due to the global warming the distribution areas of cryptogams more rapidly change than that of the phanerogams, due to their easier dispersal by spoesres. For example, in Europe, during the last five decades a number of bryophytes moved already a few hundred kilometers northwards, especially in open habitats, following the movements of isothermes (Frahm 2003 [4], 2005 [5], Frahm & Klaus 2001 [3], Pócs 2005 [14]). At the same time, due to the increasing climatic extremes in southeast Europe and due to the desiccation of some tropical countries, bryophytes of humid or wet habitats are decimated.

How to continue the protection of cryptogams, what to do?

- It is essential to prepare cryptogamic floras with good keys and illustrations, especially in the less known areas.
- Habitat monitoring and making species inventories in national parks and protected areas is very important, enabling us to follow up changes in biodiversity.
- Taxonomic revisions of critical groups, based on modern methodology.
- Mapping the distribution of protected or endangered species.
- Study the distributional history of taxa (phylogeography).
- To establish hot spots with high diversity, at national, continent and world level.
- The conservation of hot spots by establishing complex reserves and national parks.

- To take care of the legal process for the sake of effective protection.
- International cooperation in conservation research.
- Alert and strengthen public awareness.
- To popularize the cryptogamic plants and their protection at all levels of education.

Acknowledgements

The author is grateful to Dr. Irina Goia and to Dr. Gheorghe Dihoru for supplying him with important literature resources and to Dr. Adrian Oprea and the Organizing Committee for inviting him to the very useful Symposium (150 years from the foundation of the Botanic Garden "Anastasie Fătu" in Iaşi '1856 – 2006', 25th-28th of May, 2006).

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150 YEARS FROM THE FOUNDATION OF THE BOTANIC GARDEN "ANASTASIE FĂTU" IN IAŞI (1856 – 2006)

ADRIAN OPREA[*]

We are celebrating, this year, the foundation of the first botanic garden in Romania, here in Iaşi, 150 years ago. In 1856, our patriot, philanthropist and cultivated man, Anastasie Fătu, physician and naturalist in the same time, has been succeed to set up to a small botanic garden, on his own field, and with his own funds, nearby "Râpa Galbenă" in Iaşi. That botanic garden, had to be till the death of the great learned man, an important centre of education for all the students and pupils from Iaşi, thus being possible to study the Botany on "living teaching aids", but also a very good educational point for all the nature lovers. All these nobiliary ideals of the founder of that botanic garden have been assumed, 4 years later, in 1860, by the newest University in Romania. The University from Iaşi, by means of the Faculty of Natural Sciences, has colaborated with Dr. Anastasie Fătu to set up a newly botanic garden, which had to correspond to the needs of their times, as well as the students. În 1871, Dr. Anastasie Fătu published in an „Index Seminum" at least 2,500 plant species, all of them being cultivated in that botanic garden. After his death, the botanic garden had started to shatter. In 1914, one of his daughter, Lucreţia E. Frunzetti, sold that field, and nowadays, only two street names, namely: „*Strada Florilor*" and „*Strada Anastasie Fătu*", has remind us of the first botanic garden in Iaşi.

A second location for the botanic garden has been a field just in the front of the Museum of the Natural Sciences (today, Independenţei Avenue), started with 1873, on a surface of ca. 3,000 sq. m.; that field was in the property of the Society of Physicians and Naturalists from Iaşi. The Botanic Garden has been started also by Dr. Anastasie Fătu, but has been put „on the ground" by Dr. Dimitrie Brândză, in his quality of retentionist of the Museum. A part from the lignaceous plant species, which have been planted in that garden, are still surviving today. Among those trees, one can see: two individuals of oaks (*Quercus robur*), two individuals of white poplar (*Populus alba*), and an individual of horse chestnut (*Aesculus hippocastanum*).

A third location for the botanic garden has been the field situated around the former building of the Old University (today, it is the University of Medicine and Pharmacy *„Gr. T. Popa"*), after a request of the senate of the University to create a new botanic garden in Iaşi. Thus, in 1876, there has been initiated a third garden, having as director, Professor Dr. Cristea Buicliu. Fitting out that newly botanic garden, director sended out to the Minister of Public Education, justifications of spending 800 lei, used between the 1st of January and 31st of March, 1876. Because, concomitantly, the Ministry of Public Education, has offer some subsidies also to the old garden, Professor Anastasie Fătu, had as an obligation, to care out both of the botanic gardens, due to the fact that the job of Director, has been eliminated in the staff diagram of the University. The recurrent steps made by the Board of the Faculty, as well as by the Senate of the University toward the Ministry of Public Education, has led to allot, in 1884, of a small amount of money, still insufficient for the needs of the botanic garden. As emerges from the files keeped in the archives of the

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University, no sign of progress has been made till 1897. As a conclusion, that botanic garden could not face to the biological teaching process at that times.

After a proposal of the Prefecture of the Iaşi county, a field situated behind the present Palace of Culture, was alloted in order to set up a new botanic garden. Only in 27th of October, 1901, the Minister of Public Education, Spiru Haret, acquired from the Ministry of Agriculture, for the University "Alexandru Ioan Cuza" Iaşi, a waste land of 55,215 sq. m. On that fourth place, was going to establish a new botanic garden for the University. Professor Alexandru Popovici has been in charge to put "on the ground", this new institution. A detailed plan of landscape gardening was elaborated in 1906 (this plan could be seen in a small museum in the present day Botanic Garden). At recurrent demands of the University and director of the botanic garden, in order to find financial resources for this newly planned botanic garden, the Ministry of Public Education gave always unfavourable answers. Thus, after 20 years of strains, due to the lack of funds, that landscape gardening plan was not put into practice ever. Nowadays, from that planned botanic garden, remind us only a name of a street nearby the swimming pool of the city, namely *„Strada Botanică"*.

Concomitantly with the efforts towards designing the garden from the Palace of Culture, the Professor Alexandru Popovici, asked from the Senate of the University "Alexandru Ioan Cuza" an approval to plant those species used in the laboratory, nearby the new building of the University. Thus, in 1921, Professor Alexandru Popovici, establish a new botanic garden, on a fifth place in Iaşi. He planted a lot of species on a field of ca 1 ha, nearby the University. Those plant species have been originated from the old botanic gardens, but also from other botanic gardens from Romania and abroad. That garden has lasted till 1959. Only in 1960, the surface of that garden was enlarged, reached at 2.5 ha, by inclusion of a land situated in the front of the University, as a section called „Decorative". In 1937, after the retiring of Professor Alexandru Popovici, the management of the botanic garden has been achieved by: Professor Constantin Papp, Professor Constantin Burduja, and Professor Constantin Dobrescu. Among those 1,300 plant species planted there, nowadays are still surviving, for instance: *Paulownia tomentosa, Ginkgo biloba*, *Maclura pomifera, Halimodendron halodendron, Catalpa bignonioides*, *Fontanesia fortunei*, *Vitex agnus-castus* and so forth. In 1958, the Council of Iaşi town has brougt in discussion "…set up a dendrological park and a botanic garden on a spoiled land in the neighborhood of Ţicău district…". At those discussions, Professor Elena Jeanrenaud, Professor Piérre Jeanrenaud, Professor Nicolae Macarovici, and Professor Constantin Burduja took part, also. In the 19th of January, 1960, in a meeting of Iaşi County Council, has been discussed a new systematized plan of the city. In that plan, a new Botanic Garden has been foresight, on a land situated in the area called "Podgoria Copou". In September, 1960, has been approved so called "Projection Plan of the Botanic Garden of University in Iaşi". A commission was named by the Ministry of Public Education, being made by: Professor Alexandru Buia (Craiova), Professor Ion Tarnavschi (Bucureşti), Professor Ştefan Csűrös (Cluj), and Professor Constantin Burduja (Iaşi). In March, 1961, the leaders of the University and City of Iaşi, established accurately the field for this new Botanic Garden, on Dumbrava Roşie street, No 7-9, with a surface of ca 70 ha.

Thus, in 1962, on a core of 8.85 ha, was established a sixth establishment of our Botanic Garden. In order to organise this new institution, Professor Emilian Ţopa has been invited to become manager, from 20th of March, 1963. The detailed plan of landscape gardening has been elaborated by the architect Ştefan Păunel, in a close collaboration with other specialists, like: Maria Lazăr, Toader Chifu, Elena Marin, Corneliu Tăbăcaru, Valeriu Movileanu, and Ioan Ostaciuc. In 1967, the surface of the Botanic Garden has been of ca 30 ha, and in 1968 it has been of ca 65 ha. Simultaneously with the systematisation of the land,

inside the administrative building, have been organised: research laboratories, a herbarium, a library, and a small museum of the vegetal world.

In 1970, Professor Emilian Ţopa has retired, and he was followed by Professor Constantin Toma, as manager. During his mandate, he made the first necessary steps in order to build up a greenhouse called „*Palmariu*". In 1970, has been taken over other 6 ha of field from the Agronomic University in Iaşi, a land strong affected by landslide procesess. On that land, there has been organised: an Relaxation Section and a Memorial Plants Section.

In October, 1973, Professor Mandache Leocov has been named as manager at our Botanic Garden. He take further the activity of his forerunners, but also he puts his own "fingers" over a lot of the achievements of the botanic garden in that period. He continued to organize from a scientific point of view all the sections of the Botanic Garden. Also, in that period, there has been organized the first three national symposiums of Botany in our institution. Under his management, the entire surface of our institution reached 99.8 ha, being now the largest one in Romania.

In 1990, Professor Mihai Mititiuc, has been named as manager of the Botanic Garden. Under his management, we continue to rise the number of the taxons, to repair and modernize the existing greenhouses, to build up other new greenhouses, to continue the maintainance works over all the plant collections, to organize flower exhibitions yearly, in Iaşi or in other towns, like the next ones: Piatra Neamţ, Bârlad, Focşani, Galaţi and so on, to repair our central heating station, to set up the "Romanian Associations of the Botanic Gardens" (having the central office in Bucureşti Botanic Garden), to collaborate at various educational activities together with a lot of schools in Iaşi city or in other places in Romania, and so on. From March, 2007, we have a new manager, Reader Cătălin Tănase.

Nowadays, the Botanic Garden belong to the University "Alexandru Ioan Cuza" in Iaşi. It is organized on 11 sections of activity, like the next: 1. Ornamental; 2. Greenhouses Complex; 3. Systematic; 4. Useful Plants; 5. Rosarium; 6. Dendrological; 7. Biological; 8. Romanian Flora and Vegetation; 9. World Flora; 10. Memorial Plants; 11. Relaxation. The entire thematic of the botanic garden has been elaborated having in mind the achievement of the next targets: teaching, scientific, conservation of a rich fund of native and exotic plant species, cultural-entertaining, and hygienic. Through its teaching activity, there is assured the education on environments and natural sciences of the pupils, students and the public at large. The scientific activity consist in the efforts of the specialists to adapt various exotic plant species to the climate of Iaşi city, to know the floristic diversity and vegetation of Romania, to preserve the natural habitats in Moldova, and so on. All the plant collection from our institution include ca 6,000 taxons, both native and exotical ones, in the greenhouses and outside. By its cultural-entertaining goal, our botanic garden organize yearly some floral exhibitions, like: "Autumn Flowers", "Azaleas and Camelias Exhibition", "Rose Exhibition", and so on.

The hygienic function is assured by its protection against the northern winds, by protection of the phreatic waters in the basement and of the mineral waters, by stabilization of the slopes of "Podgoriilor Valley" etc. Those 99.8 ha of the Botanic Garden represent a real "green lung" for the city of Iaşi, by pomping off toward it a large amount of air, rich in oxygen.

A relatively new section of our institution was set aside for ornamental plants specially chosen to attract blind people or partially sighted people.

Through the extent of thematic, the goals of our instiurion, as well as through the complexity of the landscape, we think that the Botanic Garden of Iaşi could be regard as a representatively one on a national level.