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CUPRINS

CONTENTS

J. Plant Develop.
16 (2009): 3–8

COMPARATIVE HISTO-ANATOMICAL ANALYSIS OF THE VEGETATIVE ORGANS OF *SEDUM TELEPHIUM* L. SSP. *MAXIMUM* (L.) KROCK. *IN VITRO* AND FROM NATURE

ARDELEAN MIRELA[1], STĂNESCU IRINA[2], CACHIȚĂ-COSMA DORINA[1]

Abstract. In a histo-anatomic analysis of the exemplars of *Sedum telephium* L. ssp. *maximum* (L.) Krock. from nature and *in vitro*, the root presents a secondary structure, protected by a quite thin peridermis. The central cylinder bears vascular bundles, less numerous *in vitro*; the phloemic elements are grouped in small isles in both *in vitro* and from nature exemplars. The stem presents a few vascular bundles, where the xylem vessels bear thickened and lignified walls. The petiole reveals three vascular bundles. The foliar limb is amphistomatic, bearing anizocytic stomata in both *in vitro* and from nature exemplars, with homogenous mesophyll.

Key words: *Sedum telephium* L. ssp. *maximum*, *in vitro*

Introduction

Sedum gender belongs to *Crassulaceae* family [ȘTEFAN & OPREA, 2007; METCALFE & CHALK, 1972] and consists of almost 400 species with succulent leaves. *Sedum telephium* ssp. *maximum* (L.) Krock. is frequent spread in the Romanian flora as spontaneous species, as well as ornamental cultivated species. More than that, the Romanian traditional medicine considers that this plant might have therapeutic (vulnerary, antiseptic, wounds) effects.

In the middle sixteenth century, Hieronymus Bock had reported that extracts of *Sedum telephium* ssp. *maximum* were used in Rhine valley to treat internal injuries like ulcers of the lungs. Now, medical researchers are isolating the active ingredients from those traditional medicine plants and testing their efficacy. In the early 1990's, researchers in Munich identified two polysaccharides in *Sedum telephium* ssp. *maximum* that were anti-inflammatory [MULINACCI & al., 1993]. A few years later, Italian scientists observed the ways the polysaccharides and flavonols operated on cells during wound healing.

Material and methods

The medium where individuals of *Sedum telephium* L. ssp. *maximum* (L.) Krock. grew up was prepared after *Murashige – Skoog* prescription [MURASHIGE & SKOOG, 1962], by adding vitamins (1 mg/l HCl thiamine, 1 mg/lHCl pyridoxine and 1 mg/l nicotinic acid), growing regulators: 1 mg/l benzyl adenine (BA) and 1 mg/l β-indole acetic acid (AIA), 20g/l sacharose and only 7 g/l agar – agar; medium pH was adjusted to 5,6, then the culture medium was sterilised in the autoclave for 30 minutes, at 121°C.

Subcultures of *Sedum telephium* ssp. *maximum* have been done in glass jars of 10 cm high and 4,7 cm diameter. After inoculation, the jars were obturated with polyethylene

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sheet, fixed with rubber bands, then they were transferred to the growing chamber, illuminated with fluorescent white light, with light intensity of 1700 lux and a photoperiod of 16h/day (23°C) and 8h/night (21^{o}C ± 2^{o}C).

In order to carry out the histological analysis, the vegetal material represented by the vegetative organs of *Sedum telephium* ssp. *maximum*, *in vitro* and from nature, came through the following steps:

The material has been fixed and preserved in 70% ethylic alcohol.

The sections were cut manually, by microtome, using elder pith as support. The histological sections were washed in sodium hypochlorite for 20-35 minutes, and then washed in acetic acid and distillate water [ANDREI & PARASCHIVOIU, 2003; ŞERBĂNESCU-JITARIU & al., 1983]. The sections were coloured with iodine green (1 minute), washed in 90% ethylic alcohol and distilled water then coloured with ruthenium red (1 minute) and washed in distilled water again. They were mounted in gel and analyzed in an Optika light microscope. The light micrographs were performed by means of the same light microscope, using Canon A540 camera. Drawings were obtained by employing a Romanian Projektionszeichenspiegel MC1 light microscope.

Results and discussions

The histo-anatomic cutting revealed the following aspects:

The root (Figs. 1-8)

The cross section evidences a thin peridermis with 4-6 layers of flattened cells, with thin walls. The cortex is thick, compact, not differentiated in exodermis, cortical parenchyma and endodermis, formed by 10-12 layers of cells with thin, cellulosed walls which form meatus of various dimensions. Here and there, division walls can be seen.

The central cylinder is compact, represented by 7-8 xylemic bundles (only 3-4 xylemic bundles in the *in vitro* exemplars), formed by vessels with lignified, but quite thin walls and numerous phloemic small isles, consisting of few elements (sieved tubes and guard cells, with cellulosed walls). Cambium is thin, formed by a few layers of cells where differentiation is in progress.

The aerian stem (Figs. 9-16)

The cross section has a circular profile. The epidermis is suberified, consisting of 2-3 layers of cells with thickened walls. The cortex is dense, formed by numerous layers of cells (only 6-8 layers of cells in the *in vitro* exemplars).

The central cylinder bears vascular bundles of various dimensions (4-5 in the exemplars from *in vitro*); the xylem has vessels with lignified and thickened walls, while the phloem consists of sieved tubes and guard cells. The medullary parenchyma bears big cells with cellulosed walls, which form meatus.

The leaf (Figs. 17-24)

The petiole (Figs. 17 and 21) has a crescent form in cross section. The epidemis bears izodiametric cells, having the external wall stucked out and covered by a thin cuticle (in the exemplars collected from nature). In both *in* vitro and from nature exemplars, the fundamental parenchyma is quite homogenous, formed by cells of various dimensions, with thin cellulosed walls. There are three vascular bundles, the median bundle is bigger than the others. The xylem consists of vessels with thickened walls, while the phloem is formed by sieved tubes and guard cells.

The foliar limb

Front side epidermis view (Figs. 19, 20, 23, 24):

The upper epidermis bears cells with waved walls and anyzocitic stomata (stomata surrounded by cells of various dimensions). The lower epidermis has a similar structure to that of the upper epidermis, but the cells bear more waved walls; as stomata are present in both epidermis, the foliar limb is amphistomatic.

The cross section through the foliar limb dispays common elements: the epidermis consists of big cells; their external wall is covered by thin cuticle; the mesophyll is homogenous, so the lamina has a normal bifacial-izofacial structure. There are a few vascular bundles, the one from the center is bigger than the others. The xylem bears vessels with thickened but unlignified walls, while the phloem bears sieved tubes and guard cells.

Conclusions

The root, the stem and the leaf present similar histological characteristics in both studied exemplars. The main differences regard quantitative aspects (various number of layers in the root cortex, various number of vascular bundles- xylemic and phloemic, different organization of the mixed vascular bundles in the leaf).

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Explanation of plates

PLATE I
Cross section through the root (Fig. 1: from nature; Fig. 2: *in vitro*);
Cross section through the root- peridermis (Fig. 3: from nature; Fig. 4: *in vitro*);
Cross section through the root- vascular bundles (Figs. 5 and 7: from nature; Fig. 6 and 8: *in vitro*);
PLATE II
Cross section through the stem (Fig. 8: from nature; Fig. 10: *in vitro*)
Cross section through the stem- epidermis (Fig. 11: from nature; Fig. 12: *in vitro*)
Cross section through the stem- central cylinder (Fig. 13: from nature; Fig. 14: *in vitro*)
Cross section through the stem- detailed vascular bundle (Fig. 17: from nature; Fig. 18: *in vitro*)
PLATE III
Anatomy of the leaf (petiole and foliar limb)
Legend: ep = epidermis, ep c = epidermic cell, f pr = fundamental parenchyma, l ep = lower epidermis, mzph = mezophyll, phl = phloem, st = stomata, u ep = upper epidermis, xy = xylem;
Bar = 100 μm

PLATE I

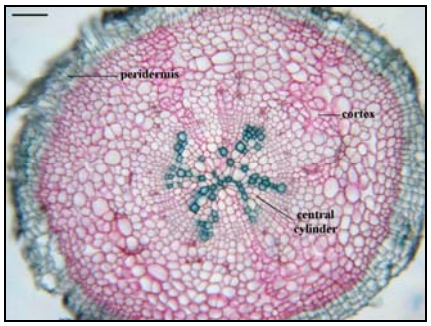

Fig. 1

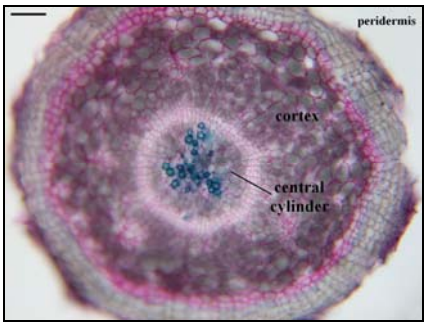

Fig. 2

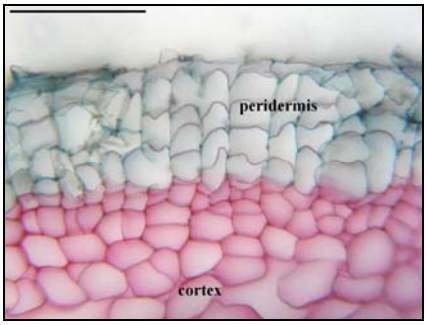

Fig. 3

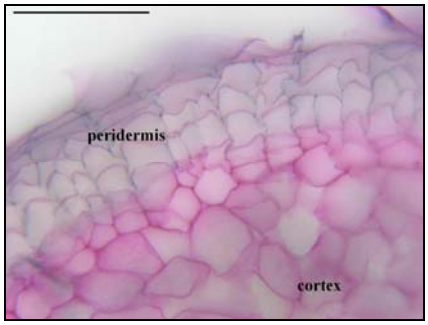

Fig. 4

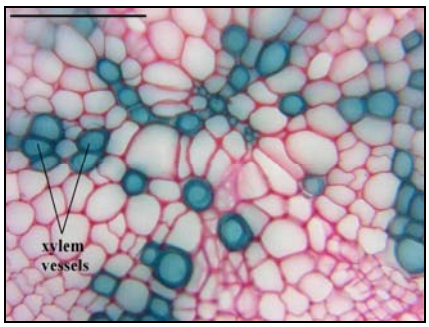

Fig. 5

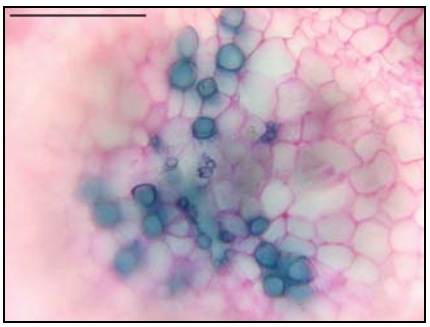

Fig. 6

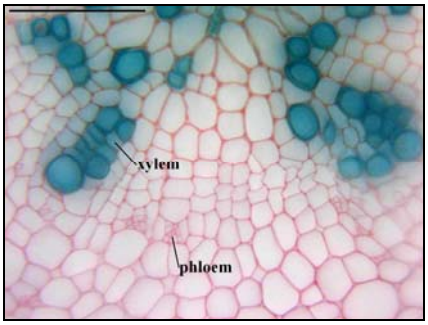

Fig. 7

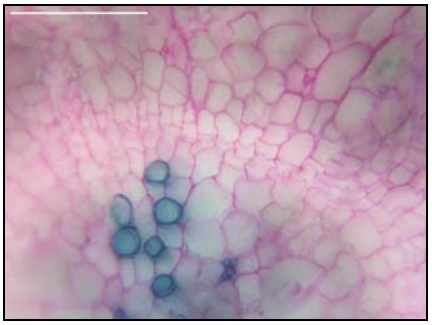

Fig. 8

PLATE II

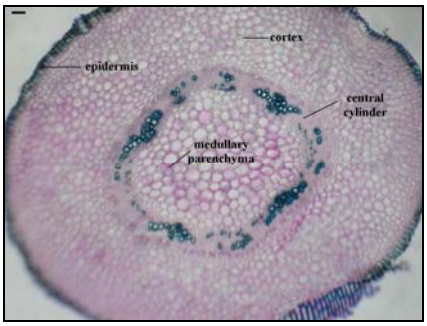

Fig. 9

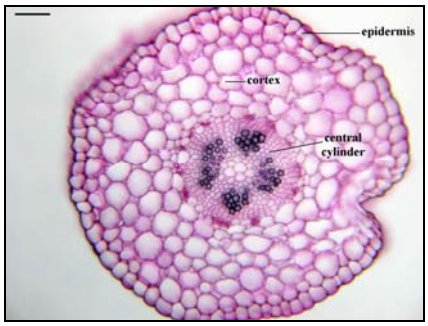

Fig. 10

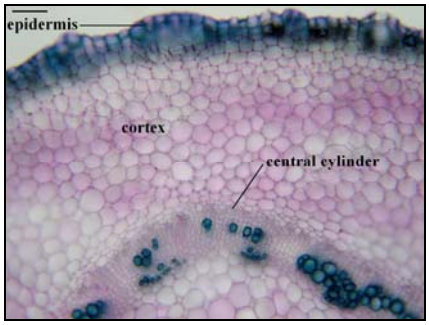

Fig. 11

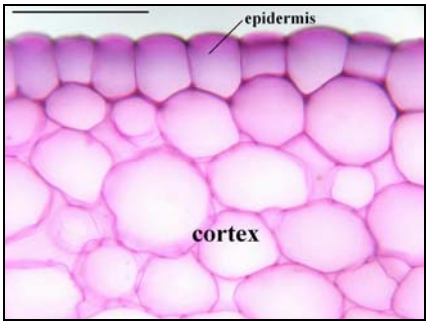

Fig. 12

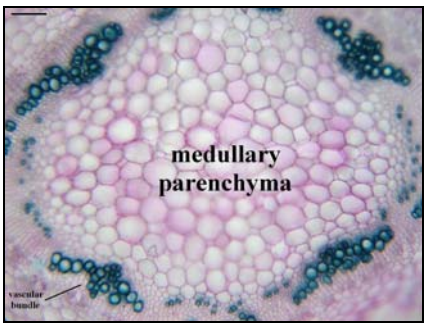

Fig. 13

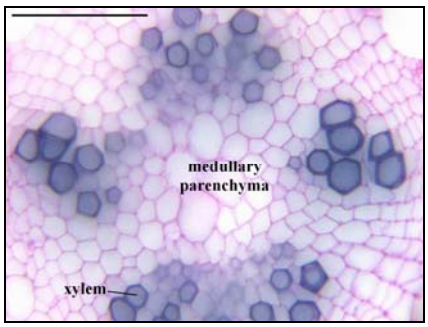

Fig. 14

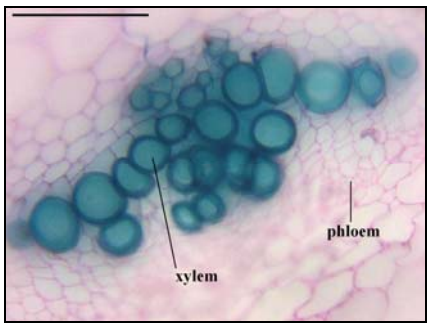

Fig. 15

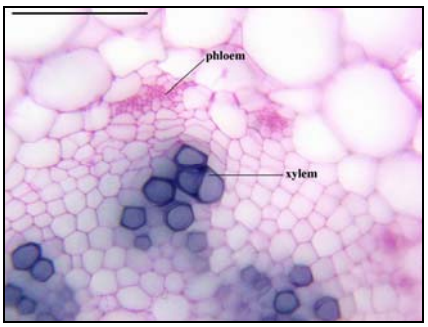

Fig. 16

PLATE III

From nature

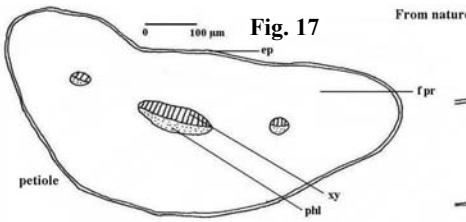

Fig. 17

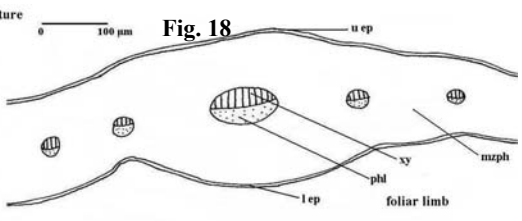

Fig. 18

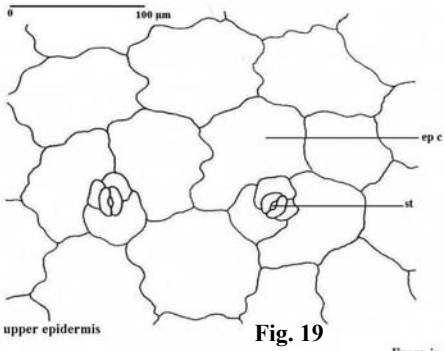

Fig. 19

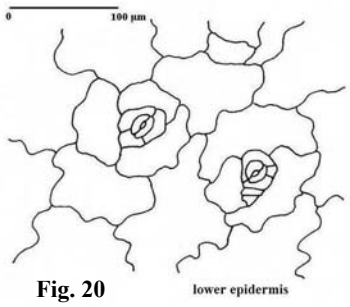

Fig. 20

From *in vitro* cultures

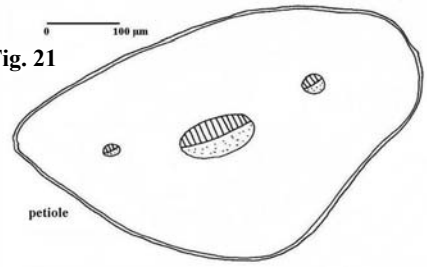

Fig. 21

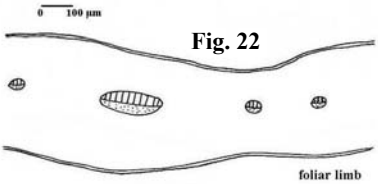

Fig. 22

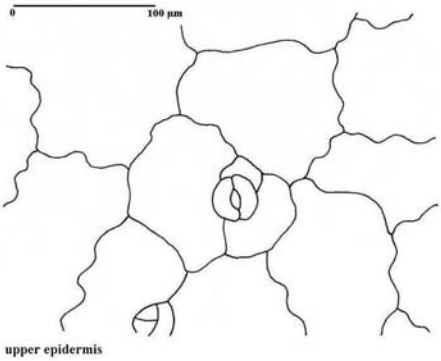

Fig. 23

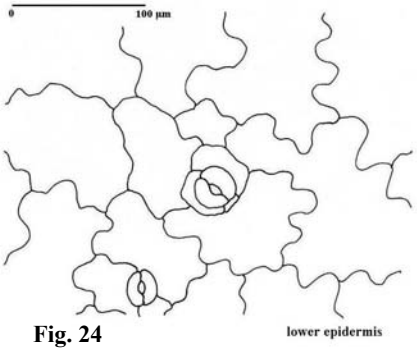

Fig. 24

J. Plant Develop.
16 (2009):9–16

MORPHO-ANATOMICAL CONSIDERATIONS UPON THE SHOOT OF SOME *ROSA* L. CULTIVARS FROM THE BOTANIC GARDEN OF IASI (1ST NOTE)

DELINSCHI (FLORIA) VIOLETA[1], STĂNESCU IRINA[1], MIHALACHE MIHAELA[1], ADUMITRESEI LIDIA[1]

Abstract. The paper presents the results of a comparative study regarding shoot morphology and anatomy of two climbing rose cultivars from the Botanic Garden of Iasi: *'Paul's Scarlet Climber'* and *'Veichenblau'*.

Key words: *Rosa* cultivars, morpho-anatomy, shoot

Introduction

The presence of the rose collection in the Rosarium Section of the Botanic Garden, which contains more than 600 rose cultivars and over 20 rose species [FINCIUC CARMEN & MITITIUC M., 2002] let us carry out some complex morphological and anatomical observations, in order to explain the behavior (acclimatization) of those cultivars in the Rosarium Section.

The main structure characteristics of the species which belong to *Rosaceae* family are presented in numerous synthesis regarding dicotyledons anatomy or angiosperms anatomy [METCALFE C. R. & CHALK L., 1950; MORVILLEZ M. F., 1919; SOLEREDER H., 1899]. In Romania there were made less histo-anatomic studies with taxonomic importance, useful to make differences between closed taxa, as an appendix to the morphologic studies [ADUMITRESEI LIDIA & TĂNĂSESCU VIOLETA, 2005; ADUMITRESEI LIDIA & al., 2006; ADUMITRESEI LIDIA & al., 2005, TOMA C. & al., 1997; TOMA C. & RUGINĂ RODICA, 1998; ZAMFIRACHE MARIA-MAGDALENA & al., 2006].

The paper ekes out the morphological observations in two *Rosa* infraspecific taxa with some anatomic observations upon the shoot, which can better explain some biologic qualities of the taxa, in order to find better culture measures, to evidence their ornamental value..

Material and methods

The paper is focused on two once-flowering rose cultivars, a climbing rose: *'Paul's Scarlet Climber'* (Fig. 1) and a rambling rose: *'Veichenblau'* (Fig. 2).

In order to carry out the histological analysis, the vegetal material represented by the shoot, has been fixed and preserved in 70% ethylic alcohol on May, 6th, 2009 and processed upon the methods used in vegetal anatomy studies. The cross sections through the middle region of root, rachis and foliar limb were analyzed in a Novex-Holland light microscope. The light micrographs were performed using a Sony DSC-W5/W7/W15/W17 camera. More than that, the epidermis of the foliar limb has been analyzed in front side view.

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Results and discussions

Morphologic dates

'Paul's Scarlet Climber' (Fig. 1)

Author: Paul, W., 1916. Climber, once-flowering. Long branches, above 300 cm; glossy, dark green leaves. Involte big flowers, with dark red petals, weak perfumed. Resistant to diseases and frost. It lends to balconies, pyramids, pergolas.

'Veichenblau' (Fig. 2)

Author: Schmidt, Germany, 1909. Rambler, once-flowering. Long branches, above 400 cm, almost devoid of spines; glossy, dark green leaves. Small, semi-involte flowers, grouped in big clusters; mauve petals, white stripped, with strong fragrance.

Although is old and once-flowering, this cultivar is still in culture due to its ornamental qualities.

Histo-anatomic dates

The shoot (Fig. 3)

'Paul's Scarlet Climber'

The cross section has a circular shape. The epidermis bears cells with thickened and strong cutinized external wall; the cuticle goes deeply through the epidermic cells, till the subepidermic layer. Stomata, less numerous, are situated under the level of the surrounding epidermic cells.

The cortex is quite thick (12-13 layers of cells) and collenchymatized (4-5 layers of cells) in the external part. Some of the cells belonging to the central part or to the external part of the cortex contain simple calcium oxalate crystals, rarely ursines.

The conductive tissues are represented by numerous vascular bundles disposed on a ring, separated by narrow medullar rays. The phloem consists of sieved tubes, guard cells and a few parenchymatic cells. The xylem consists of vessels disposed on radial rays, separated by lignified parenchyma near the pith, and of lignified parenchyma and libriform near the phloem. At the periphery of the bundles, a thick sheath of sclerenchymatic fibers is present, with thick walls, strongly lignified and reduced lumina.

Pith is parenchymatic, formed by two categories of cells: some of them are very small and other very big, both having thickened and lignified walls, framing a characteristic network (Fig. 3); the cells with oxalate crystals are absent.

'Veichenblau' (Fig. 4)

The epidermis bears cells with thickened and cutinized external wall; the cuticle goes partially through the epidermic cells, on a smaller superficies than in the other cultivar. Here and there, stomata are present, situated under the level of the surrounding epidermic cells.

The cortex is thick (14-15 layers of cells) and collenchimatized in its external part; the collenchyma consists of 5-6 layers, grouped as poles (Fig. 4); some of the cells of the cortex contain simple oxalate crystals. The oxalate crystals are more numerous than in the other studied species (Fig. 5).

The conductive tissues form numerous vascular bundles disposed on a ring and separated by narrow medullar rays. The oxalate crystals are present in the phloemic parenchymatic rays, but are extremely rare. Phloem consists of sieved tubes, guard cells and parenchymatic cells. The xylem presents vessels disposed on radial layers, separated by cellulosed parenchyma near the medulla and lignified parenchyma and libriform near the

phloem. At the periphery of the phloem belonging to all vascular bundles there is a sheath of sclerenchymatic fibers with lignification in progress (Fig. 4).

Pith is parenchymatic-cellulosed with both big and small cells which contain few simple oxalate crystals or ursines (Fig. 6) and form a characteristic network.

The leaf

'Paul's Scarlet Climber'

The rachis (Fig. 7-9)

The cross section has a circular shape, with a deep adaxial groove and two ribs. The angular subepidermic collenchyma, almost continuous, consists of 2-3 layers. The cells with oxalate crystals are absent. The conductive tissues form 4 vascular bundles: one of them is very big, in the center, two of them are small, lateral bundles, and the forth appear in one of the two ribs. Sometimes, the fifth bundle can be observed, very small, consisting only of xylem (Fig. 7). The periphloemic sclerenchyma is well developed, formed by cells with thickened walls (Fig. 8). Around each vascular bundle, near the periphloemic sclerenchyma, the cells belonging to the fundamental parenchyma have thickened and lignified walls (Fig. 9).

At the adaxial face, in the groove and in its lateral parts, going to the abaxial face (where the collenchyma is present) there are numerous cells with lignified walls, grouped or isolated.

The foliar limb

The epidermis, in front side view, is formed by numerous cells of irregular shape, with waved lateral walls (in the upper epidermis) or moderately to strongly waved lateral walls (in the lower epidermis). Anomocytic stomata are numerous; they are present only in the lower epidermis, so the foliar limb is hypostomatic. Along the veins, by transparency, a few cells with simple oxalate crystals or ursines are present in the upper epidermis and numerous in the lower epidermis. Protective hairs are absent.

In cross section, the middle vein is prominent at the abaxial face. The protective hairs and the crystalliferous cells are absent. The collenchyma of the middle vein consists of only 2 layers. The periphloemic sclerenchyma forms a continuous cordon, bearing cells with thickened walls and narrow lumina. Both epidermis (Fig. 10), but especially the upper one, display big cells, with the external wall strongly thickened and covered by a thin cuticle.

The mesophyll (Fig. 10) consists of bilayered palisade tissue (trilayered in some regions) and lax lacunary tissue, with wide aeriferous spaces. The structure of the foliar limb is difacial-heterofacial with normal dorsiventrality.

'Veichenblau'

The rachis (Figs. 11 and 15)

The cross section of the rachis has an elliptic shape; the abaxial face has a sinuous contour (with ribs and delves), while the adaxial face presents two high ribs and a deep groove, in form of W (in comparison with the anterior studied species).

In both abaxial and adaxial faces, the epidermis presents unicellular protective hairs (Fig. 11). The mechanic tissues: the collenchyma (3-4 layers of cells- Figs. 11 and 12) and the perifascicular sclerenchyma are well represented; in the sclerenchyma, the cells have thick walls (the lignification is in progress) and reduced lumina (Figs. 14 and 15).

The crystalliferous cells are quite rare, presented only in the adaxial face. The vascular tissue consists of 6 vascular bundles: 3 of them are disposed on a big arch; other 2-3 are present on each lateral part (Fig. 11).

The foliar limb

In front side view, the epidermis (Fig. 17) presents cells of polygonal profile, with moderately waved lateral walls (in the upper epidermis) and of irregular shape with moderately to strong waved lateral walls (in the lower epidermis). Anomocytic and tetracytic stomata are present, uniform spread in the lower epidermis, so the limb is hypostomatic. Here and there a few groups of stomata are present in the axils of the veins (Fig. 17b). In the epidermis of the veins, unicellular protective hairs are present, with thick walls and reduced lumina. They are rare in the upper epidermis and numerous in the lower epidermis.

Calcium oxalate, as macles and ursines, in quite equal proportions, is weak represented in the upper epidermis and more numerous in the lower epidermis.

In cross section through the foliole (Fig. 18), the median vein is prominent at the lower epidemis. Both epidermis consists of izodiametric cells, 3-4 layers of collenchyma in hypodermic position, a fundamental parenchyma with a few cells containing simple oxalate crystals or ursines, a vascular bundle with primary structure and a sheath of sclerenchymatic fibers with cellulosed walls. The epidermis of the middle vein as well as the epidermis of the lateral regions present small and medium protective hairs, with thick wall and reduced lumina.

Both epidermis, but especially the upper one, bear big cells, tangentially elongated, with the external wall thicker than the others; some of the cells present division walls, which is a characteristic of the *Rosaceae* family. The mesophyll is differentiated in bilayered palisade tissue (Fig. 18) towards the upper epidermis and lacunary tissue (3 layers of cells), more compact, towards the lower epidermis, so the foliar limb has a bifacial structure, with normal dorsiventrality. The crystalliferous cells are absent.

Conclusions

The epidermic cells of the stem have thickened and strong cutinized external walls; the cuticle goes deeply through the epidermic cells, to the hypodermic layer (*'Paul's Scarlet Climber'*) or partially (*'Veichenblau'*). The cortex has various thickness (12-13 layers in *'Paul's Scarlet Climber'* or 14-15 in *'Veichenblau'*), collenchymatized in the external part (continuous collenchyma in *'Paul's Scarlet Climber'* and discontinuous in *'Veichenblau'*) and presents cells with oxalate crystals. The presence of calcium oxalate indicates the adaptability of the studied taxa in the conditions of the Botanic Garden, in conformity with researches in other taxa [5].

The classification of the two taxa in climbing and rambling roses is testified by the structure of the mechanic tissues, especially by the better developed sclerenchyma in *'Paul's Scarlet Climber'* than in *'Veichenblau'*, as well as by the structure of the pith, as a network, with lignification tendencies in *'Paul's Scarlet Climber'* regards *'Veichenblau'* where is still cellulosed. Those aspects justify the necessity of using props in order to sustain the stem of *'Veichenblau'* and even of *'Paul's Scarlet Climber'* (later).

In the rachis of the leaf numerous vascular bundles are present: 4-5 in *'Paul's Scarlet Climber'* and 5-6 in *'Veichenblau'*; the periphloemic sclerenchyma is lignified in *'Paul's Scarlet Climber'* and still in progress in *'Veichenblau'*. The differences are made by the profile, too, as well as by the presence of some groups of cells with lignified walls in the fundamental parenchyma of the rachis of *'Paul's Scarlet Climber'* which play a supplementary role in the climbing process.

Regarding the folioles, the epidermic cells display irregular shape; the protective hairs are present only in *'Veichenblau'*, while the oxalate crystals are present in both studied cultivars; stomata are anomocytic, exception in *'Veichenblau'* where tetracytic stomata are present, too; those aspects can explain the hybrid origin of the cultivar. The mesophyll in bilayered in *'Veichenblau'* and trilayered in *'Paul's Scarlet Climber'*.

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Explanation of plates

PLATE I
'Paul's Scarlet Climber' (Fig. 1)
'Veichenblau' (Fig. 2)
Cross section through the shoot of *'Paul's Scarlet Climber'* (Fig. 2), *'Veichenblau'* (Fig. 3);
Cross section through the shoot of *'Veichenblau'* (Figs. 5 and 6);
PLATE II
'Paul's Scarlet Climber': Cross section through the rachis (Figs. 7-9), cross section through the foliar limb (Fig. 10);
Cross section through the rachis of *'Veichenblau'* (Figs. 11 and 12);
PLATE III
Cross section through the rachis of *'Veichenblau'* (Figs. 13-15);
'Paul's Scarlet Climber' – epidermis in front side view: upper (a) and lower (b) epidermis (Fig. 16);
'Veichenblau' – epidermis in front side view: upper (a) and lower (b) epidermis (Fig. 17);
'Veichenblau' – Cross section through the foliar limb (Fig. 18);
Bar = 100 μm

PLATE I

Fig. 1

Fig. 2

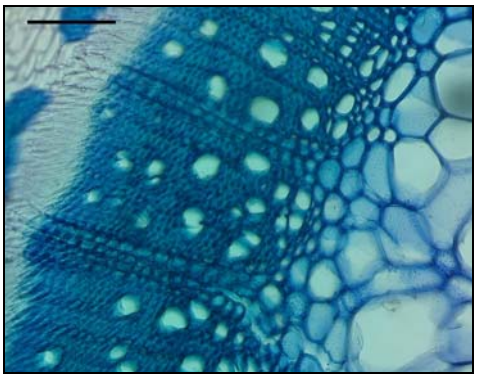


Fig. 3

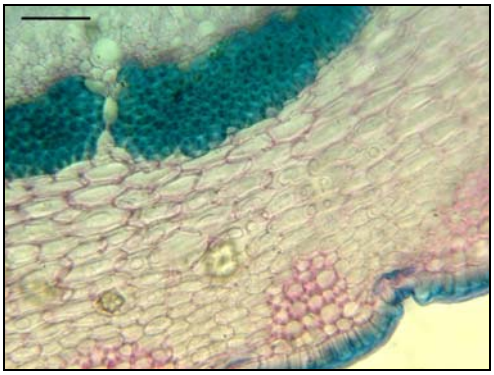
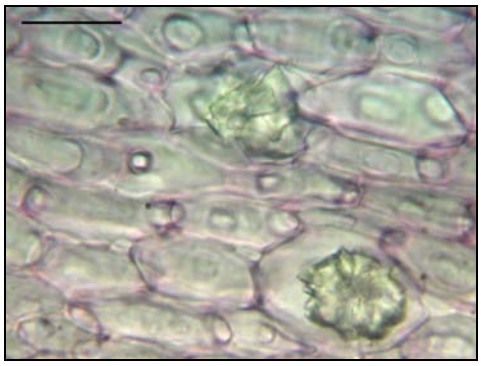


Fig. 4



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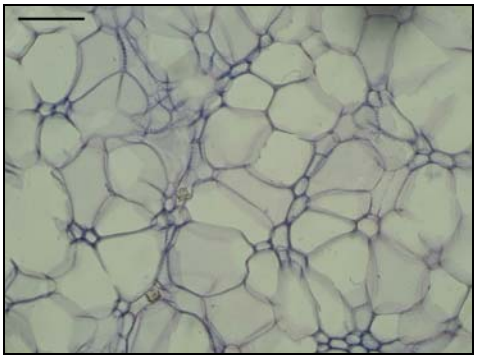
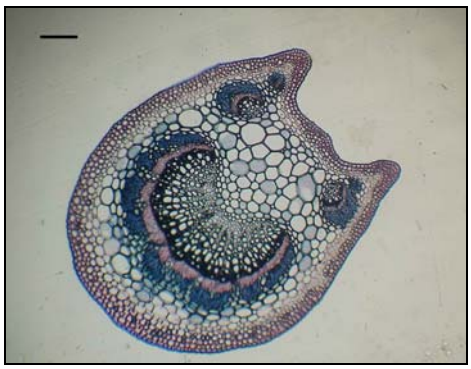


Fig. 6

PLATE II



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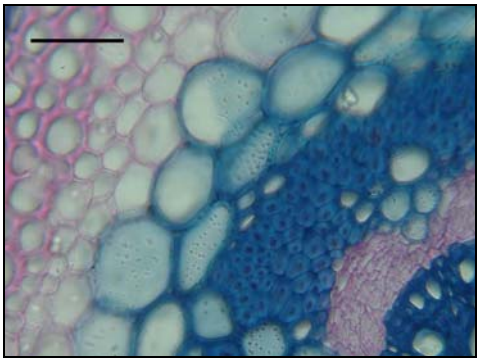
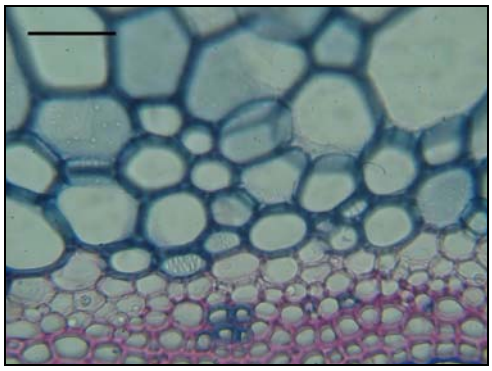


Fig. 8



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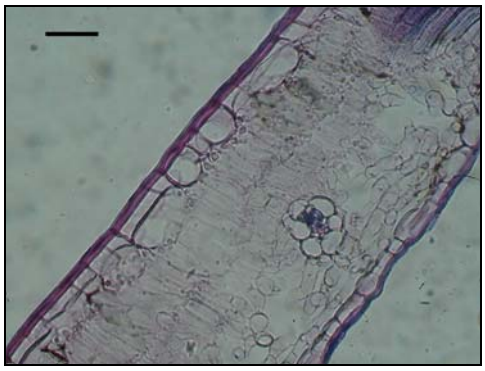

Fig. 10

Fig. 11

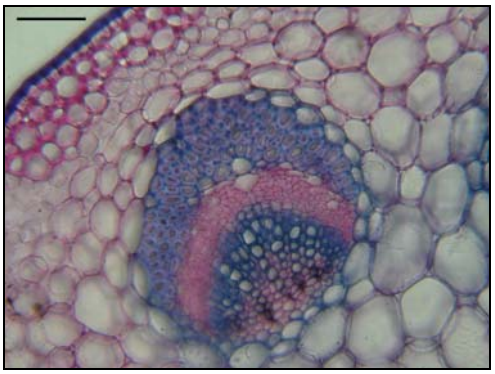

Fig. 12

PLATE III

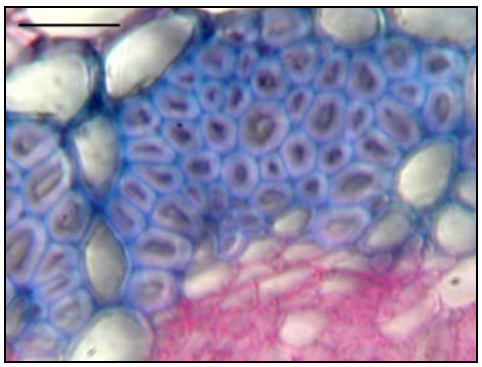

Fig. 13

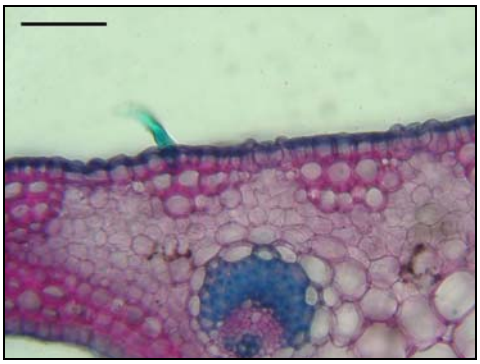

Fig. 14

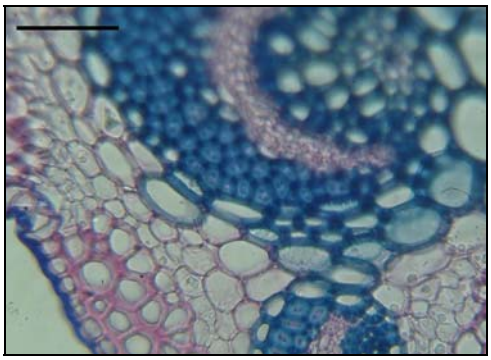

Fig. 15

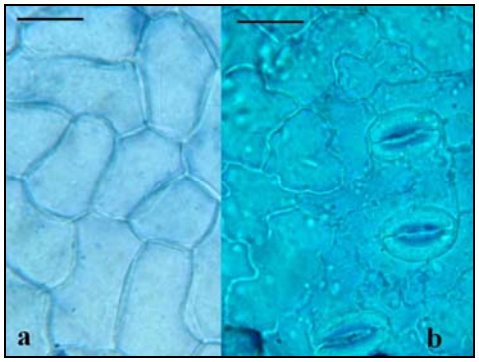

Fig. 16

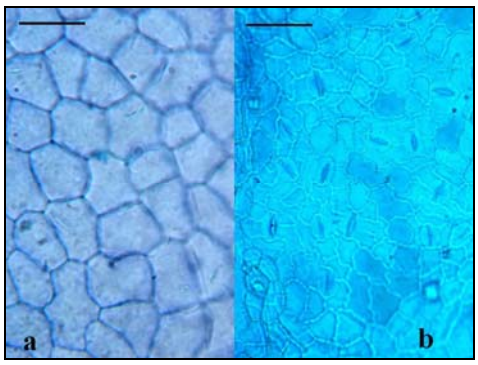

Fig. 17

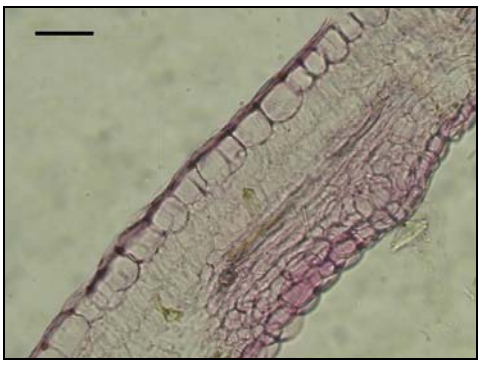

Fig. 18

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NEW LICHEN SPECIES IDENTIFIED IN BISTRITA MOUNTAINS (EASTERN CARPATHIANS)

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Abstract: The paper presents the results of the studies upon lichen species from Bistrita Mountains (Eastern Carpathians) realized in 2008-2009 period. The conspectus of lichens taxa identified in this area includes another 70 new lichens taxa besides species identified previously.

Key words: lichens species, natural ecosystems, Bistrita Mountains

Introduction

In a previous paper we have presented the results of the researches realized in 2004-2005 period in Bistrița Mountains [POPA, 2006]. The studies have continued in 2008-2009 period and, besides the 115 species and subspecies previously presented, supplementary, there have been identified another 70 lichens species.

Material and method

The lichens taxa identification has been realized taking into account prestigious works: [CIURCHEA, 2004], [DOBSON, 1997], [PURVIS, 1992], [THOMSON, 1984], [WIRTH, 1995]. The used classifications system is that adopted by ERIKSSON (2006), www.fieldmuseum.org/myconet/, and Index Fungorum [www.indexfungorum. org], excepting the *Lecanorales* suborders where the nomenclature corresponds to Person et al. (2004). For each species is specified the area within it was found, the localities names being coded as following: 1-Arsita lui Macovei, 2- Neagra Broştenilor valley, 3-Pârâul Caprei, 4-Barnar keys, 5-Broşteni, 6-Zugreni, 7-Pârâul Văcăriei, 8-Budacu Mountain, 9-Pietrosul Bistritei peak, 10-Ortoaia, 11-Dorna Arini, 12-Cozănesti, 13-Barnar valley, 14-Rusca II, 15-Borca, 16-Holda, 17-Păltiniş, 18-Cristişor-Neagra Broşteni, 19-Tulgheş, 20-Bâda.

Results and discussion

The next list of species includes taxa identified by us and not quoted before. In this way, the latest researches have completed the data regarding lichens species spreading in Bistrita Mountains.

ASCOMYCOTA
Class *Lecanoromycetes*
Subclass *Acarosporomycetidae*
ORD. ACAROSPORALES: Fam. *Acarosporaceae* Zahlbr. (1906): *Acarospora macrospora* (Hepp.) A. Massal ex Bagl., saxicolous, 19; Fam. *Candelariaceae* Hakulinen

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(1954): *Candelariella aurella* (Hoffm.) Zahlbr., saxicolous, 19; *Candelariella vitellina* (Hoffm.) Müll. Arg., saxicolous, 12.
Subclass *Ostropomycetidae* (Lumbsch et al. 2007.)
ORD. PERTUSARIALES M. Choisy ex D. Hawksw. & O. Eriksson (1986): Fam. *Pertusariaceae* Korb. Ex Korb. (1855): *Pertusaria albescens* (Huds.) M. Choisy & Werner, corticolous, 3, 6,10, *Pertusaria amara* (Ach.) Nyl., corticolous, 1, 19; *Ochrolechia pallescens* (L.) A. Massal., corticolous, 19; Fam. *Megasporaceae*: *Aspicilia calcarea* (L.) Mudd, saxicolous, 13, 19; *Ostropomycetidae* families of uncertain order position: Fam. *Phlyctidaceae* Poelt. Ex J.C. David&D. Hawksw. (1991): *Phlyctis argena* (Spreng.) Flot., on mosses, corticolous, 9, 19.

Subclass Lecanoromycetidae
ORD. LECANORALES Nannf. (1932)
SUBORD. PELTIGERINEAE: Fam. *Peltigeraceae* (1822): *Peltigera membranacea* (Ach.) Nyl., on mosses, terricolous, 19; *Solorina saccata* (L.) Ach., on mosses, 18, 19; Fam. *Lobariaceae* Chev. (1826): *Lobaria pulmonaria* (L.) Hoffm., corticolous, 10, 18; Fam. *Collemataceae* Zenker. (1827): *Collema cristatum* (L.) Weber ex F.H.Wigg., saxicolous, 19; *Leptogium gelatinosum* (With.) J.R.Laundon, on mosses, 19; *Leptogium lichenoides* (L.) Zahlbr., on mosses, 19; *Leptogium saturninum* (J. Dicks) Nyl., on mosses, corticolous, 4, 18, 19; *Leptogium tenuissimum* (Dicks.) Körb., on mosses, 19.

SUBORD. LECANORINEAE: Fam. *Lecanoraceae* Korb.(1854): *Lecanora carpinea* (L.) Vain., corticolous, 9; *Lecanora muralis* (Schreb.) Rabenh., saxicolous, 12, 16, 19; *Lecanora varia* Ach., lignicolous, 10, 16; Fam. *Cladoniaceae* Zenker (1827): *Cladonia caespiticia* (Pers.) Flörke., terricolous, 3; *Cladonia cenotea* (Ach.) Schaer., terricolous, 11, 17; *Cladonia cornuta* (L.) Hoffm., terricolous, 3, 8, 12; *Cladonia pyxidata* (L.) Hoffm. ssp. *pocillum* (Ach.) Dahl, on mosses, 2, 19, 20; *Cladonia symphycarpa* (Flörke) Fr., on mosses, 19; Fam. *Stereocaulaceae* Chev. (1826): *Lepraria membranacea* (J. Dicks.) Vain., on mosses, 6; Fam. *Parmeliaceae* Zenker (1827): *Cetraria ericetorum* Opiz, terricolous, 9; *Evernia mesomorpha* Nyl., corticolous, 10; *Flavocetraria cucullata* (Bellardi) Kärnef. & Thell, terricolous, 9; *Hypotrachyna revoluta* (Flörke) Hale, lignicolous, 19; *Melanelia exasperata* (De Not.) Essl., corticolous, 10; *Melanelia subargentifera* (Nyl.) Essl., lignicolous, 10; *Parmelina tiliacea* (Hoffm.) Hale, lignicolous, 10, 17; *Parmeliopsis ambigua* (Wulfen) Nyl., lignicolous, 10; *Platismatia glauca* (L.) W. Culb. & C. F. Culb., corticolous, 10; *Tuckermannopsis clorophylla* (Willd.) Hale, corticolous, 7, 10; *Usnea ceratina* Ach., corticolous, 17; *Usnea glabrescens* (Nyl. ex Vain) Vain., corticolous, 9, 17; *Usnea lapponica* Vain., corticolous, 12.

SUBORD. PSORINEAE: Fam. *Psoraceae* Zahlbr. (1898): *Protoblastenia rupestris* (Scop.) J.Steiner, saxicolous, 19; Fam. *Ramalinaceae* Ag.(1821): *Ramalina calicaris* (L.) Fr., corticolous, 19; *Ramalina farinacea* (L.) Ach., corticolous, 9, 18; *Ramalina polinaria* (Westr.) Ach., corticolous, 9, 18; *Ramalina subfarinacea* (Nyl. ex Cromb.) Nyl., saxicolous, 9; *Lecania erysibe* (Ach.) Mudd, saxicolous, 16, 19; *Toninia candida* (Web.) Th. Fr., on mosses, 19; *Toninia sedifolia* (Scop.) Timdal, on mosses, 19.

SUBORD. PHYSCIINEAE: Fam. *Physciaceae* Zahlbr. (1898): *Rinodina bischoffii* (Hepp) A.Massal., saxicolous, 19; *Calicium viride* Pers., corticolous, 17; *Physconia grisea* (Lam.) Poelt., on mosses, 19.

SUBORD. TELOSCHISTINEAE: Fam. *Teloschistaceae* Zahlbr. (1898): *Caloplaca aurantia* (Pers.) J. Steiner, saxicolous, 9; *Caloplaca cerina* (Ehrh. ex Hedw.) Th.Fr., saxicolous, 19; *Caloplaca cirrochroa* (Ach.) Th.Fr., saxicolous, 19; *Caloplaca citrina* (Hoffm.) Th.Fr., saxicolous, 19; *Caloplaca decipiens* (Arnold) Blomb. & Forssell, saxicolous, 9; *Caloplaca variabilis* (Pers.) Müll.Arg. , saxicolous, 19; *Xanthoria fallax* (Hepp.) Arnold, on mosses, 19; *Xanthoria polycarpa* (Hoffm.) Rieber, corticolous, 17.

SUBORD. LECIDEINEAE: Fam. *Lecideaceae*: *Lecidoma demissum* (Rutstr.) Gotth.Schneid. & Hertel, saxicolous, 19; Fam. *Porpidiaceae* Zahlbr. (1898), *genus of uncertain family position: Leprocaulon microscopicum* (Vill.) Gams, terricolous, 7; *Scoliciosporum umbrinum* (Ach.) Arnold. (1871), terricolous, 7.
ORD. UMBILICARIALES Lumbsch, Hestmark & Lutzoni 2007: Fam. *Umbilicariaceae* Chev. (1826): *Umbilicaria crustulosa* (Ach.) Frey, saxicolous, 9; *Umbilicaria polyphylla* (L.) Baumg., saxicolous, 9; *genus of uncertain order Umbilicariales position*: *Hypocenomyce scalaris* (Ach.) M. Choisy, lignicolous, 6; *Class Eurotiomycetes, Subclass Chaetothyriomycetidae*.

ORD. PYRENULALES Fink. ex D. Hawksw.&O. Eriksson (1986): Fam. *Monoblastiaceae: Acrocordia conoidea* (Fr.) Körb., saxicolous, 19; *Acrocordia gemmata* (Ach.) A. Massal., corticolous, 9, 19.
ORD. VERRUCARIALES Mattik ex D. Hawksw.&O. Eriksson (1986): Fam. *Verrucariaceae* Zenker (1827): *Verrucaria calciseda* DC. , saxicolous, 19; *Verrucaria nigrescens* Pers., saxicolous, 19; *Dermatocarpon intestiniforme* (Körb.) Hasse, saxicolous, 19; *Thelidium decipiens* (Nyl.) Kremp., saxicolous, 19; *Thelidium minutulum* Körb., saxicolous, 19; Subclass *Mycocaliciomycetidae*.

ORD. MYCOCALICIALES Tibell&Wedin (2000): Fam. *Mycocaliciaceae* A. Schmidt (1970): *Stenocybe pullatula* (Ach.) Stein., corticolous, 7.

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SCABIOSA TRINIIFOLIA FRIV. IN THE ROMANIA'S FLORA

CIOCÂRLAN VASILE [1], TURCU GHEORGHE [1]

Abstract: The authors present a new species in flora of Romania – *Scabiosa triniifolia* Friv., identified in Natural Park of the Iron Gates. Also, in this paper, it is showed that *Scabiosa triniifolia* Friv. and *Scabiosa silaifolia* Velen. are not synonymous name and the authors make a proposal ro subordinate the taxa *Scabiosa silaifolia* as a var. at *Scabiosa triniifolia*

Key words: *Scabiosa triniifolia* Friv., Romania

The vascular flora of Romania is relatively well-known, thank to the outstanding opera "Flora României", as well as to other synthesis paper appeared afterwards.

The flora of a certain territory is a dynamic element, is easily changeable as a result of alterations of certain ecologic factors. Thus, some of the plant species is widening their distribution area, as well as their number of individuals become more and more greater. Otherway, other species become more and more rarer, reaching thus in a disappearing edge or even they disappear at all.

Recently researches, in the last two or three decades, made by both Romanian and foreign investigators of the flora, thus bringing new and important contributions to the knowledge of the vascular flora of Romania, by adding other new species or changing in plant nomenclature or in their taxonomical position, and completing the knowledges on the plant distribution, and so on.

Here are few other new plant species, which have been identified in Romanian Plain, Dobrudja, and Banat in lately decades. All of these plant species have as their distribution area mainly in the South, Balkans, or subMediterranean zones, as the next ones: *Aegilops triuncialis, Asperula laevigata, Chamaecytisus danubialis, Daucus broteri, Hesperis pycnotricha, Jurinea tzar-ferdinandi, Ranunculus neapolitanus, Trifolium hirtum* etc.

The extent of the distribution area of these southern species toward north is an other evidence of the global warming of climate, of the rising level of continentalisms, as well as the land drying process.

In this paper, we present a new plant species identified by us into the Romania's flora, having its mainly distribution area in the Balkan peninsula.

Scabiosa triniifolia Friv., Flora Regensb. **18**: 333 (1835) (*S. silaifolia* Velen., *S. ochroleuca* L. var. *mucronata* Form.).

The iconography is inserted in the "Conspectul Florei Dobrogei", p. III-a, pp. 45 [PRODAN, 1939], under the name *S. silaifolia* Velen..

The examined samples: 1. the herbarium BUCA, with the provenance in Bulgaria; 2. the herbarium CL, with the provenance also from Bulgaria.

This species is cited by [PRODAN, 1939; BORZA, 1949], from southern Dobrudja – Batova valley, in Bulgaria.

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This species has been identified in the Natural Park of the Iron Gates, in the northern part of Drencova village (the county of Caraş-Severin), on sunny and dry meadows, on the forest edges and stony substrate.

Since this plant species (*Scabiosa triniifolia*) is close enough in its appearance by *Scabiosa ochroleuca* L. and could easily be mistaken in identifying it, we will present those discriminating features of those two plants, namely:

Scabiosa ochroleuca L.

– the basal leaves and lower ones on the stems are entire or simple penately-divided. The involucral bracts are shorter than the flowers. The calyx setae are of 2-3 times longer than the crown (epicalyx). The corolla of the outer flowers is obvious longer than the central flowers.

Distribution area: Central and south-east Europe.

Scabiosa triniifolia Friv.

– the basal leaves and lower ones on the stems are of 2-3 times penately-divided, with liniar segments. The involucral bracts are as longer as the flowers. The calyx setae are of 2-5 times longer than the crown (epicalyx). The corolla of the outer flowers is hardly longer than the corolla of central flowers.

Distribution area: Balkan Peninsula (Albania, Bulgaria, Serbia, Turkey).

In the Flora of Bulgaria, t. II, 1967, *Scabiosa silaifolia* Velen. is treated as a separate species, as well as in "Conspectul Florei Dobrogei", p. III-a, pp. 45 [PRODAN, 1939]. Even PRODAN (1939) said in his opera that "…the individuals from Bulgaria collected by V. Strbrny, in Rhodope ad Bačkovo have their leaves more hairy, and the lacinia of the leaves are a little bit narrower…".

A comparatively analyses made by us on the individuals collected from the northern part of Drencova village (the county of Caraş-Severin) versus the individuals collected from the Batova valley in Bulgaria, is more or less identically, but is different by the individuals collected from Rhodope; that why, we appreciate that those two plant species are not synonime species, and that *Scabiosa silaifolia* Velen. must be considered as a variety at *Scabiosa triniifolia* Friv.

BORZA (1949) made a synonimization of the taxa *Scabiosa silaifolia* Velen. with *Scabiosa ochroleuca* L. var. *mucronata* Form. This opinion must be corrected now, because the taxa *Scabiosa silaifolia* Velen. is much more close to the taxa *Scabiosa triniifolia* Friv.

Scabiosa triniifolia Friv. var. *silaifolia* (Velen.) Ciocârlan et Turcu comb. et stat. nov.

Basyonim: *Scabiosa silaifolia* Velen. Flora Bulgarica, Pragae, (1898), p. 244.

We make a mention that our individuals, collected from the Natural Park of the Iron Gates, is corresponding to the taxa *Scabiosa triniifolia* Friv. var. *silaifolia* (Velen.) Ciocârlan et Turcu (Fig. 1).

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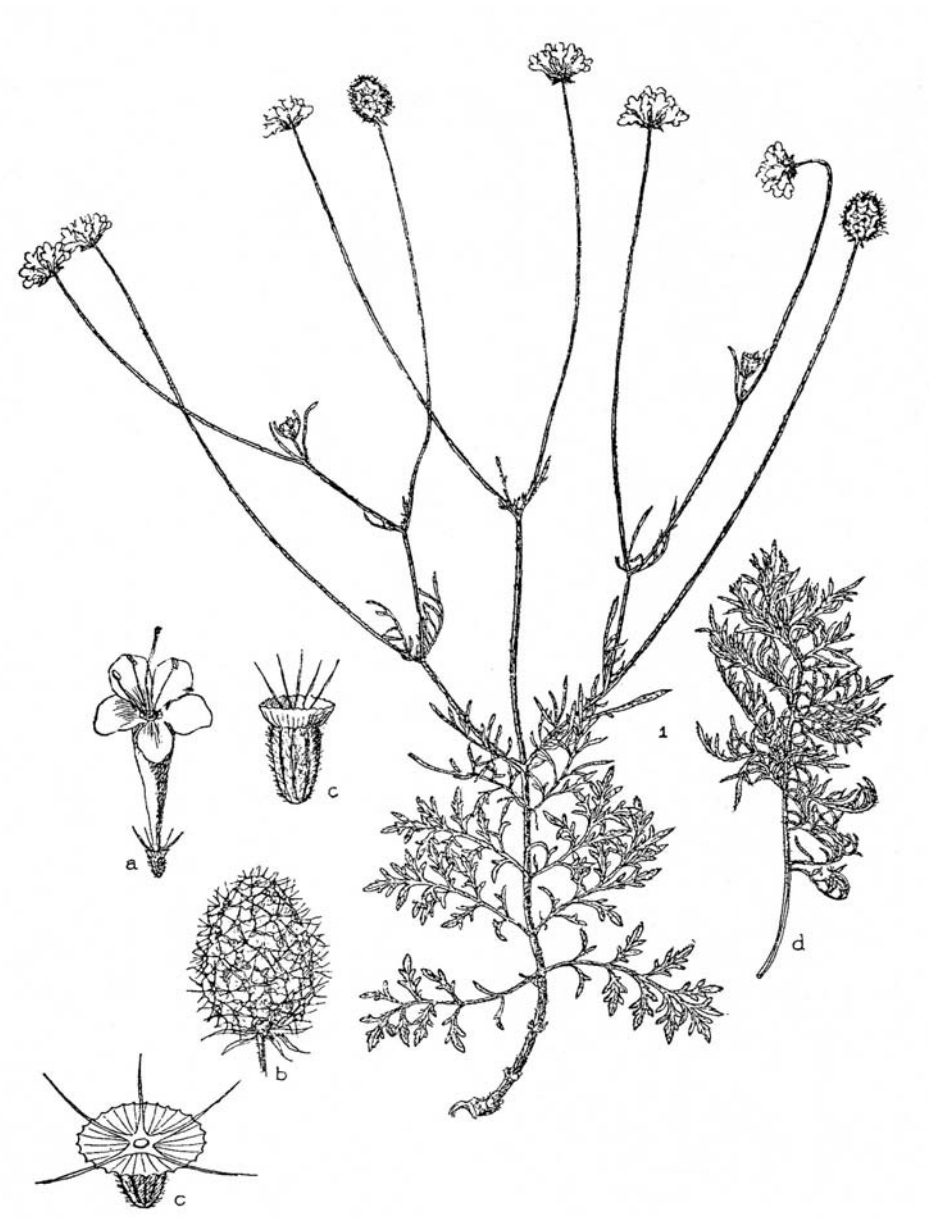

1. *Scabiosa silaifolia* Vel. *a* = floarea, *b* = capitul, *c* = fructul cu caliciu, *d* = frunza

Fig. 1

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CONTRIBUTIONS TO THE KNOWLEDGE OF THE VASCULAR FLORA OF ROMANIA

CIOCÂRLAN VASILE [1]

Abstract: There are present and discussed the fact that the legitimate name is *Cirsium heterophyllum* (L.) Hill and the synonime name is *Cirsium helenioides* auct., non (L.) Hill.
In the flora of Romania, as well as in Europe, is growing *Cirsium heterophyllum* (L.) Hill; *Cirsium helenioides* (L.) Hill is growing in Central Asia and in Siberie.
Follow, it is showed that the taxa *Juncus trifidus* L. ssp. *monanthos* (Jacq.) Asch. & Graebn. is not growing in the flora of Romania. There is presented an infraspecific taxa, new for the science, namely: *Juncus trifidus* L. ssp. *trifidus* var. *brevifolia* Ciocârlan var. nova., discovered in the Mountains of Cozia (Vâlcea county).
Also, in this paper is presented two rare plants in the flora of Romania: *Dianthus kladovanus* Degen and *Thymus longicaulis* C. Presl, species listed in the "Red Lists", discovered by the author in new localities.

Key words: *Cirsium heterophyllum* (L.) Hill (*C. helenioides* auct., non (L.) Hill.); *Juncus trifidus* L. ssp. *monanthos* (Jacq.) Asch. & Graebn. Romania.

Introduction

The vascular flora of Romania, though is relatively well known, require other investigations in order to assure a better acquaintance of it. Thus:
– we do not know, with certainty, the presence or absence of some species into the Romanian Flora. In a previous paper [CIOCÂRLAN, 2006] there are mentioned 29 species present under various "Red Lists", which are not exist in Romania.

- There are a lot of discrepancies among various authors, concerning the taxonomic value of some species.
- There are a lot of discrepancies over the nomenclature of various plants.
- We do not know completely the present location of those rare species in Romania, which must be preserved.

Results

We will try to clarify some aspects concerning the topics above mentioned, in this paper.

I. NYÁRÁDY showed, in "Flora R. P. Române" (t. IX, 1964), at the genus *Cirsium*, a species, namely *Cirsium helenioides* (L.) Hill (*C. heterophyllum* (L.) Hill. In the investigated references there are other points of view. Thus, we have to answer at two questions:

- if those two species (*Cirsium helenioides* (L.) Hill and *C. heterophyllum* (L.) Hill) are synonimous, which name is the legitimate one?

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– if those two species (*Cirsium helenioides* (L.) Hill and *C. heterophyllum* (L.) Hill) are different, which species is growing in flora of Romania?

In order to clarify these aspects we have seen a lot of botanical references and a great number of herbarium sheets were examined, including the Herbarium of the Cluj-Napoca University (CL). In the botanical references there are four points of view, namely:

1. those two plant species are synonymous, having the species *C. helenioides* (L.) Hill on the first position and *C. heterophyllum* (L.) Hill as a synonime name [NYÁRÁDY, 1964; WERNER, 1976; POPESCU & SANDA, 1998; OPREA, 2005];
2. those two plant species are synonymous having the species *C. heterophyllum* (L.) Hill on the first position and *C. helenioides* (L.) Hill as a synonime name [PRODAN, 1939; BORZA, 1949; CIOCÂRLAN, 2000; BELDIE, 1979; LOPEZ & JIMENEZ, 1974; SZAFER & al., 1986; FISCHER, 1994, SENGHAS & SEYBOLD, 2000];
3. those two plant species are synonymous having the species *C. heterophyllum* (L.) Hill on the first position and *C. helenioides* auct., non (L.) Hill as a synonime name [LAMBINON & al., 1992; KERGUÉLEN, 1993; STACE, 2001];
4. those two plant species are different [CHARADZE, 1963; LAMBINON & al., 1992; KERGUÉLEN, 1993; STACE, 2001].

It is worth to be mentioned that Stace in "New flora of the British Isles" (2001) did not follow the point of view from "Flora Europaea", t. 4 (1976).

In conclusion, in flora of Romania, as well as in flora of Europe, is growing the species *Cirsium heterophyllum* (L.) Hill. The other species, *Cirsium helenioides* (L.) Hill, is growing in central Asia and Siberie [CHARADZE, 1963].

II. *Juncus trifidus* L.

In the references there are different points of view. Thus, in the "Flora of Romania", different authors [PRODAN, 1939); BORZA, 1949] are not presenting any infraspecific taxa at *Juncus trifidus* L.

Later on, other authors [GRINȚESCU, 1966; BELDIE, 1979; POPESCU & SANDA, 1998; CIOCÂRLAN, 2000; OPREA, 2005], presents at *J. trifidus* L. a subspecies, namely: subsp. *monanthos* (Jacq.) Asch. & Graebn.

In order to clarify this controversy among the Romanian authors, the botanical references, as well as the herbarium sheets, were examined.

The results of our analyses indicate that in the flora of Romania does not grow the taxa *J. trifidus* L. subsp. *monanthos* (Jacq.) Asch. & Graebn. This infrataxa is growing as a matter of fact in the Alps and Appennins, only [SNOGERUP, 1980; ZÁNGERI, 1976].

We will present the main differential features between *J. trifidus* L. ssp. *trifidus* and *J. trifidus* L. subsp. *monanthos* (Jacq.) Asch. & Graebn.

– Basal leaves without lamina or having a very short lamina, to 1 cm, setaceous. The stem leaves (bracteals) longer than the inflorescence, which has 2-4 flowers. Tepals of 3-4 mm. A calcifugal taxa ……..*J. trifidus* L. ssp. *trifidus*
– Basal leaves with a lamina to 10-15 cm (Fig. 1). The stem leaves (bracteals) are exceed the inflorescence a little. Solitary flowers. Tepals of 4-5 mm. A calcicolous taxa .....*J. trifidus* L. ssp. *monanthos* (Jacq.) Asch. & Graebn.

Obs. in "Flora Italica" [ZÁNGERI, 1976] and "Flora of Austria" [ADLER, 1994] this taxa is given as a species: *J. monanthos* Jacq.

The author of this paper collected from the Mountain of Cozia (Southern Carpathians, Romania), in 1987, two different individuals of *J. trifidus*. As a consequence of the analyss on those two different individuals, the author showed that an individual represents the typical species *J. trifidus* L. ssp. *trifidus* and the second one represents a new variety at *J. trifidus* L. ssp. *trifidus*. This new individual has the stem leaves (bracteals) ± equals with the inflorescence (Fig. 2).

J. trifidus L. ssp. *trifidus* var. *brevifolia* Ciocârlan var. nova.

Folia caulis (bracteae) ± aequals cum inflorescentia.

Holotypus in Herb. Univ. Sci. Agron. Bucureşti conservatur. Montes Cozia, circa 1660 m alt. Romania.

III. We present two rare plants in the flora of Romania; both of them are listed on the "Red Lists". These two plants were identifiesd by us in new localities.

1. *Dianthus kladovanus* Degen was identified in Satu Mare county, at Foieni, on fixed sand dunes.
2. *Thymus longicaulis* C. Presl was identified in Braşov county, on Sasului Hill, close to Bran, in meadows and rocks.

Both of these species are stored in the Herbarium BUAG.

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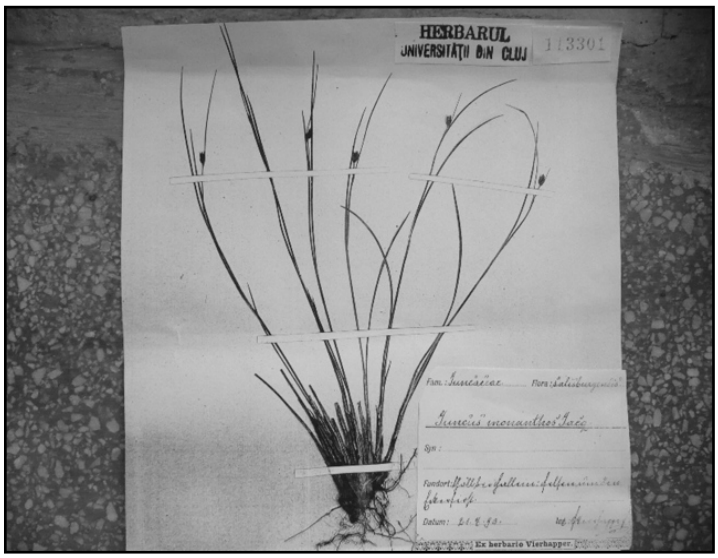
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Fig. 1


Juncus trifidus L.
Juncus trifidus
var. brevifolia Ciosărlan
var. nova
Muntele Gozia (jud. Vâlcea)
alt. circa 1660 m s.m.
6-7.VIII.1987.

Fig. 2

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

MARDARI CONSTANTIN [1]

Abstract: The paper presents aspects of the floristic diversity (*Cormobionta*) from Neagra Broştenilor river basin including species from *Aceraceae* to *Lemnaceae* botanic families.

Key words: flora, cormophytes, Neagra Broştenilor

Material and method

The study presents a continuation of a previous work [MARDARI, 2008] including the species from *Lycopodiaceae* to *Rhamnaceae* botanic families. The plants species (from Neagra Broştenilor river basin) have been identified by us in 2005-2008 period and not published before, some of them have been identified (and confirmed) both by us and other authors and another species have been identified and published by other authors in this territory but not found by us during field researches (for these are presented the bibliographic references). The identification of cormophytes species has been realized taking into account prestigious works [CIOCÂRLAN, 2000], [SÂRBU & al., 2001], [SĂVULESCU (eds.), 1952-1976], [TUTIN (eds.), 1964-1980]. In this paper, the used classification system is that adopted by V. Ciocârlan and the families are phylogenetic ordered. Within a botanic family the species are presented in alphabetical order.

Results and discussion

MAGNOLIOPHYTA

Magnoliatae (Dicotyledonatae)

Aceraceae: *Acer campestre* L.: Broşteni; *Acer platanoides* L.: Broşteni, Neagra Broşteni, Budacu, Căliman Izvor; *Acer pseudoplatanus* L.: Broşteni, Bradului valley, Neagra Broşteni, Cristişor, Izvorul Călimanului, Căliman Cerbuc, Budacu; Glodu; Drăgoiasa; *Acer tataricum* L.: Broşteni [MITITELU & al., 1989]; **Oxalidaceae**: *Oxalis acetosella* L.: Broşteni, Neagra Broşteni, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Glodu; Budacu, Dragoiasa; Păltiniş; **Geraniaceae:** *Erodium cicutarium* (L.) L' Herit.: Păltiniş, Broşteni; *Geranium dissectum* L.: Broşteni [MITITELU & al., 1989]; *Geranium divaricatum* Ehrh.: Cristişor peat-bog [LUNGU, 1969]; Neagra Broşteni [MITITELU & al., 1989]; *Geranium palustre* L.: Broşteni, Neagra Broşteni, Cristişor peat-bog, Drăgoiasa; *Geranium phaeum* L.: Neagra Broşteni, Cristişor, Izvorul Călimanului, Căliman Cerbuc; *Geranium pratense* L.: Broşteni, Cristişor, Drăgoiasa, Neagra Broşteni; *Geranium pussilum* L.: Broşteni [GRECESCU, 1898]; *Geranium robertianum* L.: Broşteni, Neagra Broşteni, Păltiniş, Negrişoara, Oilor rivulet, Cristişor peat-bog, Budacu, Glodu; **Balsaminaceae:** *Impatiens noli-tangere* L.: Negrişoara, Broşteni, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Neagra Broşteni, Glodu; **Linaceae:** *Linum catharticum* L.: Broşteni, Neagra Broşteni, Păltiniş, Cristişor, Căliman Cerbuc; Drăgoiasa; **Polygalaceae:** *Polygala amara* L.: Cristişor peat-bog, Neagra Broşteni; *Polygala amarella* Crantz: Drăgoiasa; *Polygala comosa* Schkuhr: Păltiniş; Cristişor; Neagra Broşteni; *Polygala vulgaris* L.: Păltiniş; Drăgoiasa; Neagra Broşteni; **Araliaceae:** *Hedera helix* L.: Budacu; **Apiaceae:**

[1] "Anastasie Fătu" Botanic Garden, str. Dumbrava Roşie, no. 7-9, Iassy

Aegopodium podagraria L.: Păltiniş, Cristişor, Broşteni, Neagra Broşteni, Glodu; *Aethusa cynapium* L.: Broşteni [MITITELU & al., 1989]; *Angelica archangelica* L.: Drăgoiasa; *Angelica sylvestris* L.: Drăgoiasa, Cristişor peat-bog, Broşteni, Izvorul Călimanului, Căliman Cerbuc, Neagra Broşteni; *Anthriscus sylvestris* (L.) Hoffm.: Cristişor peat-bog, Neagra Broşteni; *Astrantia major* L.: Broşteni, Păltiniş, Neagra Broşteni, Budacu; *Bupleurum falcatum* L. ssp. *falcatum*: Neagra Broşteni, Păltiniş; ssp. *cernuum* (Ten.) Archangel: Broşteni [MITITELU & al., 1989]; *Carum carvi* L.: Neagra Broşteni, Păltiniş, Broşteni, Cristişor, Drăgoiasa, Budacu; *Caucalis platycarpos* L.: Broşteni [MITITELU & al., 1989]; *Chaerophyllum aromaticum* L.: Neagra Broşteni, Broşteni, Cristişor, *Chaerophyllum aureum* L.: Neagra Broşteni; *Chaerophyllum bulbosum* L.: Broşteni, Cristişor peat-bog, Neagra Broşteni; *Chaerophyllum hirsutum* L.: Broşteni, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Budacu, Glodu; *Chaerophyllum temulum* L.: Cristişor peat-bog, Neagra Broşteni; *Conium maculatum* L.: Broşteni, Neagra Broşteni; *Daucus carota* L.: Păltiniş, Cristişor, Broşteni; *Eryngium planum* L.: Broşteni [GRECESCU, 1898]; *Heracleum carpaticum* Porcius: Cristişor peat-bog [LUNGU, 1969]; Broşteni [POPOVICI & al., 1996]; *Heracleum sphondyllium* L. ssp. *sphondylium*: Izvorul Călimanului, Căliman Cerbuc, Broşteni, Neagra Broşteni, Păltiniş; ssp. *sibiricum* (L.) Simonkai: Cristişor peat-bog [LUNGU, 1969]; ssp. *elegans* (Crantz) Schübler et Martens: Cristişor peat-bog [LUNGU, 1969], Izvorul Căliman [CSÜRÖS, 1951]; *Laser trilobum* (L.) Borkh.: Broşteni [MITITELU & al., 1989]; *Laserpitium krapfii* Crantz: Izvorul Călimanului, Căliman Cebuc; *Laserpitium latifolium* L.: Broşteni, Neagra Broşteni; Grinţieş; *Ligusticum mutellina* (L.) Crantz.: Căliman Izvor, Căliman Cerbuc; *Peucedanum oreoselinum* (L.) Moench: Păltiniş; *Peucedanum palustre* (L.) Moench: Cristişor peat-bog, Drăgoiasa; *Pimpinella major* (L.) Hudson: Bradului rivulet, Cristişor, Broşteni, Budacu; *Pimpinella saxifraga* L. ssp. *saxifraga*: Păltiniş, Cristişor, Drăgoiasa, Neagra Broşteni; *Sanicula europaea* L.: Broşteni, Cristişor, Păltiniş; *Seseli annuum* L.: Păltiniş; Broşteni; *Seseli libanotis* (L.) Koch: Neagra Brosteni, Căliman Cerbuc; **Hypericaceae:** *Hypericum elegans* Stephan: Broşteni [MITITELU & al., 1989]; *Hypericum hirsutum* L.: Neagra Broşteni, Broşteni; *Hypericum maculatum* Crantz: Broşteni, Păltiniş, Cristişor peat-bog, Budacu, Drăgoiasa, Neagra Broşteni; *Hypericum montanum* L.: Grinţieş mountain, Tomnatic rivulet, Căliman Cerbuc; *Hypericum perforatum* L.: Broşteni, Cristişor peat-bog, Neagra Broşteni; *Hypericum richeri* Vill. ssp. *grisebachii* (Boiss.) Nyman: Căliman Cerbuc; ssp. *transsilvanicum* (Celak) Ciocârlan: Broşteni [MITITELU & al., 1989]; *Hypericum tetrapterum* Fries: Broşteni; Neagra Broşteni; **Tiliaceae:** *Tilia cordata* Mill.: Broşteni, Neagra Broşteni, Negrişoara, Drăgoiasa, Păltiniş, Budacu; **Malvaceae:** *Althaea officinalis* L.: Neagra Broşteni; *Lavathera thuringiaca* L.: Broşteni [GRECESCU, 1898]; *Malva neglecta* Wallr.: Broşteni; *Malva sylvestris* L.: Broşteni, Neagra Broşteni, Drăgoiasa; **Droseraceae**: *Drosera rotundifolia* L.: Drăgoiasa, Cristişor peat-bog [LUNGU, 1969]; **Violaceae:** *Viola biflora* L.: Căliman Cerbuc; *Viola canina* L. ssp. *canina*: Păltiniş, Cristişor [LUNGU, 1969]; ssp. *ruppii* (All.) Schubler et Martens: mlaştina turboasă de la Cristişor, Drăgoiasa; *Viola declinata* Waldst. et Kit.: Păltiniş, Negrişoara, Neagra Broşteni, Budacu; *Viola mirabilis* L.: Neagra Broşteni; *Viola odorata* L.: Păltiniş, Stânii rivulet, Broşteni; *Viola reichenbachiana* Jordan: Cristişor, Drăgoiasa, Neagra Broşteni; *Viola riviniana* Reichenb.: Cristişor peat-bog [LUNGU, 1969]; Drăgoiasa [MITITELU & al., 1989]; *Viola tricolor* L. ssp. *tricolor*: Broşteni, Neagra Broşteni, Catrinari, Păltiniş, Cristişor, Budacu, Drăgoiasa; **Cistaceae:** *Helianthemum nummularium* (L.) Mill. ssp. *nummularium* (Scop.) Schinz. et Thell.: Broşteni, Păltiniş, Drăgoiasa; ssp. *obscurum* (Celak.) Holub.: Broşteni; **Tamaricaceae**: *Myricaria germanica* (L.) Desv.: Negrişoara, Dârmoxa; **Brassicaceae:** *Alliaria petiolata* (Bieb.) Cavarra et Grande: Stânii rivulet, Neagra Broşteni, Broşteni, Păltiniş; *Alyssum saxatile* L.: Neagra Broşteni; *Arabis alpina* L.: Grinţieş rivulet, Budacu, Căliman Cerbuc; *Arabis hirsuta* (L.) Scop.: Neagra Broşteni, Cristişor peat-bog, Păltiniş, Budacu; *Berteroa incana* (L.) DC.: Pinului rivulet, Broşteni; *Bunias orientalis* L.: Broşteni, Cristişor, Neagra Broşteni; *Camelina alyssum* (Mill.) Thell.: Broşteni [MITITELU & al., 1989]; *Camelina microcarpa* Andrz. ex DC.: Broşteni [MITITELU & al., 1989]; *Capsella bursa-pastoris* (L.) Medik.: Cristişor, Broşteni, Drăgoiasa; *Cardamine amara* L.: Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc; *Cardamine flexuosa* With. in Stokes: Broşteni, Păltiniş; *Cardamine impatiens* L.: Cristişor peat-bog, Budacu, Neagra Broşteni; *Cardamine pratensis* L.: Broşteni, Neagra Broşteni; Cristişor, Drăgoiasa; *Cardaminopsis arenosa* (L.) Hayek: Neagra Broşteni, Broşteni, Budacu, Glodu, Căliman Cerbuc; *Cardaminopsis halleri* (L.) Hayek ssp. *halleri*: Broşteni, Cristişor; ssp. *ovirensis* (Wulfen) Hegi et

Schmidt: Broşteni [MITITELU & al., 1989]; *Cardaria draba* (L.) Desv.: Broşteni, Neagra Broşteni, Păltiniş; *Dentaria bulbifera* L.: Pinului rivulet, Budacu; *Dentaria glandulosa* Waldst. et Kit.: Negrişoara, Cristişor, Budacu, Neagra Broşteni; *Descurainia sophia* (L.) Webb: Cristişor peat-bog [LUNGU, 1969]; Păltiniş; *Diplotaxis muralis* (L.) DC.: Neagra Broşteni; *Draba nemorosa* L.: Broşteni [SEGHEDIN, 1986]; Cristişor peat-bog; *Erysimum cheiranthoides* L.: Broşteni [BRANDZA, 1883]; *Erysimum virgatum* Roth.: Broşteni, Neagra Broşteni [SEGHEDIN, 1986]; *Lepidium ruderale* L.: Broşteni; *Roripa palustris* (L.) Besser: Cristişor peat-bog, Neagra Broşteni; *Rorippa sylvestris* (L.) Besser ssp. *sylvestris*: Cristişor, Neagra Broşteni; *Sinapis arvensis* L.: Broşteni; *Sisymbrium officinale* (L.) Scop.: Broşteni; *Thlaspi arvense* L.: Cristişor, Broşteni; **Resedaceae:** *Reseda lutea* L.: Drăgoiasa, Neagra Broşteni; **Salicaceae:** *Populus tremula* L.: Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa, Neagra Broşteni; *Salix alba* L.: Drăgoiasa, Broşteni, Neagra Broşteni, Glodu; *Salix aurita* L.: Drăgoiasa, Cristişor peat-bog; *Salix caprea* L.: Broşteni, Bradului rivulet, Păltiniş, Cristişor peat-bog, Dârmoxa, Drăgoiasa, Izvorul Călimanului, Căliman Cerbuc, Glodu, Budacu, Grinţieş; *Salix cinerea* L.: Cristişor, Broşteni, Drăgoiasa, Cristişor peat-bog, Budacu; *Salix elaeagnos* Scop.: Broşteni [SEGHEDIN, 1986]; *Salix fragilis* L.: Broşteni, Cristişor peat-bog, Drăgoiasa; *Salix pentandra* L.: Drăgoiasa, Păltiniş, Cristişor peat-bog; *Salix purpurea* L. ssp. *purpurea*: Cristişor peat-bog; Broşteni, Neagra Broşteni; *Salix rosmarinifolia* L.: Drăgoiasa; *Salix silesiaca* Willd.: Drăgoiasa; Cristişor peat-bog; Căliman Cerbuc; *Salix starkeana* Willd.: Drăgoiasa [MITITELU & al., 1989]; *Salix triandra* L. emend. Ser. ssp. *triandra*: Păltiniş, Cristişor peat-bog, Broşteni, Neagra Broşteni; **Cucurbitaceae:** *Echinocystis lobata* (Michx.) Torrey et A. Gray: Broşteni [MITITELU & al., 1989]; **Ericaceae:** *Andromeda polifolia* L.: Cristişor peat-bog, Drăgoiasa; *Bruckenthalia spiculifolia* (Salisb.) Reichenb.: Grinties; *Calluna vulgaris* (L.) Hull: Broşteni [MITITELU & al., 1989]; *Oxycoccus microcarpus* Turcz.: Drăgoiasa, Cristişor peat-bog; *Oxycoccus palustris* Pers. (*Vaccinium oxycoccos* L.): Drăgoiasa, Cristişor peat-bog; *Rhododendron myrtifolium* Schott et Kotschy: Izvorul Călimanului, Căliman Cerbuc; *Vaccinium gaultherioides* Bigelow: Păltiniş, Grinţieş; *Vaccinium myrtillus* L.: Broşteni, Păltiniş, Cristişor peat-bog, Drăgoiasa, Izvorul Călimanului, Căliman Cerbuc, Budacu, Neagra Broşteni, Glodu; *Vaccinium uliginosum* L.: Izvorul Călimanului, Drăgoiasa, Căliman Cerbuc, Broşteni, Budacu; *Vaccinium vitis-idaea* L.: Broşteni, Drăgoiasa, Neagra Broşteni, Păltiniş, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Budacu; **Empetraceae:** *Empetrum nigrum* L. ssp. *hermafroditicum*: Izvorul Călimanului, Căliman Cerbuc; **Pyrolaceae:** *Moneses uniflora* (L.) A. Gray: Broşteni, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Budacu, Neagra Broşteni; Drăgoiasa; Păltiniş; *Orthilia secunda* (L.) House: Broşteni, Grinţieş mountain, Cristişor peat-bog, Drăgoiasa, Izvorul Călimanului, Căliman Cerbuc, Păltiniş; *Pyrola chlorantha* Swartz: Cristişor peat-bog [MITITELU & al., 1989]; *Pyrola media* Swartz: Cristişor peat-bog, Neagra Broşteni, Drăgoiasa; *Pyrola minor* L.: Cristişor peat-bog [LUNGU, 1969]; Izvorul Călimanului, Căliman Cerbuc; *Pyrola rotundifolia* L.: Păltiniş, Cristişor, Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa; **Primulaceae:** *Anagallis arvensis* L.: Păltiniş, Broşteni; *Lysimachia nummularia* L.: Broşteni, Neagra Broşteni, Cristişor peat-bog, Drăgoiasa, Glodu, Arsurii rivulet; *Lysimachia vulgaris* L.: Neagra Broşteni, Drăgoiasa, Cristişor peat-bog, Glodu; *Primula elatior* (L.) L. ssp. *elatior*: Neagra Broşteni; Păltiniş; Dârmoxa; ssp. *leucophylla* (Pax) H. Harrison ex W.W. Sm. et Fletcher: Broşteni, Neagra Broşteni, Căliman Cerbuc; *Primula minima* L.: Izvorul Călimanului, Căliman Cerbuc; *Primula veris* L.: Drăgoiasa; *Soldanella hungarica* Simonkai ssp. *major* (Neilr.) Pawl.: Grinţieş peak; Budacu; **Gentianaceae:** *Centaurium erythraea* Rafin.: Broşteni, Neagra Broşteni; *Gentiana acaulis* L.: Păltiniş; Izvorul Călimanului, Budacu; *Gentiana asclepiadea* L.: Broşteni, Neagra Broşteni, Păltiniş, Cristişor, Grinţieş mountain, Izvorul Călimanului, Căliman Cerbuc, Budacu, Drăgoiasa; *Gentiana cruciata* L.: Broşteni, Bradului rivulet; Păltiniş, Izvorul Călimanului, Căliman Cerbuc, Neagra Broşteni, Budacu; *Gentiana nivalis* L.: Păltiniş [SEGHEDIN, 1986]; *Gentiana punctata* L.: Izvorul Călimanului, Căliman Cerbuc; *Gentiana utriculosa* L.: Păltiniş; *Gentianella amarella* (L.) Börner: Broşteni, Glodu; *Gentianella austriaca* (A. et J. Kerner) Holub.: Păltiniş, Broşteni, Neagra Broşteni; *Swertia perennis* L.: Drăgoiasa [POP, 1960]; **Asclepiadaceae:** *Vincetoxicum hirundinaria* Medik.: Broşteni, Neagra Broşteni; Păltiniş; **Oleaceae:** *Fraxinus excelsior* L.: Neagra Broşteni, Broşteni, Cristişor, Păltiniş; **Solanaceae:** *Atropa belladonna* L.: Bradului rivulet, Dârmoxa, Neagra Broşteni, Păltiniş; *Datura stramonium* L.: Păltiniş [MITITELU & al., 1989]; Broşteni; *Hyoscyamus niger* L.: Broşteni, Neagra Broşteni; *Solanum dulcamara* L.:

Cristişor peat-bog, Arsurii rivulet; *Solanum nigrum* L.: Broşteni, Neagra Broşteni; **Convolvulaceae:** *Calystegia sepium* (L.) R. Br.: Broşteni, *Convolvulus arvensis* L.: Păltiniş, Broşteni, Neagra Broşteni; **Cuscutaceae:** *Cuscuta epithymum* (L.) L. ssp. *epithymum* : Păltiniş, Dârmoxa; ssp. *trifolii* (Bab.) Berher: Budacu; *Cuscuta europaea* L.: Păltiniş, Broşteni; **Menyanthaceae:** *Menyanthes trifoliata* L.: Drăgoiasa, Păltiniş, Cristişor peat-bog; **Polemoniaceae:** *Polemonium caeruleum* L.: Broşteni [BRANDZA, 1883]; Izvorul Călimanului, Căliman Cerbuc; **Boraginaceae:** *Echium vulgare* L.: Cristişor, Broşteni, Neagra Broşteni; *Myosotis alpestris* F. W. Schmidt: Budacu; *Myosotis arvensis* Hill: Neagra Broşteni [SEGHEDIN, 1986]; *Myosotis scorpioides* L.: Broşteni, Drăgoiasa, Cristişor peat-bog, Budacu, Glodu, Arsurii rivulet; *Myosotis sylvatica* Ehrh.: Cristişor peat-bog, Budacu; *Pulmonaria mollis* Wulfen ex Hornem: Cristişor peat-bog [LUNGU, 1969]; *Pulmonaria officinalis* L.: Neagra Broşteni, Glodu; Broşteni, Păltiniş; *Pulmonaria rubra* Schott: Bradului rivulet, Negrişoara, Cristişor, Budacu, Neagra Broşteni; *Symphytum cordatum* Waldst. et Kit.: Neagra Broşteni; Cristişor, Broşteni, Izvorul Călimanului, Căliman Cerbuc; *Symphytum officinale* L.: Broşteni, Cristişor peat-bog, Drăgoiasa, Neagra Broşteni; *Symphytum tuberosum* L.: Cristişor, Drăgoiasa; **Verbenaceae:** *Verbena officinalis* L.: Păltiniş, Broşteni, Neagra Broşteni; **Lamiaceae:** *Acinos alpinus* (L.) Moench ssp. *alpinus*: Păltiniş, Drăgoiasa, Neagra Broşteni, Cristişor; ssp. *majoranifolius* (Mill.) Ball: Broşteni [MITITELU & al., 1989]; *Ajuga genevensis* L.: Păltiniş, Cristişor, Drăgoiasa; *Ajuga reptans* L.: Păltiniş, Cristişor, Drăgoiasa, Budacu, Neagra Broşteni; *Ballota nigra* L. ssp. *nigra*: Păltiniş, Broşteni; *Calamintha menthifolia* Host: Broşteni, Neagra Broşteni; Cristişor; *Clinopodium vulgare* L.: Broşteni, Păltiniş, Cristişor, Neagra Broşteni; *Elsholtzia ciliata* (Thunb.) Hyl.: Neagra Broşteni; *Galeopsis ladanum* L.: Broşteni; *Galeopsis pubescens* Besser: Broşteni, Izvorul Călimanului, Căliman Cerbuc, Păltiniş; *Galeopsis speciosa* Mill.: Neagra Brosteni, Cristişor peat-bog, Broşteni, Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa, Glodu; *Galeopsis tetrahit* L.: Dârmoxa, Cristişor, Broşteni, Neagra Broşteni, Drăgoiasa, Budacu; *Glechoma hederacea* L.: Neagra Broşteni, Cristişor, Broşteni; *Glechoma hirsuta* Waldst. et Kit.: Neagra Broşteni; *Lamium galeobdolon* (L.) L.: Cristişor, Glodu, Drăgoiasa; *Lamium maculatum* L. ssp. *maculatum*: Broşteni, Dârmoxa, Cristişor, Broşteni, Budacu, Neagra Broşteni, Glodu; *Lamium purpureum* L.: Neagra Broşteni; *Leonurus cardiaca* L. ssp. *villosus*: Broşteni; *Lycopus europaeus* L.: Cristişor peat-bog, Arsurii rivulet; *Lycopus exaltatus* L. fil.: Broşteni, Cristişor; *Marrubium vulgare* L.: Broşteni; *Mentha aquatica* L.: Drăgoiasa, Glodu; *Mentha arvensis* L. ssp. *arvensis*: Neagra Broşteni; Cristişor peat-bog [LUNGU, 1969]; Broşteni; *Mentha longifolia* (L.) Hudson: Cristişor; *Mentha x verticillata* L.: Cristişor peat-bog, Broşteni, Neagra Broşteni, Drăgoiasa; *Nepeta nuda* L.: Broşteni, Neagra Broşteni; *Origanum vulgare* L.: Broşteni, Dârmoxa, Păltiniş, Cristişor, Izvorul Călimanului, Căliman Cerbuc, Budacu, Grinţieş; *Prunella grandiflora* (L.) Scholler: Păltiniş; *Prunella vulgaris* L.: Broşteni, Păltiniş, Cristişor, Drăgoiasa, Budacu, Neagra Broşteni, Glodu; *Salvia glutinosa* L.: Broşteni, Izvorul Călimanului, Căliman Cerbuc, Cristişor, Budacu, Neagra Broşteni, Drăgoiasa; *Salvia pratensis* L.: Cristişor peat-bog [LUNGU, 1969]; *Salvia verticillata* L.: Păltiniş, Broşteni; *Scutellaria galericulata* L.: Cristişor peat-bog, Broşteni, Neagra Broşteni; *Stachys alpina* L.: Broşteni; *Stachys officinalis* (L.) Trev.: Broşteni, Neagra Broşteni, Drăgoiasa, Păltiniş; *Stachys palustris* L.: Broşteni, Cristişor peat-bog, Neagra Broşteni; *Stachys sylvatica* L.: Broşteni, Neagra Broşteni, Cristişor, Glodu, Păltiniş; *Teucrium chamaedrys* L.: Păltiniş, Neagra Broşteni, Broşteni; *Thymus alpestris* Tausch ex A. Kerner: Căliman Izvor; *Thymus pannonicus* All.: Păltiniş [SEGHEDIN, 1986]; *Thymus pulegioides* L. ssp. *pulegioides*: Budacu, Drăgoiasa, Neagra Broşteni; ssp. *montanus* (Bentham) Ronniger: Broşteni, Păltiniş; ssp. *chamaedrys* (Fries) Guşuleac: Cristişor peat-bog [LUNGU, 1969]; **Callitrichaceae:** *Callitriche cophocarpa* Sendtner: Cristişor peat-bog; *Callitriche palustris* L.: Broşteni, Arsurii rivulet; **Plantaginaceae:** *Plantago lanceolata* L.: Broşteni, Păltiniş, Dârmoxa, Cristişor, Budacu, Drăgoiasa; *Plantago major* L.: Broşteni, Păltiniş, Cristişor, Neagra Broşteni; *Plantago media* L.: Broşteni, Păltiniş, Cristişor, Drăgoiasa, Glodu; **Scrophulariaceae:** *Digitalis grandiflora* Mill.: Broşteni, Neagra Broşteni, Păltiniş, Dârmoxa, Cristişor, Căliman Cerbuc; *Euphrasia minima* Jacq.: Grinţieş mountain, Izvorul Călimanului, Căliman Cerbuc, Budacu; *Euphrasia officinalis* L. ssp. *pratensis* Schubler et Martens: Broşteni, Păltiniş, Cristişor, Drăgoiasa; *Euphrasia stricta* Wolff ex J.F. Lehm.: Broşteni, Catrinari, Cristişor, Budacu, Neagra Broşteni; *Gratiola officinalis* L.: Broşteni Neagra [GRECESCU, 1898]; *Lathraea squamaria* L.: Neagra Broşteni; *Linaria vulgaris* Miller: Neagra Broşteni; *Limosella aquatica* L.: Cristişor peat-bog; *Melampyrum saxosum* Baumg.: Păltiniş,

Broşteni, Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa; Budacu; *Melampyrum sylvaticum* L.: Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa, Păltiniş; *Pedicularis exaltata* Besser: Izvorul Călimanului [CSÜRÖS, 1951]; *Pedicularis palustris* L.: Drăgoiasa, Broşteni; *Pedicularis sceptrum-carolinum* L.: Drăgoiasa; *Rhinanthus angustifolius* C.C. Gmelin: Păltiniş, Cristişor, Neagra Broşteni; *Rhinanthus minor* L.: Neagra Broşteni, Păltiniş, Cristişor, Drăgoiasa; *Scrophularia nodosa* L.: Broşteni, Neagra Broşteni, Dârmoxa, Cristişor, Izvorul Călimanului, Căliman Cerbuc, Budacu, Păltiniş; *Scrophularia scopolii*: Dârmoxa; Izvorul Călimanului, Căliman Cerbuc; *Tozzia alpina* L. ssp. *carpatica* (Woloszczak) Hayek: Cristişor peat-bog [5]; *Verbascum alpinum* Turra (*V. lanatum* Schrad.): Broşteni [MITITELU & al., 1989]; *Verbascum densiflorum* Bertol.: Broşteni [MITITELU & al., 1989]; *Verbascum lychnitis* L.: Neagra Broşteni, Broşteni; *Verbascum nigrum* L.: Broşteni, Neagra Broşteni, Păltiniş; *Verbascum speciosum* Schrader: Budacu; *Verbascum thapsus* L.: Neagra; *Veronica anagallis-aquatica* L: Broşteni, Păltiniş, Cristişor peat-bog, Arsurii rivulet; *Veronica arvensis* L.: Broşteni [BRANDZA, 1883]; Neagra Broşteni; *Veronica baumgartenii* Roemer et Schult.: Izvorul Călimanului, Căliman Cerbuc; *Veronica beccabunga* L.: Broşteni, Neagra Broşteni, Cristişor peat-bog, Drăgoiasa, Arsurii rivulet; *Veronica chamaedrys* L.: Neagra Broşteni, Cristişor, Broşteni, Budacu, Drăgoiasa; *Veronica fruticans* Jacq.: Izvorul Călimanului, Căliman Cerbuc; *Veronica montana* L.: Păltiniş; Broşteni, Cristişor; *Veronica officinalis* L.: Broşteni, Păltiniş, Cristişor peat-bog, Budacu, Neagra Broşteni, Drăgoiasa; *Veronica persica* Poiret: Păltiniş; *Veronica polita* Fries: Dârmoxa; *Veronica scutellata* L.: Cristişor peat-bog [LUNGU, 1969]; *Veronica serpyllifolia* L.: Cristişor, Budacu; *Veronica urticifolia* Jacq.: Broşteni, Neagra Broşteni, Dârmoxa, Cristişor, Budacu, Drăgoiasa; **Orobanchaceae:** *Orobanche alba* Stephan ex Willd.: Broşteni on Piciorul Văcăriei [GRECESCU, 1898]; *Orobanche caryophyllacea* Sm.: Broşteni; *Orobanche purpurea* Jacq.: Păltiniş; **Campanulaceae:** *Campanula abietina* Griseb.: Broşteni, Neagra Broşteni, Izvorul Călimanului, Budacu, Căliman Cerbuc, Drăgoiasa, Păltiniş; *Campanula alpina* Jacq.: Izvorul Călimanului, Căliman Cerbuc; *Campanula bononiensis* L.: Broşteni, Neagra Broşteni; *Campanula carpatica* Jacq.: Neagra Broşteni, Dârmoxa, Bradului rivulet, Drăgoiasa; *Campanula cervicaria* L.: Broşteni, Neagra Broşteni, Păltiniş, Cristişor, Izvorul Călimanului, Căliman Cerbuc; *Campanula cochleariifolia* Lam.: Broşteni [MITITELU & al., 1989]; *Campanula glomerata* L. ssp. *glomerata*: Broşteni, Cristişor, Izvorul Călimanului, Neagra Broşteni, Drăgoiasa; ssp. *hispida* (Witasek) Hayek: Cristişor peat-bog; *Campanula latifolia* L.: Neagra Broşteni, Broşteni, Cristişor, Păltiniş; *Campanula patula* L.: Bradului rivulet, Păltiniş, Cristişor, Broşteni, Budacu, Drăgoiasa, Neagra Broşteni; *Campanula persicifolia* L.: Broşteni, Izvorul Călimanului; Păltiniş, Cristişor; *Campanula rapunculoides* L.: Neagra Broşteni, Păltiniş, Cristişor, Broşteni, Drăgoiasa; *Campanula rapunculus* L.: Broşteni [MITITELU & al., 1989]; *Campanula rotundifolia* L. ssp. *kladniana* (Schur) Tacik: Păltiniş; Izvorul Călimanului, Căliman Cerbuc; ssp. *polymorpha* (Witasek) Tacik: Căliman Cerbuc; *Campanula serrata* (Kit.) Hendr.: Cristişor, Broşteni, Neagra Broşteni, Drăgoiasa, Păltiniş; *Campanula sibirica* L. ssp. *divergens* Waldst. et Kit.: Broşteni [GRECESCU, 1898]; *Campanula trachelium* L.: Neagra Broşteni, Cristişor, Broşteni, Păltiniş; *Phyteuma orbiculare* L.: Păltiniş, Budacu; *Phyteuma spicatum* L.: Păltiniş, Izvorul Călimanului; *Phyteuma tetramerum* Schur: Neagra Broşteni, Catrinari, Păltiniş, Căliman Cerbuc; **Rubiaceae:** *Cruciata glabra* (L.) Ehrend.: Păltiniş, Cristişor peat-bog, Broşteni, Drăgoiasa, Neagra Broşteni; *Cruciata laevipes* Opiz: Cristişor, Broşteni; *Cruciata pedemontana* (Bell.) Ehrend.: Broşteni [MITITELU & al., 1989]; *Galium album* Mill.: Broşteni, Drăgoiasa, Neagra Broşteni, Păltiniş; *Galium anysophyllon* Vill.: Grinţieş peak, Izvorul Călimanului, Căliman Cerbuc; *Galium aparine* L.: Broşteni, Dârmoxa, Cristişor peat-bog, Izvorul Călimanului, Neagra Broşteni; *Galium humifusum* Bieb.: Broşteni [8]; *Galium mollugo* L.: Broşteni; Cristişor; *Galium odoratum* (L.) Scop.: Neagra Broşteni, Broşteni, Cristişor; *Galium palustre* L.: Păltiniş, Neagra Broşteni, Drăgoiasa, Cristişor peat-bog; *Galium rivale* (Sibth. et Sm.) Griseb. (*Asperula rivalis* Sibth. et Sm.): Neagra Broşteni; *Galium schultesii* Vest: Dârmoxa, Broşteni, Neagra Broşteni; *Galium spurium* L.: Neagra Broşteni; *Galium uliginosum* L.: Cristişor peat-bog, Drăgoiasa; *Galium verum* L.: Broşteni, Păltiniş, Cristişor; *Sherardia arvensis* L.: Broşteni [SĂVULESCU T. (eds.) & al., 1952-1976]; **Caprifoliaceae:** *Lonicera nigra* L.: Dârmoxa, Cristişor, Căliman Cerbuc; *Lonicera xylosteum* L.: Bradului rivulet, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Budacu, Neagra Broşteni, Drăgoiasa; *Sambucus ebulus* L.: Broşteni; *Sambucus racemosa* L.: Broşteni, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Glodu, Drăgoiasa; *Viburnum*

lantana L.: Broşteni; *Viburnum opulus* L.: Neagra Broşteni, Cristişor peat-bog, Drăgoiasa; **Adoxaceae:** *Adoxa moschatellina* L: Cristişor peat-bog [LUNGU, 1969]; **Valerianaceae:** *Valeriana montana* L.: Broşteni, Neagra Broşteni; *Valeriana officinalis* L.: Păltiniş, Drăgoiasa, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Neagra Broşteni; *Valeriana sambucifolia* Mikan fil.: Neagra Broşteni, Cristişor peat-bog, Budacu; *Valeriana simplicifolia* (Reichenb.) Kabath: Drăgoiasa; *Valeriana tripteris* L.: Bradului rivulet, Cristişor peat-bog, Broşteni, Izvorul Călimanului, Căliman Cerbuc, Budacu, Glodu, Neagra Broşteni; **Dipsacaceae:** *Dipsacus fullonum* L. (*D. sylvestris* Huds.): Broşteni, Păltiniş; *Knautia arvensis* (L.) Coult.: Broşteni, Păltiniş, Cristişor, Drăgoiasa, Neagra Broşteni; *Knautia dipsacifolia* Kretzer: Broşteni [SAVULESCU T. (eds.) & al., 1952-1976]; *Knautia longifolia* (Waldst. et Kit.) Koch: Păltiniş, Izvorul Călimanului, Budacu; *Scabiosa columbaria* L.: Drăgoiasa, Neagra Broşteni; ssp. *banatica* (Waldst. et Kit.) Diklić: Broşteni [MITITELU & al., 1989]; Neagra Broşteni; *Scabiosa lucida* Vill. ssp. *barbata* E.I. Nyarady: Dârmoxa, Păltiniş, Drăgoiasa; *Scabiosa ochroleuca* L.: Broşteni; *Succisa pratensis* Moench: Neagra Broşteni, Păltiniş, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa; **Asteraceae:** *Achillea asplenifolia* Vent.: Broşteni [MITITELU & al., 1989]; *Achillea distans* Waldst. et Kit. ssp. *distans*: Păltiniş, Budacu; ssp. *alpina* (Rochel) Soó: Grinţieş mountain [GRECESCU, 1898]; *Achillea lingulata* Waldst. et Kit.: Izvorul Călimanului [CSÜRÖS, 1951]; *Achillea millefolium* L.: Păltiniş, Broşteni, Cristişor, Neagra Broşteni, Drăgoiasa, Budacu; *Achillea stricta*: Neagra Broşteni; *Adenostyles alliariae* (Gouan) A. Kern.: Izvorul Călimanului, Căliman Cerbuc; *Antennaria dioica* (L.) Gaertn.: Păltiniş, Broşteni, Izvorul Călimanului, Căliman Cerbuc, Budacu; *Anthemis tinctoria* L. ssp. *tinctoria*: Broşteni, Cristişor, Drăgoiasa; *Arctium lappa* L.: Cristişor, Glodu; *Arctium tomentosum* Mill.: Broşteni, Neagra Broşteni; *Arnica montana* L.: Broşteni, Izvorul Călimanului, Păltiniş, Cristişor, Budacu, Neagra Broşteni; *Artemisia annua* L.: Broşteni; *Artemisia vulgaris* L.: Broşteni; *Aster alpinus* L: Broşteni, Grinţieş peak [LUPŞA, 1977]; *Bellis perennis* L.: Păltiniş, Budacu, Drăgoiasa, Broşteni; *Bidens cernua* L.: Dârmoxa, Cristişor peat-bog, Drăgoiasa; *Bidens tripartita* L.: Broşteni, Neagra Broşteni, Cristişor peat-bog, Drăgoiasa, Arsurii rivulet; *Carduus acanthoides* L.: Broşteni; Neagra Broşteni; *Carduus crispus* L.: Broşteni, Drăgoiasa; *Carduus glaucinus* Holub: Broşteni, Ortoiţa rivulet; *Carduus hamulosus* Ehrh.: Broşteni [MITITELU & al., 1989]; *Carduus kerneri* Simonkai: Broşteni [MITITELU & al., 1989]; *Carduus nutans* L.: Broşteni [MITITELU & al., 1989]; *Carduus personatus* (L.) Jacq.: Broşteni, Neagra Broşteni, Cristişor peat-bog, Budacu, Glodu; *Carlina acaulis* L.: Broşteni, Bradului rivulet, Păltiniş, Budacu, Drăgoiasa, Căliman Cerbuc; *Carlina vulgaris* L.: Broşteni, Neagra Broşteni, Păltiniş; *Centaurea biebersteinii* DC.: Broşteni [SĂVULESCU T. (eds.) & al., 1952-1976]; *Centaurea indurata* Janka: Neagra Broşteni; *Centaurea jacea* L.: Cristişor, Drăgoiasa, Neagra Broşteni, Budacu; *Centaurea phrygia* L.: Neagra Broşteni, Păltiniş, Cristişor, Drăgoiasa; *Centaurea pseudophrygia* C.A. Mey.: Neagra Broşteni, Broşteni; *Centaurea triumfetti* All. ssp. *aligera* (Gugler) Dostál: Neagra Broşteni; *Cicerbita alpina* (L.) Wallr.: Cristişor, Izvorul Călimanului, Căliman Cerbuc, Budacu, Neagra Broşteni; *Cirsium arvense* (L.) Scop.: Păltiniş, Cristişor, Neagra Broşteni, Drăgoiasa; *Cirsium canum* (L.) All.: Catrinari; Cristişor peat-bog [LUNGU, 1969]; *Cirsium decussatum* Janka: Drăgoiasa; *Cirsium erisithales* (Jacq.) Scop.: Neagra Broşteni, Broşteni, Cristişor, Drăgoiasa, Păltiniş, Căliman Izvor, Căliman Cerbuc, Budacu; *Cirsium furiens* Griseb. et Schenk: Broşteni, Neagra Broşteni [SĂVULESCU, 1953]; *Cirsium heterophyllum* (L.) Hill: Păltiniş, Dârmoxa, Drăgoiasa, Neagra Broşteni; *Cirsium oleraceum* (L.) Scop.: Păltiniş, Broşteni, Cristişor peat-bog, Neagra Broşteni, Drăgoiasa; *Cirsium palustre* (L.) Scop.: Păltiniş, Neagra Broşteni, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa; *Cirsium pannonicum* (L. fil.) Link: Broşteni, Neagra Broşteni, Păltiniş; *Cirsium rivulare* (Jacq.) All.: Păltiniş, Catrinari, Cristişor peat-bog, Neagra Broşteni; *Cirsium vulgare* (Savi) Ten.: Broşteni, Neagra Broşteni, Păltiniş; *Crepis biennis* L.: Broşteni, Păltiniş, Cristişor; *Crepis foetida* L. ssp. *rhoeadifolia* (Bieb.) Celak.: Cristişor; *Crepis mollis* (Jacq.) Ascherson: Păltiniş [MITITELU & al., 1989]; *Crepis paludosa* (L.) Moench: Drăgoiasa, Păltiniş, Cristişor peat-bog; *Crepis praemorsa* (L.) F.W. Walter: Broşteni [GRECESCU, 1898]; *Doronicum austriacum* Jacq.: Izvorul Călimanului, Budacu; *Doronicum columnae* Ten.: Păltiniş; *Echinops exaltatus* Schrad. (*E. commutatus* Jurat.): Drăgoiasa; *Erechtites hieracifolia* (L.) Rafin.: Broşteni; *Erigeron acris* L. ssp. *acris*: Broşteni, Neagra Broşteni, Cristişor; ssp. *macrophyllus* (Herbich) Guterm.: Broşteni [SĂVULESCU T. (eds.) & al., 1952-1976]; *Erigeron annuus* (L.) Pers.: Broşteni, Neagra Broşteni; *Erigeron atticus* Vill.: Broşteni [MITITELU

& al., 1989]; *Eupatorium cannabinum* L.: Broşteni, Neagra Broşteni, Cristişor; *Galinsoga ciliata* (Rafin.) Blake: Broşteni; *Galinsoga parviflora* Cav.: Cristişor, Broşteni; *Gnaphalium supinum* L.: Izvorul Călimanului, Căliman Cerbuc; *Gnaphalium sylvaticum* L.: Broşteni; Cristişor, Izvorul Călimanului; Budacu; *Gnaphalium uliginosum* L.: Cristişor peat-bog; *Hieracium alpinum* L.: Izvorul Călimanului, Căliman Cerbuc; Budacu; *Hieracium aurantiacum* L.: Broşteni, Păltiniş, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa, Neagra Broşteni; *Hieracium bifidum* Kit.: Neagra Broşteni; *Hieracium caespitosum* Dumort.: Budacu; *Hieracium cymosum* L.: Broşteni; *Hieracium lachenalii* C.C. Gmel.: Neagra Broşteni; *Hieracium lactucella* Wallr.: Neagra Broşteni; Drăgoiasa; *Hieracium murorum* L.: Broşteni, Budacu; *Hieracium pilosella* L.: Păltiniş, Cristişor, Drăgoiasa, Budacu, Grinţieş; *Hieracium pojoritense* Woloszczak: Neagra Broşteni; *Hieracium ramosum* Waldst. et Kit.: Neagra Broşteni; *Hieracium transsylvanicum* Heuffel: Cristişor, Neagra Broşteni, Budacu; Drăgoiasa, Păltiniş; *Hieracium umbellatum* L.: Păltiniş, Glodu; *Homogyne alpina* (L.) Cass.: Izvorul Călimanului, Căliman Cerbuc, Cristişor, Budacu, Păltiniş; *Hypochoeris maculata* L.: Păltiniş, Cristişor, Broşteni, Neagra Broşteni; *Hypochoeris radicata* L.: Broşteni, Cristişor, Dârmoxa; *Hypochoeris uniflora* Vill.: Păltiniş, Catrinari, Broşteni, Izvorul Călimanului, Budacu; *Inula ensifolia* L.: Păltiniş, Neagra Broşteni; *Inula salicina* L.: Broşteni; *Lapsana communis* L.: Broşteni, Neagra Broşteni, Budacu; *Leontodon autumnalis* L.: Broşteni, Drăgoiasa, Cristişor, Neagra Broşteni, Păltiniş; *Leontodon hispidus* L.: Broşteni, Cristişor, Drăgoiasa; *Leucanthemum vulgare* Lam.: Broşteni, Cristişor, Drăgoiasa, Budacu, Glodu, Neagra Broşteni; *Leucanthemum waldsteinii* (Schulty Bip.) Pouzar: Broşteni, Neagra Broşteni, Cristişor, Grinţieş mountain, Căliman Cerbuc; *Ligularia sibirica* (L.) Cass.: Drăgoiasa, Cristişor peat-bog; *Matricaria discoidea* DC.: Păltiniş, Broşteni; *Matricaria recutita* L.: Broşteni; *Mycelis muralis* (L.) Dumort.: Neagra Broşteni, Cristişor peat-bog, Budacu, Păltiniş; *Petasites albus* (L.) Gaertn.: Cristişor peat-bog, Neagra Broşteni; *Petasites hybridus* (L.) P. Gaertn., B. Meyer et Schreb.: Cristişor peat-bog, Dârmoxa, Neagra Broşteni, Drăgoiasa; *Picris hieracioides* L.: Neagra Broşteni, Broşteni; *Prenanthes purpurea* L.: Căliman Cerbuc; *Scorzonera rosea* Waldst. et Kit.: Broşteni, Păltiniş, Izvorul Călimanului, Căliman Cerbuc, Budacu, Grinţieş; *Senecio germanicus* Wallr.: Izvorul Călimanului, Căliman Cerbuc; *Senecio glaberrimus* (Rochel) Simokai: Izvorul Călimanului, Căliman Cerbuc; *Senecio jacobaea* L.: Broşteni, Neagra Broşteni; *Senecio ovatus* (P. Gaertn., B. Meyer et Schreb.) Willd.: Negrişoara, Izvorul Călimanului, Căliman Cerbuc, Cristişor peat-bog, Neagra Broşteni, Glodu, Păltiniş, Budacu; *Senecio sarracenicus* L.: Broşteni, Arsurii rivulet; *Senecio squalidus* L.: Neagra Broşteni, Budacu; *Senecio viscosus* L.: Broşteni, Glodu; *Solidago virgaurea* L. ssp. *minuta* (L.) Archangeli: Broşteni, Izvorul Călimanului, Păltiniş, Cristişor, muntele Grinţieş, Ortoiţa rivulet; *Sonchus arvensis* L.: Cristişor peat-bog [LUNGU, 1969]; Broşteni; *Sonchus asper* (L.) Hill: Păltiniş, Neagra Broşteni; *Sonchus oleraceus* L.: Păltiniş, Broşteni; *Tanacetum corymbosum* (L.) Schultz Bip.: Broşteni, Grinţieş, Budacu; *Tanacetum vulgare* L.: Broşteni; *Taraxacum officinale* Weber ex Wiggers: Broşteni, Neagra Broşteni, Păltiniş, Negrişoara, Cristişor, Budacu, Drăgoiasa; *Telekia speciosa* (Schreb.) Baumg.: Neagra Broşteni, Budacu, Grinţieş, Drăgoiasa, Izvorul Călimanului, Căliman Cerbuc, Glodu; *Tragopogon pratensis* L. ssp. *orientalis* (L.) Čelak: Broşteni, Păltiniş, Neagra Broşteni; *Tussilago farfara* L.: Broşteni, Drăgoiasa, Glodu, Păltiniş, Căliman Cerbuc; *Xanthium spinosum* L.: Neagra Broşteni;

Liliatae (Monocotyledonatae)

Alismataceae: *Alisma lanceolatum* With.: Broşteni, Neagra Broşteni; *Alisma plantago-aquatica* L.: Broşteni, Neagra Broşteni, Păltiniş, Cristişor; *Sagittaria sagittifolia* L.: Broşteni [SĂVULESCU T. (eds.) & al., 1952-1976]; **Juncaginaceae**: *Triglochin palustre* L.: Păltiniş, Drăgoiasa, Cristişor peat-bog; **Scheuchzeriaceae**: *Scheuchzeria palustris* L.: Cristişor peat-bog; Drăgoiasa; **Trilliaceae**: *Paris quadrifolia* L.: Broşteni, Dârmoxa, Cristişor, Neagra Broşteni; Păltiniş; **Liliaceae**: *Colchicum autumnale* L.: Dârmoxa, Neagra, Păltiniş, Drăgoiasa; *Gagea lutea* (L.) Ker-Gawl.: Cristişor peat-bog [LUNGU, 1969], Broşteni; *Gagea pratensis* (Pers.) Dumort.: Broşteni [MITITELU & al., 1989]; *Lilium martagon* L.: Broşteni; Neagra Broşteni, Păltiniş, Izvorul Călimanului, Căliman Cerbuc, Budacu; *Maianthemum bifolium* (L.) F.W. Schmidt: Broşteni, Păltiniş, Cristişor peat-bog, Grinţieş mountain, Budacu; Dragoiasa, Neagra Broşteni; *Polygonatum latifolium* (Jacq.) Desf.: Cristişor; *Polygonatum odoratum* (Miller) Druce: Budacu; *Polygonatum multiflorum* (L.) All.: Broşteni [BRÂNZĂ, 1883]; *Polygonatum verticillatum* (L.) All.: Bradului rivulet, Păltiniş, Cristişor peat-bog, Budacu, Neagra Broşteni; *Scilla bifolia* L.: Neagra Broşteni; *Streptopus amplexifolius* (L.) DC.:

Broşteni, Bradului rivulet, Cristişor peat-bog, Neagra Broşteni; *Veratrum album* L.: Broşteni, Neagra Broşteni, Păltiniş, Izvorul Călimanului, Căliman Cerbuc, Cristişor, Budacu, Glodu, Dragoiasa; **Alliaceae**: *Allium senescens* L. ssp. *montanum* (Fries) Holub.: Budacu; *Allium victorialis* L.: Izvorul Călimanului, Grinţieş; **Amaryllidaceae**: *Galanthus nivalis* L.: Broşteni; **Iridaceae**: *Crocus vernus* (L.) Hill: Bradului rivulet, Dârmoxa, Păltiniş, Drăgoiasa, Căliman Cerbuc, Budacu; *Gladiolus imbricatus* L.: Neagra Broşteni; *Iris pseudacorus* L.: Neagra Broşteni; *Sisyrinchium montanum* E. L. Greene: Budacu, Drăgoiasa; **Orchidaceae**: *Anacamptis pyramidalis* (L.) Rich.: Păltiniş, Neagra Broşteni; *Cephalanthera longifolia* (L.) Fritsch: Broşteni, Glodu; *Cephalanthera rubra* (L.) L.C.M. Richard: Drăgoiasa; *Corallorrhiza trifida* Chatel.: Grinţieş, Broşteni [PANŢU, 1915]; Cristişor peat-bog [LUNGU, 1969]; Izvorul Călimanului, Căliman Cerbuc; *Cypripedium calceolus* L.: Broşteni; *Dactylorhiza cordigera* (Fries) Soó: Drăgoiasa; *Dactylorhiza fistulosa* (Moench) H. Baumann et Kunkele: Budacu; *Dactylorhiza maculata* (L.) Soó: Păltiniş, Neagra Broşteni, Cristişor peat-bog, Drăgoiasa; *Dactylorhiza sambucina* (L.) Soó: Budacu; *Epipactis atrorubens* (Hoffm.) Besser: Drăgoiasa; *Epipactis helleborine* (L.) Crantz: Broşteni, Neagra Broşteni; *Epipactis palustris* (L.) Crantz: Broşteni, Neagra Broşteni, Păltiniş, Drăgoiasa; *Goodyera repens* (L.) R. Br.: Păltiniş, Neagra Broşteni; *Gymnadenia conopsea* (L.) R. Br.: Broşteni, Păltiniş, Cristişor, Izvorul Călimanului, Drăgoiasa, Neagra Broşteni; *Gymnadenia odoratissima* (L.) Rich.: Neagra Broşteni; Cristişor; *Herminium monorchis* (L.) R. Br.: Broşteni [BRÂNDZĂ, 1883], Neagra Broşteni [SEGHEDIN, 1986], Cristişor peat-bog [LUNGU, 1969]; *Listera cordata* (L.) R. Br.: Neagra Broşteni, Budacu, Grinţieş; *Listera ovata* (L.) R. Br.: Păltiniş, Cristişor; *Microstylis monophyllos* (L.) Lindley: Cristişor peat-bog [LUNGU, 1969]; *Neottia nidus-avis* (L.) Rich.: Neagra Broşteni, Budacu; *Nigritella rubra* (Wettst.) K. Richter: Păltiniş [SEGHEDIN, 1986]; *Orchis coriophora* L.: Broşteni [PANŢU, 1915]; *Orchis militaris* L.: Păltiniş, Neagra Broşteni; *Orchis ustulata* L.: Păltiniş, Budacu; *Platanthera bifolia* (L.) Rich.: Neagra Broşteni, Budacu, Drăgoiasa; *Pseudorchis albida* (L.) A. et D. Löve: Izvorul Călimanului, Căliman Cerbuc; *Traunsteinera globosa* (L.) Reichenb.: Broşteni, Păltiniş, Izvorul Călimanului, Drăgoiasa; **Juncaceae**: *Juncus articulatus* L.: Negrei Broşteni, Cristişor peat-bog, Drăgoiasa; *Juncus bufonius* L.: Drăgoiasa, Cristişor peat-bog, Neagra Broşteni; *Juncus compressus* Jacq.: Cristişor peat-bog, Broşteni, Drăgoiasa, Budacu; *Juncus conglomeratus* L.: Păltiniş, Cristişor peat-bog, Drăgoiasa, Budacu, Neagra Broşteni; *Juncus effusus* L.: Broşteni, Păltiniş, Neagra Broşteni, Cristişor peat-bog, Drăgoiasa, Arsurii rivulet; *Juncus gerardi* Loisel.: Cristişor, Broşteni; *Juncus inflexus* L.: Păltiniş, Cristişor peat-bog, Grinţieşul Mic, Drăgoiasa, Neagra Broşteni; *Juncus subnodulosus* Schrank: Grinţieşul Mic [MITITELU & al., 1989]; *Juncus tenuis* Willd.: Păltiniş, Cristişor peat-bog, Grinţieşul Mic, Glodu; *Juncus thomasii* Ten.: Broşteni [PROCOPIANU-PROCOPOVICI, 1906]; Grinţieşul Mic [MITITELU & al., 1989]; Izvorul Călimanului, Căliman Cerbuc [CSÜRÖS, 1951]; *Juncus trifidus* L.: Izvorul Călimanului, Căliman Cerbuc, Grinţieşul Mic, Budacu; *Juncus triglumis* L.: Grinţieşul Mic; *Luzula campestris* (L.) DC.: Cristişor, Drăgoiasa, Budacu, Neagra Broşteni; *Luzula luzuloides* (Lam.) Dandy et Wilmott ssp. *rubella* (Hoppe ex Mert. et Koch) Holub.: Izvorul Călimanului, Căliman Cerbuc, Budacu; ssp. *luzuloides*: Izvorul Călimanului, Căliman Cerbuc, Neagra Broşteni, Păltiniş, Cristişor peat-bog, Budacu, Drăgoiasa; *Luzula multiflora* (Ehrh.) Lej.: Izvorul Călimanului, Căliman Cerbuc [CSÜRÖS, 1951]; *Luzula pallescens* Swartz: Cristişor peat-bog; *Luzula pilosa* (L.) Willd.: Cristişor peat-bog [LUNGU, 1969]; *Luzula spicata* (L.) DC.: Izvorul Călimanului, Căliman Cerbuc, Cristişor peat-bog, Drăgoiasa, Budacu; *Luzula sudetica* (Willd.) Schult.: Drăgoiasa, Dârmoxa; *Luzula sylvatica* (Huds.) Gaudin: Grinţieşul Mic, Cristişor peat-bog, Budacu, Drăgoiasa, Păltiniş; **Cyperaceae**: *Blysmus compressus* (L.) Panzer ex Link: Păltiniş, Drăgoiasa; *Carex acuta* L.: Neagra Broşteni, Cristişor peat-bog, Drăgoiasa; *Carex acutiformis* Ehrh.: Broşteni, Arsurii rivulet; *Carex alba* Scop.: Neagra Broşteni, Bradului rivulet, Păltiniş; *Carex appropinquata* Schumacher: Drăgoiasa [POP, 1960]; Cristişor peat-bog [LUNGU, 1969]; *Carex atrata* L.: Izvorul Călimanului, Căliman Cerbuc; *Carex brizoides* L.: Cristişor peat-bog, Neagra Broşteni; *Carex brunnescens* (Pers.) Poir.: Cristişor peat-bog [MITITELU & al., 1989]; *Carex buekii* Wimmer: Cristişor peat-bog [LUNGU, 1969]; *Carex capillaris* L.: Drăgoiasa [MITITELU & al., 1989]; *Carex caryophyllea* Latourr.: Drăgoiasa [MITITELU & al., 1989]; *Carex chordorrhiza* L. fil.: Drăgoiasa [ŞTEFUREAC & al., 1963]; *Carex curta* Good.: Drăgoiasa, Neagra Broşteni, Cristişor peat-bog, Păltiniş; *Carex diandra* Schrank: Drăgoiasa, Cristişor peat-bog; *Carex digitata* L.: Drăgoiasa; Neagra Broşteni; *Carex dioica* L.: Drăgoiasa, Cristişor peat-bog; *Carex distans* L.:

Cristişor peat-bog, Drăgoiasa, Budacu; *Carex echinata* Murray: Păltiniş, Drăgoiasa, Cristişor peat-bog, Neagra Broşteni; *Carex elongata* L: Cristişor peat-bog [LUNGU, 1969]; *Carex flava* L.: Păltiniş, Drăgoiasa, Cristişor peat-bog, Neagra Broşteni; Glodu; *Carex hirta* L.: Cristişor peat-bog, Neagra Broşteni; *Carex humilis* Leyss.: Bradului rivulet, Păltiniş; *Carex lasiocarpa* Ehrh: Drăgoiasa, Cristişor peat-bog; *Carex lepidocarpa* Tausch.: Cristişor peat-bog; *Carex limosa* L.: Drăgoiasa, Cristişor; *Carex loliacea* L.: Drăgoiasa [ŞTEFUREAC & al., 1963]; Cristişor peat-bog; *Carex montana* L.: Păltiniş, Budacu; *Carex nigra* (L.) Reichard ssp. *nigra*: Drăgoiasa, Cristişor peat-bog, Arsurii rivulet, Neagra Broşteni; *Carex ovalis* Good.: Drăgoiasa, Cristişor peat-bog, Păltiniş, Budacu; *Carex pairae* F. W. Schultz: Cristişor peat-bog; *Carex pallescens* L.: Păltiniş, Neagra Broşteni, Cristişor, Drăgoiasa, Budacu; *Carex panicea* L.: Cristişor peat-bog [LUNGU, 1969]; *Carex paniculata* L.: Drăgoiasa; *Carex pauciflora* Lightf.: Drăgoiasa [ŞTEFUREAC & al., 1963]; Cristişor peat-bog [LUNGU, 1969]; *Carex pendula* Huds.: Păltiniş, Broşteni, Neagra Broşteni; *Carex pilosa* Scop.: Păltiniş, Broşteni, Dârmoxa, Neagra Broşteni; *Carex pseudocyperus* L.: Cristişor peat-bog; *Carex remota* L.: Cristişor; *Carex riparia* Curt.: Neagra Broşteni, Drăgoiasa; *Carex rostrata* Stokes: Drăgoiasa, Neagra Broşteni, Cristişor peat-bog, Neagra Broşteni; *Carex spicata* Huds.: Cristişor peat-bog, Broşteni, Neagra Broşteni; *Carex sylvatica* Huds.: Negrişoara, Cristişor, Budacu; *Carex tomentosa* L.: Drăgoiasa; *Carex vesicaria*: Neagra Broşteni, Drăgoiasa, Cristişor, Arsurii rivulet; *Carex vulpina* L.: Neagra Broşteni, Păltiniş, Drăgoiasa, Budacu; *Cladium mariscus* (L.) Pohl.: Drăgoiasa, Cristişor; *Eleocharis palustris* (L.) Roem. et Schult.: Păltiniş, Cristişor, Drăgoiasa, Arsurii rivulet; *Eriophorum angustifolium* Honck.: Drăgoiasa, Cristişor peat-bog; *Eriophorum latifolium* Hoppe: Drăgoiasa, Păltiniş, Cristişor peat-bog; *Eriophorum vaginatum* L.: Drăgoiasa, Cristişor peat-bog; *Rhynchospora alba* (L.) Vahl: Păltiniş [SEGHEDIN, 1986]; *Scirpus sylvaticus* L.: Izvorul Călimanului, Căliman Cerbuc, Drăgoiasa, Cristişor peat-bog, Păltiniş, Budacu, Neagra Broşteni, Glodu; **Poaceae**: *Agrostis canina* L.: Drăgoiasa, Neagra Broşteni; *Agrostis capillaris* L.: Broşteni, Păltiniş, Drăgoiasa, Cristişor, Neagra Broşteni, Izvorul Călimanului, Căliman Cerbuc, Dârmoxa, Glodu; *Agrostis stolonifera* L.: Neagra Broşteni, Broşteni, Cristişor peat-bog, Drăgoiasa; *Alopecurus aequalis* Sobol.: Neagra Broşteni, Cristişor, Arsurii rivulet; *Alopecurus geniculatus* L.: Broşteni; Neagra Broşteni; *Alopecurus pratensis* L.: Cristişor, Broşteni, Drăgoiasa; *Anthoxanthum odoratum* L.: Broşteni, Drăgoiasa, Cristişor, Izvorul Călimanului, Căliman Cerbuc, Budacu, Neagra Broşteni; *Apera spica-venti* (L.) Beauv.: Broşteni [GRECESCU, 1898]; *Arrhenatherum elatius* (L.) Beauv.: Broşteni, Drăgoiasa, Neagra Broşteni; *Avenula planiculmis* (Schrader) W. Sauer et Chmelitschek: Neagra Broşteni; *Avenula pubescens* (Huds.) Dumort.: Neagra Broşteni; *Brachypodium pinnatum* (L.) Beauv.: Neagra Broşteni, Broşteni, Păltiniş; *Brachypodium sylvaticum* (Huds.) Beauv.: Negrişoara, Neagra Broşteni, Cristişor peat-bog, Broşteni; *Briza media* L.: Broşteni, Cristişor peat-bog, Drăgoiasa, Neagra Broşteni, Căliman Cerbuc; *Bromus arvensis* L.: Broşteni [GRECESCU, 1898]; *Bromus commutatus* Schrad.: Păltiniş, Broşteni, Neagra Broşteni; *Bromus hordeaceus* L.: Broşteni [GRECESCU, 1898]; Cristişor peat-bog [LUNGU, 1969]; *Bromus tectorum* L.: Păltiniş [SEGHEDIN, 1986]; *Calamagrostis arundinacea* (L.) Roth: Broşteni, Neagra Broşteni, Izvorul Călimanului, Cristişor peat-bog, Dragoiasa, Budacu; *Calamagrostis canescens* (Weber) Roth: Păltiniş, Cristişor; *Calamagrostis epigeios* (L.) Roth: Drăgoiasa, Cristişor, Broşteni; *Calamagrostis stricta* (Timm) Koeler: Drăgoiasa; *Calamagrostis villosa* (Chaix) Gmel.: Grinţieş, Broşteni, Drăgoiasa, Căliman Cerbuc; *Catabrosa aquatica* (L.) Beauv.: Broşteni [MITITELU & al., 1989]; *Cynosurus cristatus* L.: Broşteni, Păltiniş, Cristişor, Drăgoiasa, Neagra Broşteni, Glodu; *Dactylis glomerata* L.: Bradului rivulet, Păltiniş, Cristişor, Broşteni, Drăgoiasa, Glodu, Neagra Broşteni, Budacu; *Dactylis polygama* Horv.: Neagra Broşteni; *Danthonia decumbens* (L.) DC.: Budacu; *Deschampsia caespitosa* (L.) Beauv.: Păltiniş, Drăgoiasa, Broşteni, Neagra Broşteni, Cristişor peat-bog, Izvorul Călimanului, Căliman Cerbuc, Dârmoxa; *Deschampsia flexuosa* (L.) Trin.: Păltiniş, Izvorul Călimanului, Căliman Cerbuc, Budacu; *Echinochloa crus-galli* (L.) Beauv.: Broşteni; *Elymus caninus* (L.) L.: Cristişor peat-bog [LUNGU, 1969]; *Elymus repens* (L.) Gould.: Broşteni; *Festuca gigantea* (L.) Vill.: Cristişor peat-bog, Broşteni, Arsurii rivulet; *Festuca nigrescens* Lam.: Păltiniş, Budacu, Grinţieş, Căliman Cerbuc; *Festuca picta* Kit.: Izvorul Călimanului, Căliman Cerbuc [CSÜRÖS, 1951]; *Festuca pratensis* Huds. ssp. *pratensis*: Drăgoiasa; Păltiniş, Neagra Broşteni; ssp. *apennina* (De Not.) Hegi: Neagra Broşteni, Cristişor peat-bog; *Festuca rubra* L.: Broşteni, Păltiniş, Cristişor peat-bog, Drăgoiasa, Izvorul Călimanului, Budacu, Neagra Broşteni, Glodu; *Festuca supina* Schur: Grinţieş,

Izvorul Călimanului, Căliman Cerbuc, Budacu; *Festuca versicolor* Tausch.: Grinţieş; *Glyceria fluitans* (L.) R. Br.: Cristişor; Neagra Broşteni; *Glyceria maxima* (Hartm.) Holmberg: Broşteni; *Glyceria notata* Chevall.: Neagra Broşteni, Păltiniş, Cristişor peat-bog, Drăgoiasa; *Holcus lanatus* L.: Broşteni, Negrişoara, Dârmoxa, Neagra Broşteni, Cristişor peat-bog, Drăgoiasa; *Holcus mollis* L.: Broşteni, Neagra Broşteni; *Koeleria macrantha* (Ledeb.) Schultes: Dârmoxa; *Lolium perenne* L.: Păltiniş, Neagra Broşteni, Broşteni; *Melica nutans* L.: Neagra Broşteni; *Melica uniflora* Retz.: Neagra Broşteni; *Milium effusum* L.: Neagra Broşteni, Cristişor, Drăgoiasa, Budacu; Căliman Cerbuc; *Molinia caerulea* (L.) Moench: Neagra Broşteni, Păltiniş, Drăgoiasa, Cristişor peat-bog; *Nardus stricta* L.: Grinţieş, Păltiniş, Cristişor, Budacu, Neagra Broşteni, Izvorul Călimanului, Căliman Cerbuc, Dârmoxa; *Phalaris arundinacea* L.: Cristişor peat-bog [LUNGU, 1969]; *Phleum alpinum* L.: Broşteni [BRÂNDZĂ, 1883]; Izvorul Călimanului, Căliman Cerbuc; *Phleum bertolonii* DC.: Cristişor peat-bog [LUNGU, 1969]; *Phleum hirsutum* Honck.: Broşteni; *Phleum pratense* L.: Broşteni, Păltiniş, Drăgoiasa, Neagra Broşteni; *Phragmites australis* (Cav.) Steud.: Arsurii rivulet; *Poa annua* L.: Broşteni, Păltiniş, Cristişor peat-bog, Neagra Broşteni; *Poa chaixii* Vill.: Grinţieş, Neagra Broşteni, Izvorul Călimanului, Budacu; *Poa nemoralis* L.: Neagra Broşteni, Broşteni, Budacu, Drăgoiasa; *Poa palustris* L.: Păltiniş, Cristişor, Neagra Broşteni; *Poa pratensis* L.: Păltiniş, Drăgoiasa, Cristişor peat-bog, Neagra Broşteni; *Poa trivialis* L.: Cristişor, Glodu; *Sesleria heuflerana* Schur: Broşteni [POPOVICI & al., 1996]; *Setaria pumila* (Poiret) Schult.: Păltiniş, Broşteni; *Setaria verticillata* (L.) Beauv.: Păltiniş, Broşteni; *Setaria viridis* (L.) Beauv.: Broşteni; *Trisetum flavescens* (L.) Beauv.: Broşteni, Neagra Broşteni; **Sparganiaceae**: *Sparganium emersum* Rehm.: Păltiniş [SEGHEDIN, 1986]; Cristişor; *Sparganium erectum* L.: Cristişor peat-bog; ssp. *neglectum* (Beeby) Richter: Drăgoiasa, Neagra Broşteni; **Typhaceae**: *Typha latifolia* L.: Neagra Broşteni; *Typha shuttlewortii* Koch et Sonder: Neagra Broşteni, Arsurii rivulet; Cristişor; **Araceae**: *Calla palustris* L.: Broşteni [MITITELU & al., 1989]; **Lemnaceae**: *Lemna minor* L.: Neagra Broşteni, Cristişor; Arsurii rivulet.

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NORTH-EAST ROMANIA AS A FUTURE SOURCE OF TREES FOR URBAN PAVED ENVIRONMENTS IN NORTH-WEST EUROPE

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Abstract: Trees are an important feature of the urban environment. The problem today lies not in finding a wide range of well-adapted tree species for park environments, but in finding species suitable for urban paved sites. In terms of north-west Europe, it is unlikely that the limited native dendroflora will provide a large variety of tree species with high tolerance to the environmental stresses characterising urban paved sites in the region. However, other regions with a comparable climate but with a rich dendroflora can potentially provide new tree species and genera well-suited to the growing conditions at urban sites in north-west Europe. This paper examines the potential of a geographical area extending over north-east Romania and the Republic of Moldavia to supply suitable tree species for urban paved sites in Central and Northern Europe (CNE). The study involved comparing the temperature, precipitation, evapotranspiration and water runoff in the woodland area of Iasi, Romania, with those the current inner-city climate of Copenhagen, Denmark and those predicted for Copenhagen 2100. The latter included urban heat island effects and predicted global climate change. The results revealed similar pattern in summer water deficit and temperature between natural woodlands in Iasi and inner-city environment of Copenhagen today. On the other hand, there is a weak match between Iasi and the future Copenhagen. In order to match the future scenario of Copenhagen with the present situation in Iasi, a greater understanding in a early phase that the solution not only depends on suitable tree species, but also on technical solutions being developed in order to have trees in paved environments in the future. On the basis of precipitation and temperature data, natural woodlands in north-east Romania have the potential to be a source of suitable trees for urban paved environments in the CNE region, even for a future climate if other aspects in the planning of trees in paved sites are included.

Keywords: Urban paved environment, city trees, site-adapted species use, urban heat island, climate change.

Introduction

Trees fulfil important aesthetic, social and environmental functions in urban areas. However, trees growing along streets and in paved environments are exposed to numerous hostile factors such as heat, drought, soil compaction, pollution, de-icing salt, high soil lime content and high soil p*H*, which cause reduced vitality and decline and render trees susceptible to pest and diseases [PAULEIT, 2003]. The sealed surface and increased temperatures in cities minimise water infiltration, while simultaneously increasing evaporation rates [FLINT, 1985]. Therefore, many trees in urban paved sites are periodically exposed to critical water stress. In addition to the negative site conditions in urban paved environments, another serious threat to urban tree stocks is lack of diversity, particularly in view of predicted climate change. Traditionally, a limited number of species and genera have dominated urban tree stocks, and recent surveys in European and North American cities show that a few species/genera continue to dominate, especially in urban paved sites [e.g. BÜHLER O. & al. 2007; PAULEIT & al., 2002; RAUPP & al. 2006]. Furthermore, many of the most used tree species show severe symptoms of decline. The recurring outbreaks of

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disease in some of the most commonly used species and the threat of future diseases and pest infestations [e.g. RAUPP & al. 2006; SUN, 1992; TELLO & al. 2005] have led to considerable and persistent arguments on the necessity of using a wider range of species that are better adapted to the harsh conditions in urban paved environments [BARKER, 1975; BASSUK & al. 2003; GREY & DENEKE, 1986; MILLER & MILLER, 1991; MOLL, 1989; SANTAMOUR, 1990; SMILEY E. T., KIELBASO & PROFFER, 1986].

The awareness of habitat factors when bringing trees to city parks, squares and avenues was probably not much developed in the past, partly because the city environment did not differ that much from the local natural habitat at that time. Therefore most of the city trees were origin from local forest areas. Nowadays we tend to use the same species as before, in spite of the fact that the city habitat has changed very much and nowadays have few similarities with the natural grow conditions in the local woodlands and this pattern will change even further in the future.

Therefore, identification of natural environments where trees have evolved in habitats more related to the paved city context may be a successful strategy for selection of new species for urban areas [WARE, 1994]. There are several areas of the world with a climate regime that is similar to the microclimate of streets, squares and courtyards. These areas are mainly found in continental regions, as the continental climate type has obvious similarities to the inner city climate.

Today, we face two important challenges in the planning and management of trees in urban streets and other paved sites. Firstly, there is a need for more knowledge and practical experience about site-adapted use of species. Secondly, a greater variety of species and genus with natural adaptations for surviving and developing well at such sites needs to be introduced. The objective of this paper was to examine the potential of a geographical area encompassing north-east Romania and the Republic of Moldavia to supply suitable tree species for urban paved environments in northern parts of Central Europe and in adjacent, mild parts of Northern Europe (in the following abbreviated to ‘the CNE region’). This study forms part of a four-year research programme initiated by the Swedish University of Agricultural Sciences to examine selection of site-adapted species for urban paved sites, with the main focus on identifying geographical areas in the world which have the potential to supply promising tree species for further evaluation.

Global and local climate changes

The modern city creates its own climate, with warmer temperatures compared with the surrounding rural landscape, a phenomenon normally referred to as *Urban Heat Island* (UHI). The city is warmer than the countryside because of differences between the energy gains and losses in each region [KING & DAVIS, 2007]. In a city of 1 million people, this UHI effect can increase the mean annual temperature by 1-3 ^{o}C and in the evening the difference between inner-city environment and surrounding rural landscape can be as high as 12 ^{o}C [LANDSBERG, 1981; US EPA, 2009]. The UHI effect will be much more pronounced in the future as a result of the expected climate change in the CNE region, which is predicted to adversely affect the conditions for tree growth through increased average temperatures of 2-6 ^{o}C combined with more frequent heatwaves and periods of drought during summer [GILL & PAULEIT, 2007; IPCC, 2007; SOU, 2007].

Among the multiple stress factors that characterise urban paved sites, water stress is widely argued to be the main constraint for tree growth and health [e.g. CRAUL, 1999; WHITLOW & BASSUK, 1986]. Water stress is likely to become much more severe in paved city environments in the future, since the UHI effect combined with predicted

climate change is likely to cause an increase in mean annual temperature [SIEGHARDT & RANDRUP, 2005; WARE, 1994]. A recent study in Copenhagen, Denmark, indicated that street trees suffer from water stress even in this temperate climate today and this will get worse in the predicted future [BÜHLER & LARSEN, 2007]. This suggests that trees that are able to cope with critical periods of water stress in nature and develop well despite such stress would be of particular interest in future selection of trees for use in urban paved environments.

Areas suitable for supplying trees for urban paved environments in the CNE region

In nature, trees have been stress-tested and selected over evolutionary periods of time. Some species have developed an extensive plasticity and tolerance to a range of environmental conditions, while others have specialised in certain habitat types [GUREVITCH & al. 2002]. In the search for new tree species to be used at urban paved sites, it may be helpful to look at the ecological background of species and concentrate on the selection of species that have specialised in natural habitats with an environment and climate similar to that of urban paved sites [DUCATILLION & DUBOIS, 1997; FLINT, 1985; SÆBØ & SLYCKEN, 2005; WHITLOW & BASSUK, 1986].

From the perspective of the CNE region, it is unlikely that the species-poor native dendroflora can contribute a large variety of tree species with extended tolerance to the environmental stresses characterising urban paved sites of the region [DUHME & PAULEIT, 2000]. However, other regions with a comparable climate yet having a rich dendroflora may potentially contain new tree species and genera well-suited to the growing conditions at such urban paved sites in the CNE region [BRECKLE, 2002; TELLO & al. 2005].

Materials and methods

Study areas: Iasi, north-east Romania, and Copenhagen, Denmark

One of the most interesting areas containing tree species growing in a climate and site conditions similar to those in urban paved environments in the CNE region is south-east Europe. In this area there is a much more continental climate, with cool winters and hot, dry summers. One particular region of interest is north-east Romania (the Moldavian region of Romania) together with the Republic of Moldavia, where various steppe forest types exist. In these steppe forest systems, trees have evolved in a climate with hot, dry summers combined with cold, dry winters. In order to evaluate the potential of this geographical area to supply suitable trees, climate data from a woodland area at Iasi in Romania and from the city of Copenhagen in Denmark were compared. Further, in order to evaluate the climate and site conditions from areas were the majority of the today most used city tree species origin from, also the conditions of woodlands in Copenhagen will be included in the comparison.

Data collection

In predicting the survival of trees transplanted from one region to another, precipitation, temperature, water runoff and evapotranspiration are considered to be the most important parameters [NEILSON & MARKS, 1994]. For our comparison, we obtained climate data for Iasi from Sirbu (2003) [SÎRBU, 2003] and for Copenhagen from the Danish Meteorological Institute [DMI, 2009]. Due to the predicted scenario of global climate changes the comparison with Iasi also included the predicted inner-city climate of Copenhagen 2100. In order to compare Iasi with the future scenario in Copenhagen, we obtained worst case scenario data due to global climate change in the region from the Swedish Meteorological and Hydrological Institute [SMHI, 2009].

As mentioned earlier, drought is the main stress factor for trees in urban paved environments. It is therefore important to predict the future potential water stress in the actual city or region of interest in order to match the tree supply area to requirements. This can be done by combining data on the climate parameters listed above with potential evaporation and water runoff and then comparing these data to assess the match between the areas. To calculate potential evapotranspiration, we used the regression model by Thornthwaite [THORNTHWAITE, 1948], where the potential evapotranspiration is a function of monthly values of temperature, number of sunshine hours per day and cloudiness. The numbers of sunshine days was then based on the amount of sunshine hours divided by day length [MEEUS, 1991]. The water runoff data were based on Pauleit and Duhme [PAULEIT & DUHME, 2000], were woodlands assumed to have less than 10% water runoff, and pavements in Copenhagen approximately 70% water runoff.

Results

The climate data presented in Table 1a and 1b show the current situation in the two areas, while Table 1c shows the climate situation in woodland areas of Copenhagen today. When comparing the climate data between urban paved sites and natural woodlands of Copenhagen today a significant difference is noticeably in the cumulative water net difference where the negative trend starts much earlier and is in greater quantity in paved sites due to a much more effective water runoff (Fig. 1). When comparing the climate of Iasi with Copenhagen today, annual precipitation is rather similar with 532mm in Iasi and 525mm in Copenhagen. Further, when comparing the summer precipitation (May-September) between the two areas the sum is again rather similar with 298mm in Iasi and 250mm in Copenhagen, yet the average temperature during same period much higher temperatures occur in Iasi with med. 19,2 ^{o}C compare to Copenhagen 14,5 ^{o}C. This difference in temperatures clearly affects the evapotranspiration which is much more effective in the warmer climate of Iasi (Tab. 1a and 1b). The cumulative water net difference between Iasi and Copenhagen today, differ somewhat with a partial water stress in April in the Copenhagen case while Iasi experiences a partial water stress in May (Fig. 1). Further, in both areas the water netto differences have a similar trend and quantity during the remaining season, yet with a slightly more negative trend in paved sites of Copenhagen today. This variation in water net difference between the areas disappear in July and August were same levels of water stress occur and thereafter it is Iasi which have a slightly higher water stress (Fig. 1). When comparing the water netto difference between woodlands areas in Iasi with woodlands areas in Copenhagen today, similar conclusion can be made as the comparison with paved sites of Copenhagen today – with a poor matching with each other (Fig. 1).

In the future climate scenario of Copenhagen 2100, the mean temperature during December, January and February increased by 9 ^{o}C whiles the temperature in the remaining months increased by 8 ^{o}C. In addition, precipitation during summer decreased by 50%, while precipitation during spring and autumn increased by with 15% and that in winter by 70% (Tab. 1d). Comparing the climate in Iasi and the future scenario in Copenhagen 2100, the annual precipitation still does not differ greatly. However, in summer (May-September) there is up to 111 mm less precipitation in the future Copenhagen and in terms of day temperatures in May-September, it is predicted to be 3,3 ^{o}C warmer in the future Copenhagen compare to the present situation in Iasi (Tab. 1d). When comparing the cumulative water net difference between Iasi and the future Copenhagen, a clear difference is visibly with a negative water netto already in March, which thereafter has a dramatically negative trend (Fig. 1).

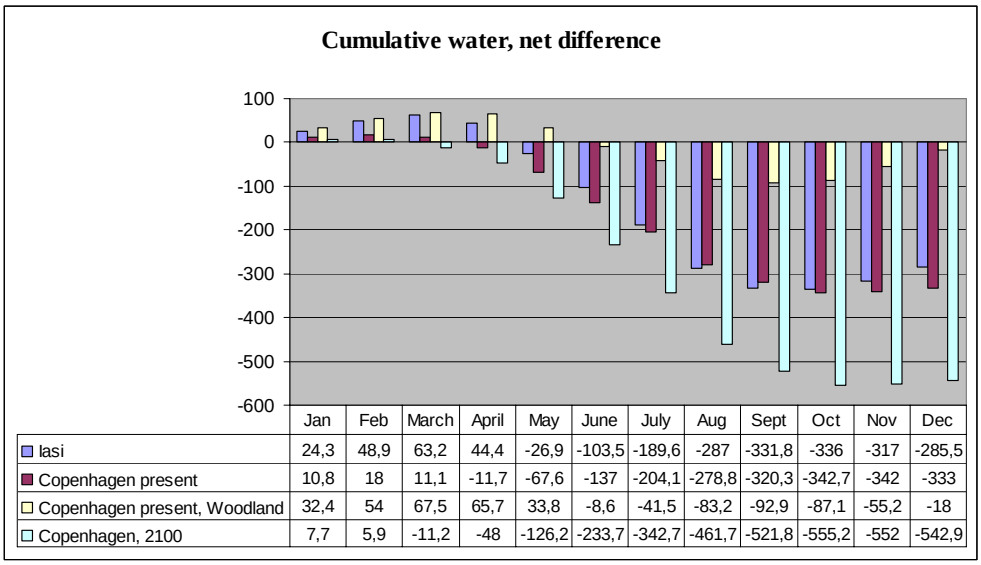
Tab. 1a-d. Heat and water stress conditions in natural woodland at Iasi compared with those in the inner-city environment and natural woodlands of Copenhagen at present and inner-city environment of a future Copenhagen, 2010.

Iasi	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Mean monthly temp. (ºC)	0	0,4	3,6	11,2	16,6	20,8	22	20,9	15,7	9,9	4	0
Sunshine daily (h)	9	9	12	13	16	16	17	19	16	14	8	7
Precipitation (mm)	27	28	29	36	34	64	74	70	56	48	31	35
Left after water runoff	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Potential evapotranspiration (mm)	0,0	0,1	1,2	5,2	9,2	12,2	13,3	11,7	7,4	3,9	1,2	0,0
Cumulative water net difference (mm)	24,3	48,9	63,2	44,4	-26,9	-103,5	-189,6	-287,0	-331,8	-336,0	-317,0	-285,5

Copenhagen, present	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Mean monthly temp. (ºC)	0	0	4	6	11	15	16.5	16.5	13.5	9.5	5	2
Sunshine daily (h)	6	8	10	13	14.5	13	12	13	10	9	7	6
Precipitation (mm)	36	24	34	35	40	45	57	55	53	47	52	47
Left after water runoff	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Potential evapotranspiration (mm)	0.0	0.0	2.1	3.3	6.8	9.3	10.4	9.8	7.1	4.7	2.2	0.9
Cumulative water, net difference (mm)	10.8	18.0	11.1	-11.7	-67.6	-137.0	-204.1	-278.8	-320.3	-342.7	-342.0	-333.0

Copenhagen, present, Woodland	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Mean monthly temp. (ºC)	0	0	4	6	11	15	16.5	16.5	13.5	9.5	5	2
Sunshine daily (h)	6	8	10	13	14.5	13	12	13	10	9	7	6
Precipitation (mm)	36	24	34	35	40	45	57	55	53	47	52	47
Left after water runoff	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Potential evapotranspiration (mm)	0.0	0.0	2.1	3.3	6.8	9.3	10.4	9.8	7.1	4.7	2.2	0.9
Cumulative water, net difference (mm)	32,4	54,0	67,5	65,7	33,8	-8,6	-41,5	-83,2	-92,9	-87,1	-55,2	-18,0

Copenhagen, 2100	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Mean monthly temp. (ºC)	9	9	12	14	19	23	24.5	24.5	21.5	17.5	13	11
Sunshine daily (h)	6	8	10	13	14.5	13	12	13	10	9	7	6
Precipitation (mm)	61	41	39	40	46	23	29	28	61	54	88	80
Left after water runoff	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Potential evapotranspiration (mm)	1.8	1.8	3.6	4.9	9.2	12.8	14.5	13.7	9.7	6.4	3.4	2.5
Cumulative water, net difference (mm)	7.7	5.9	-11.2	-48.0	-126.2	-233.7	-342.7	-461.7	-521.8	-555.2	-552.0	-542.9



	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Iasi	24,3	48,9	63,2	44,4	-26,9	-103,5	-189,6	-287	-331,8	-336	-317	-285,5
Copenhagen present	10,8	18	11,1	-11,7	-67,6	-137	-204,1	-278,8	-320,3	-342,7	-342	-333
Copenhagen present, Woodland	32,4	54	67,5	65,7	33,8	-8,6	-41,5	-83,2	-92,9	-87,1	-55,2	-18
Copenhagen, 2100	7,7	5,9	-11,2	-48	-126,2	-233,7	-342,7	-461,7	-521,8	-555,2	-552	-542,9

Fig. 1. The cumulative water net difference in natural woodland at Iasi compared with those in the inner-city environment and natural woodlands of Copenhagen at present and inner-city environment of a future Copenhagen, 2100.

Discussion

The grand old man in the sphere of modern arboriculture, Alex Shigo [SHIGO, 1991] said about the use and maintenance of city trees that: *"…we must understand the tree as it grows in its natural site first. To try to treat a city tree without understanding the tree as it grows in its natural site is like drawing a data curve with only an y axis; and no base line!"* To find trees suitable for urban paved sites, it has been suggested that the ecological background of species be examined and species specialised in natural habitats with environment and climate similar to that of urban paved sites be selected [DUCATILLION & DUBOIS, 1997; FLINT, 1985; SÆBØ & al. 2005; WARE, 1994].

This paper had the aim to compare natural growing conditions in south-east Europe with inner-city environment of Copenhagen. When comparing the site situations between paved sites and natural woodlands of Copenhagen today, a clear difference is noticeable with a much more stressful environment in paved sites due a more severe water stress based on an effective water runoff (Tab. 1b and 1c). This demonstrate the mismatch between these areas, yet this is still the background for the majority of the tree species in paved sites today which undoubtedly explain the poor health status of the tree stock in urban paved sites today. In the comparison between the climate and site conditions of natural woodlands in Iasi and inner-city environment of Copenhagen today, a much closer matching is noticeable (Tab. 1a and 1b). In the calculation of potential water stress, negative numbers occur in April of Copenhagen today while negative numbers occur in May in the Iasi case (Fig. 1). This difference continues until July and August when the water netto difference is similar in the two study areas. This spring and early summer differences is probably smaller then this calculation show. In the field of climate calculation, the main parameters are temperatures, precipitation, evapotranspiration and

water runoff [NEILSON & MARKS, 1994]. However, to get even more accurate results, local climate data on humidity, wind speed and solar radiation would also be included. Humidity has in this case almost certainly an important effect in the calculation depending on the northern location of Copenhagen which diminishes the water stress due to a much lesser transpiration. Therefore it is possible to conclude that the matching between natural woodlands in Iasi have a good corresponding with urban paved sites of Copenhagen today. The comparison with natural woodlands in Iasi with the future Copenhagen 2100, show a poor matching with a much earlier and dramatically water stress status in the future Copenhagen (Fig. 1). Even if parameters such as humidity were included in the calculation the poor matching between the areas will still remains.

If this worst case scenario of climate change materialises, the question is whether it will be possible to have healthy and long-living trees in urban paved environments in Copenhagen. It is important to understand at an early phase that the solution not only depends on suitable tree species being found, but also on technical solutions being developed in order to have trees in paved environments in the future [e.g. GRABOSKY & BASSUK, 1996; KRISTOFFERSSEN, 1999; ROBERTS & al. 2006; TROWBRIDGE & BASSUK, 2004]. In a future climate there will need to be an attitude change in the overall planning of urban green structures in order to create suitable living conditions for trees in urban paved environments. Therefore it can be interesting to know the differences in cumulative net water index based on changes in water runoff, as shown for the Copenhagen 2100 in Table 2. These data clearly indicate the potential of technical solutions that decrease runoff and thus increase water infiltration into the planting pits. This potentially gives significantly later and much less extreme water stress status for the trees, with a much closer matching with the woodlands of Iasi today (Tab. 2).

Tab. 2. Effect of reducing runoff rate from 70% to 50% or 25% on cumulative net water difference in Copenhagen 2100

Copenhagen, (2100)	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Cumulative water, net difference (mm) – water runoff 70%	7.7	5.9	-11.2	-48.0	-126.2	-233.7	-342.7	-461.7	-521.8	-555.2	-552.0	-542.9
Cumulative water, net difference (mm) – water runoff 50%	19.9	26.3	17.0	-11.8	-80.8	-183.7	-286.9	-400.3	-448.2	-470.8	-450.0	-424.9
Cumulative water, net difference (mm) – water runoff 25%	35.2	51.8	52.2	33.4	-24.1	-121.2	-217.1	-323.6	-356.2	-365.3	-322.5	-277.4

Conclusions

On the basis of precipitation and temperature data, natural woodlands in north-east Romania have the potential to be a source of suitable trees for urban paved environments in the CNE region, even for a future climate if other aspects in the planning of trees in paved sites are included. However this conclusion is based on only temperatures, precipitation, evapotranspiration and water runoff while data on a number of other climate and site factors are necessary for the definitive identification of potential climate matches. Furthermore, field investigations in the actual areas are essential to provide more detailed evidence. With these additional data, it will be possible to determine the potential of the

area to provide suitable species and candidate trees can be selected for further evaluation in test plantations in urban paved sites in the CNE region. Overall, this type of theoretical approach is necessary in identifying promising and matching areas in the world that can supply new tree species for urban paved environments.

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PLANTS SPECIES WITH DECORATIVE VALUE FROM *ROMANIAN RED LISTS* CULTIVATED IN „ANASTASIE FĂTU" BOTANIC GARDEN OF IAŞI

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Abstract: The wild flora of Romania includes a lot of species presenting decorative value, some of them being already taken in cultivation and other could represent new and important horticultural resources in the future. Numerous species under this category are rare and vulnerable because of their very small growing areas, habitats destruction or collection in commercial uses. The paper presents 31 species from this categories cultivated in "Anastasie Fatu" Botanic Garden of Iaşi. For each species, the biological and ecological particularities as well as the frequency, endemic character and national, European or global sozological category, are presented.

Key words: plants, red lists, botanic garden, decorative value

Introduction

The wild flora of our country includes approximately 170 ligneous and herbaceous species having decorative value [POP, 1982] some of them very appreciated for their beautiful aspect or the colouring and perfume of their flowers, other presenting a peculiar importance in the moments of leisure or being used to decorate parks and gardens. Some of them are included in various directives, conventions, red lists aiming their protection in the circumstances of the decline of their populations under the influence of numerous environmental and human factors.

Ex situ conservation of species from Romanian Red Lists, Romanian environment legislation, international conventions and European Commission directives represents a maximum importance target for "Anastasie Fătu" Botanic Garden of Iaşi. This institution has in its collections many plant species included under these documents, species presenting a special decorative value also (ex. *Paeonia romanica, Dictamnus albus, Campanula carpatica* etc.).

Material and method

In order to elaborate the ecological and biological data sheets of the plant species, we will take into consideration the following aspects: *systematic classification*: phylum, class, subclass, order, family, subfamily [CIOCÂRLAN, 2000]; *common name*; *bioform* [CIOCÂRLAN, 2000]: the knowledge of this last parameter for a certain species offers informations on the mode in which this plant is protecting its regenerative parts (ex. vegetative buds, generative formations) during unfavourable seasons for vegetation (cold or dry seasons) [CRISTEA, 2004]; *floristic element* [CIOCÂRLAN, 2000]: gives information

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on macro and micro-climate where a certain species is developing, illustrating even the role of environment in the growing of a species outside their main geographical areal [CRISTEA, 2004]; *ecological characterization*: for each species are presented some particular information regarding ecological preferences (light, temperature, humidity, soil *pH* etc.) [CIOCÂRLAN, 2000], [ELLENBERG, 1992]; *syntaxa including current species*: offers information about coenotaxa including in their floristic composition a certain species [CHIFU & al. 2006]; *frequency in Romania*: common, frequent, rare [CIOCÂRLAN, 2000]; *sozological category of species*: presents the threatening degree at national, european or global levels: National threatened – Romanian Red Lists [BOŞCAIU, 1994], [DIHORU & al., 1994], [OLTEAN, 1994]: EX (extinct), EN (endangered), VU (vulnerable), R (rare), I (indeterminata), NT (not threatened); European threatened: Habitats Directive 92/43/EEC Ann. II b and V and Bern Convention Ann. I: LR (low risk), CR (critically endangered), VU (vulnerable); Global threatened – Global Red List: CR (critically endangered), EN (endangered), VU (vulnerable); *decorative elements*: aspect, leafs, flowers, fruits etc. [PÂRVU 2002 – 2005]; *uses*: the mode of use in parks and gardens [PÂRVU 2002 – 2005]; *propagation modalities*: by seeds, bulbs, rhysomes etc. [PÂRVU 2002 – 2005]

Results and discussion

Abies alba Mill. – systematic classification: *Pinophyta, Pinatae, Pinales, Pinaceae, Abietoideae*; common name: fir; bioform: phanerophyte; floristic element: central european (mountainous); ecological characterization: mesophyte-mesohygrophyte, mesotherme, heliophyte-sciophyte and moderate acidophilous-neutrophilous, mesotrophic; syntaxa including current species: *Abieti-Piceion, Symphyto-Fagion, Piceion excelsae*; frequency in Romania: frequent; sozological category: RRL: EN (endangered); decorative elements: compact cylindrical-pyramidal habitus, leafs and cones; uses: indicated to be cultivated (isolated, in gropus or large massifs) in parks and public gardens from mountainous to hilly regions; propagation modalities: by seeds, cuttings and grafting cuttings.

Acanthus balcanicus Heywood et I. B. K. Richardson – systematic classification: *Magnoliophyta, Magnoliatae, Asteridae, Scrophulariales, Acanthaceae*; common name: bear's breech; bioform: hemicryptophyte; floristic element: balkanic; ecological characterization: xerophyte, thermophyte; syntaxa including current species: *Orno – Cotinetalia*; frequency in Romania: rare; sozological category: RRL: VU (vulnerable); decorative elements: great leafs and white or white-blue flowers groupped in dense terminal inflorescences; uses: species used to frame the flowers beds. It can also be used in the middle of a large landscape, at the margins of arborescent massifs or isolated in lawns; propagation modalities: by seeds and cuttings.

Amygdalus nana L. **–** systematic classification: *Magnoliophyta*, *Magnoliatae*, *Rosidae*, *Rosales*, *Rosaceae*, *Prunoideae*; common name: dwarf almod; bioform: phanerophyte; floristic element: eurasiatic (continental); ecological characterization: xerophyte, thermophilous, mesotrophic; syntaxa including current species: *Prunion spinosae*; frequency in Romania: sporadic; sozological category: RRL: VU (vulnerable); decorative elements: inflorescences with pink flowers; uses: ornamental shrub cultivated in massifs by a remarkable effect in spring when it abundantly blooms. It resists perfectly to drought and can be cultivated in arid or rocky grounds; propagation modalities: by seeds.

Asphodeline lutea (L.) Rchb. – systematic classification: *Magnoliophyta*, *Liliatae*, *Liliidae*, *Liliales*, *Liliaceae, Asphodeloideae*; common name: king's spear; bioform: hemicryptophyte; floristic element: mediterranean; ecological characterization: heliophyte, thermophyte, xerophyte; syntaxa including current species: *Festucion valesiacae*; frequency in Romania: rare; sozological category: RRL: EN/R (endangered and rare); decorative elements: green-yellow flowers groupped in a

racemiform inflorescence; uses: can be cultivated in groups in flowered lawns; propagation modalities: by seeds.

Bellevalia sarmatica (Pall. ex Georgi) Woronow – systematic classification: *Magnoliophyta*, *Liliatae*, *Liliidae*, *Liliales*, *Liliaceae, Lilioideae*; common name: -; bioform: geophyte; floristic element: pontic; ecological characterization: heliophyte, sub-thermophyte, xerophyte-mesoxerophyte; syntaxa including current species: *Festucion valesiacae*; frequency in Romania: rare; sozological category: RRL: EN/R (endangered and rare); decorative elements: lilac campanulated flowers disposed in ovoid racemiform inflorescences; uses: can be cultivated in groups in flowered lawns; propagation modalities: by bulbs and seeds.

Campanula carpatica Jacq. – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Asteridae*, *Campanulales*, *Campanulaceae*; common name: censer; bioform: hemicryptophyte; floristic element: endemic (Eastern and Southern Carpathians); ecological characterization: mesophyte, saxicolous, calcicolous; syntaxa including current species: *Asplenietea, Thlaspietea*; frequency in Romania: sporadic; sozological category: RRL: R (rare); decorative elements: big blue flowers; uses: the species can be used to decorate calcareous rockeries and abrupt embankments; propagation modalities: by seeds.

Cephalanthera damasonium (Miller) Druce – systematic classification: *Magnoliophyta*, *Liliatae*, *Liliidae*, *Orchidales*, *Orchidaceae, Orchidoideae*; common name: white helleborine; bioform: geophyte; floristic element: european; ecological characterization: mesophyte, helosciaphyte-sciaphyte; syntaxa including current species: *Epipactido-Fagenion, Quercetea pubescentis*; frequency in Romania: sporadic; sozological category: RRL: NT (not threatened); decorative elements: white flowers disposed in racemiform inflorescences; uses: can be cultivated in the herbaceous layer of arborescent massifs; propagation modalities: by rhyzomes.

Cerastium transsilvanicum Schur – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Caryophyllidae*, *Caryophyllales*, *Caryophyllaceae*, *Caryophylloideae*; common name: -; bioform: chamaephyte; floristic element: endemic (Eastern and Southern Carpathians); ecological characterization: heliophyte, mesophyte, neutrophilous; syntaxa including current species: *Seslerion albicantis*; frequency in Romania: rare; sozological category: RRL: R (rare); decorative elements: white flowers grouped in inflorescences; uses: species used to decorate rockeries; propagation modalities: by seeds.

Crocus reticulatus Steven – systematic classification: *Magnoliophyta, Liliatae, Liliidae, Liliales, Iridaceae*; common name: -; bioform: geophyte; floristic element: pontic-mediterranean; ecological characterization: heliophyte, xerophyte-mesoxerophyte, neutrophilous; syntaxa including current species: *Festucion vaginatae*, *Aceri – Quercion*, *Festucion valesiacae*; frequency in Romania: sporadic; sozological category: RRL: VU (vulnerable); decorative elements: leafs and flowers; uses: the species can be cultivated in lawns, alone or mixed with other plants presenting the same flowering period; propagation modalities: by seeds and bulbs.

Dianthus spiculifolius Schur – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Caryophyllidae*, *Caryophyllales*, *Caryophyllaceae*, *Caryophylloideae*; common name: -; bioform: hemicryptophyte; floristic element: endemic (Carpathians); ecological characterization: heliophyte, xerophyte, neutrophilous, calcicolous; syntaxa including current species: *Seslerion albicantis*; frequency in Romania: sporadic; sozological category: RRL: R (rare); decorative elements: flowers; uses: species cultivated to decorate rockeries from gardens and parks; propagation modalities: by seeds.

Dictamnus albus L. ssp. ***albus*** – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Rosidae*, *Rutales*, *Rutaceae*, *Rutoideae*; common name: dittany; bioform: hemicryptophyte; floristic element: central european-submediterranean; ecological characterization: xerophyte-mesoxerophyte, sub-thermophyte; syntaxa including current species: *Geranion sanguinei, Quercion pubescentis*; frequency in Romania: sporadic; sozological category: RRL: VU/R (vulnerable and rare); decorative elements: inflorescences presenting pink coloured or white flowers; uses: dittany can be cultivated in grups, in lawns or at the limit of arborescent groups; propagation modalities: by seeds.

Digitalis ferruginea L. – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Asteridae*, *Scrophulariales, Scrophulariaceae*; common name: rusty foxglove; bioform: hemitherophyte-hemicryptophyte; floristic element: balkanic; ecological characterization: heliosciophyte, xerophyte-

mesoxerophyte, sub-thermophyte, neutrophilous; syntaxa including current species: *Quercetalia pubescentis*; frequency in Romania: rare; sozological category: RRL: VU (vulnerable); decorative elements: inflorescences presenting yellow at the exterior and brown at the interior flowers; uses: rusty foxglove can be cultivated in groups at the limit of arborescent groups; propagation modalities: by seeds.

Echinops banaticus Rochel ex Schrad. – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Asteridae*, *Asterales*, *Asteraceae*; common name: great globe thistle; bioform: hemicryptophyte; floristic element: balkanic-caucasian; ecological characterization: xeromesophyte, sub-thermophyte; syntaxa including current species: *Syringo-Carpinion orientalis*; frequency in Romania: rare; sozological category: RRL: R (rare); decorative elements: blue flowers disposed in big globular inflorescences; uses: can be cultivated in small groups in flowered lawns or at the margin of arborescent massifs; propagation modalities: by seeds.

Ephedra distachya L. – systematic classification: *Pinophyta*, *Gnetatae*, *Ephedrales*, *Ephedraceae*; common name: jointfir; bioform: phanerophyte; floristic element: eurasiatic (continental); ecological characterization: xerophyte, mesothermophyte, heliophyte; syntaxa including current species: *Scabiosion argenteae*, *Festucetalia vaginatae*, *Festucion valesiacae*; frequency in Romania: rare; sozological category: RRL: R (rare); decorative elements: curious aspect; uses: in parks and gardens it can be cultivated on sandy soils; propagation modalities: by seeds.

Evonymus nanus M. Bieb. – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Rosidae*, *Celastrales*, *Celastraceae*; common name: -; bioform: phanerophyte; floristic element: eurasiatic; ecological characterization: mesohygrophyte, mesotrophic; syntaxa including current species: *Alnion incanae*; frequency in Romania: sporadic; sozological category: RRL: R (rare); decorative elements: persistent linear leafs, 1 – 3 disposed brown-purple flowers and fruits – pink capsules; uses: this shrub is recomended to be planted on rockeries in order to make them green; propagation modalities: by grafting cuttings on *Evonymus europaeus*.

Galanthus nivalis L. – systematic classification: *Magnoliophyta*, *Liliatae*, *Liliidae*, *Liliales*, *Amaryllidaceae*; common name: snowdrop; bioform: geophyte; floristic element: central european-submediterranean; ecological characterization: mesophyte, heliosciaphyte; syntaxa including current species: *Fagetalia*; frequency in Romania: frequent; sozological category: RRL: NT (not threatened), Bern Convention (Ann. Vb); decorative elements: white, campanulated and solitary flowers; uses: decorative species cultivated in arborescent massifs, in turfs (in groups) etc.; propagation modalities: by bulbs.

Hepatica transsilvanica Fuss – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Magnoliidae*, *Ranunculales*, *Ranunculaceae*, *Ranunculoideae*; common name: -; bioform: hemicryptophyte; floristic element: endemic (Eastern and Southern Carpathians); ecological characterization: mesophyte; syntaxa including current species: *Symphyto – Fagion*; frequency in Romania: sporadic; sozological category: RRL: NT (not threatened); decorative elements: blue flowers and the shape of leafs; uses: can be cultivated as prevernal species in parks and gardens; propagation modalities: by seeds.

Iris brandzae Prodan – systematic classification: Magnoliophyta, *Liliatae*, *Liliidae*, *Liliales*, *Iridaceae*; common name: - ; bioform: geophyte; floristic element: pontic (west part); ecological characterization: heliophyte, thermophyte, xerophyte, neutrophilous; syntaxa including current species: *Festucion valesiacae*; frequency in Romania: sporadic; sozological category: RRL: VU/R (vulnerable and rare); decorative elements: blue flowers; uses: can be cultivated in small grops in flowered lawns; propagation modalities: by rhysomes and seeds.

Larix decidua Miller ssp. ***carpatica*** (Domin) Šiman – systematic classification: *Pinophyta*, *Pinatae*, *Pinales*, *Pinaceae*, *Laricoideae*; common name: larch; bioform: phanerophyte; floristic element: Carpathian and Sudets mountains; ecological characterization: mesophyte, mesothermophyte, microtherme, moderate acidophilous, mesotrophic; syntaxa including current species: *Piceion excelsae, Pinion mugi*; frequency in Romania: rare; sozological category: RRL: R (rare); decorative elements: it's aspect especially in autumn; uses: the species can be cultivated in parks and gardens isolated or groupped. Makes special effect if is planted near rockeries or greenswards; propagation modalities: by seeds or grafting cuttings.

Leucojum aestivum L. – systematic classification: *Magnoliophyta*, *Liliatae*, *Liliidae*, *Liliales*, *Amaryllidaceae*; common name: summer snowflake; bioform: geophyte; floristic element: central european-mediterranean-atlantic; ecological characterization: mesohygrophyte-hygrophyte; syntaxa including current species: *Ulmenion*, *Salicion albae*; frequency in Romania: sporadic; sozological category: RRL: VU/R (vulnerable and rare); decorative elements: inflorescences with white flowers; uses: the species can be cultivated in humid or swampy arborescent massifs, or groupped in flowered lawn. Sometimes is cultivated in flowerpots; propagation modalities: by bulbs.

Menyanthes trifoliata L. – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Asteridae*, *Solanales*, *Menyanthaceae*; common name: bogbean; bioform: hydrohelophyte; floristic element: circumpolar; ecological characterization: hygrophyte; syntaxa including current species: *Caricenion rostratae, Scheuchzerio-Caricetea fuscae*; frequency in Romania: sporadic; sozological category: RRL: R (rare); decorative elements: tri-foiled leafs and and white-rose flowers in inflorescences; uses: indicated to be cultivated around lakes, aboard rivulets or in places where the water is at soil surfacee; propagation modalities: by seeds.

Paeonia peregrina Mill. – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Dilleniideae*, *Paeoniales*, *Paeoniaceae*; common name: romanian peony; bioform: hemicryptophyte; floristic element: balkanic; ecological characterization: xeromesophyte; syntaxa including current species: *Quercetalia pubescentis*; frequency in Romania: rare; sozological category: RRL: VU/R (vulnerable and rare); decorative elements: very decorative by its big red flowers; uses: this plant can be cultivated in small groups in flowered lawns; propagation modalities: by seeds.

Paeonia tenuifolia L. – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Dilleniideae*, *Paeoniales*, *Paeoniaceae*; common name: peony; bioform: hemicryptophyte; floristic element: pontic-balkanic; ecological characterization: xeromesophyte; syntaxa including current species: *Festucetalia valesiacae, Quercetalia pubescentis*; frequency in Romania: sporadic; sozological category: RRL: VU/R (vulnerable and rare), Bern Convention Ann. I; decorative elements: very decorative by its red or pink flowers; uses: can be cultivated in small groups in flowered lawns; propagation modalities: by seeds.

Pinus cembra L. – systematic classification: *Pinophyta, Pinatae, Pinales, Pinaceae*; common name: arrola pine; bioform: phanerophyte; floristic element: eurasiatic-arctic-alpine; ecological characterization: mesophyte, microtherme, heliophyte, moderate acidophilous, oligotrophe; syntaxa including current species: *Pinion mugi, Piceion excelsae*; frequency in Romania: sporadic; sozological category: RRL: R (rare); decorative elements: remarkable by the ovoid-compact habitus and by its green foliage; uses: can be cultivated solitary or in groups in parks and gardens; propagation modalities: by seeds.

Pinus sylvestris L. – systematic classification: *Pinophyta*, *Pinatae*, *Pinales*, *Pinaceae*; common name: scots pine; bioform: phanerophyte; floristic element: eurasiatic; ecological characterization: euryphyte, eurythermic, heliophyte, moderate acidophilous, oligotrophic; syntaxa including current species: *Dicrano-Pinion, Betulion pubescentis*; frequency in Romania: sporadic; sozological category: RRL: R (rare); decorative elements: red-brown rhytidome and general aspect; uses: can be cultivated in massifs, groups or solitary in lawns or aboard alleys; propagation modalities: by seeds.

Pulsatilla grandis Wenderoth – systematic classification: *Magnoliophyta, Magnoliatae, Magnoliidae, Ranunculales, Ranunculaceae, Ranunculoideae*; common name: pasque flower; bioform: hemicryptophyte; floristic element: central and western European; ecological characterization: heliophyte, xerophyte; syntaxa including current species: *Festucetalia valesiacae*; frequency in Romania: rare; sozological category: RRL: R (rare), European threatened – Habitats Directive Ann. II b and Bern Convention Ann. I; decorative elements: solitary, violet big flowers; uses: can be cultivated in groups in flowered lawns; propagation modalities: by seeds.

Ruscus aculeatus L. – systematic classification: *Magnoliophyta*, *Liliatae*, *Liliidae*, *Liliales*, *Liliaceae*, *Asparagoideae*; common name: butcher's broom; bioform: geophyte; floristic element: pontic-mediteranean; ecological characterization: mesotrophic-eutrophic, xeromesophyte-mesophyte, thermophilous, sciaphyte-heliosciaphyte; syntaxa including current species: *Querco – Fagetea*; frequency in Romania: rare; sozological category: LRR: R (rare); Bern Convention Ann. Vb;

decorative elements: particular aspect when fructified; uses: can be cultivated on rockeries or rocky soils; propagation modalities: by seeds.

Sorbus dacica Borbás – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Rosidae*, *Rosales*, *Rosaceae*, *Maloideae*; common name: -; bioform: phanerophyte; floristic element: endemic; ecological characterization: mesoxerophyte, thermophilous, calcicolous; syntaxa including current species: *Orno-Cotinetalia*; frequency in Romania: rare; sozological category: RRL: R (rare); decorative elements: leafs, inflorescences with white flowers and red fruits; uses: species indicated to be cultivated on sunny calcareous rockeries; propagation modalities: by seeds.

Tanacetum macrophyllum (Waldst. et Kit.) – systematic classification: *Magnoliophyta*, *Magnoliatae*, *Asteridae*, *Asterales*, *Asteraceae*; common name: large leafed tansy; bioform: hemicryptophyte; floristic element: carpathian-balkanic; ecological characterization: sciophyte, mesophyte, moderate acidophilous; syntaxa including current species: *Fraxino-Cotinion*; frequency in Romania: sporadic; sozological category: RRL: R (rare); decorative elements: white flowers arranged in corymbiferous inflorescences; uses: can be cultivated in small groups at the margin of arborescent massifs; propagation modalities: by seeds.

Taxus baccata L. – systematic classification: *Pinophyta*, *Pinatae*, *Taxales*, *Taxaceae*; common name: yew; bioform: phanerophyte; floristic element: atlantic-mediterranean-central european; ecological characterization: mesophyte, mesothermophilous, sciaphyte, eutrophic; syntaxa including current species: *Querco-Fagetea*; frequency in Romania: rare; sozological category: RRL: VU/R (vulnerable and rare); decorative elements: decorative by the green colouring, red aril and general aspect; uses: can be cultivated isolated, grouped, as green walls or green hedges. Its habitus can be shaped in various ways; propagation modalities: by seeds and (vegetative) by cutting graftings.

Tulipa sylvestris L. ssp. ***australis*** (Link) Pamp. – systematic classification: *Magnoliophyta, Liliatae, Liliidae, Liliales, Liliaceae, Lilioideae*; common name: -; bioform: geophyte; floristic element: pontic-mediterranean; ecological characterization: helio-sciophyte, sub-thermophyte, neutrophilous; syntaxa including current species: *Querco-Fagetea*; frequency in Romania: sporadic; sozological category: RRL: VU/R (vulnerable and rare); decorative elements: yellow solitary flowers; sometimes, at the end of the flowering period, they are changing the colour of flowers in pink; uses: the species can be cultivated in the illuminated places inside arborescent massifs; propagation modalities: by bulbs.

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SCUTELLARIA GENUS – POSSIBILITIES FOR USE OF SPECIES AS FLORAL AND MEDICINAL CROP

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Abstract: Out of 350 species of *Scutellaria* found in the world, 90 species are reported from North America and 8 are native from Romania, but only three (*S. altissima* L., *S. galericulata* L., *S. hastifolia* L.) are very common. It is known under popular name Skullcap.
Scutellaria species have been used in the traditional medical systems of China, Korea, India, Japan, many European countries, and North America. Medicinal plants have been used as traditional remedies for hundreds of years; it is used as an anti-inflammatory, antispasmodic, febrifuge, nervine, sedative and a strong tonic in alternative medicine. In medicinal purpose are use the roots and rhizome which contain flavonoids, starch, tanning substances, and other organic substances.
They are perennial plant growing between 15-100 cm, belong to *Lamiaceae* family. It is in flower from June to September, and the seeds ripen from July to September, but can be dried for later use. Each stem only has a few flowers open at any one time. The blue to lavender flowers are two lipped. The flowers are hermaphrodite (have both male and female organs) and are pollinated by bees.
At University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, we are working on introduction in our germplasm collection and study the behavior of some *Scutellaria* species, because in Romania it is no cultivate, growing only spontaneous or in collections of the Botanical gardens. Our research in all these areas will be presented and discussed.

Key words: germplasm, spontaneous species**,** flora, characteristics

Introduction

The request for novelties is very important in the field of ornamental horticulture. The scientific research is a major factor for progress and evolution in horticulture, nowadays, when the horticulture is receiving new attributes and values, by contributing to new Romanian accomplishments in an area that reunite the beauty and the useful.

Scutellaria is an herbaceous plant (mint family *Lamiaceae*). During the 19th century, the common name used in America was "Mad Dog".

Other names include: Scullcap, Hoodwort, Quaker Bonnet, Helmet Flower, Hoodwart, Greater Skullcap, American skullcap, Blue skullcap, Blue pimpernel, Mad dog weed, Mad weed etc.

The name "skullcap" describes the shape of the calyx at the base of the flowers, which resemble medieval helmets. The yellow, fibrous root system supports a branching stem 0,3-1 m tall. Contains vitamins C & E, calcium, potassium, zinc, magnesium, iron, and volatile oils. The blue to lavender flowers are two lipped. Plants generally bloom from May to August. Above ground parts are gathered in summer at flowering time and they are dried and stored for later use as herb.

Followers of a 19th century Anglo-American school of herbal medicine were called Physiomedicalists and were the first to discover skullcap's use as a nerve tonic (http://www.innvista.com/health/herbs/skullcap.htm).

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The plant was first listed as an antispasmodic and sedative in the U. S. Pharmacopoeia in 1863 and is still regarded by Herbalists as a very effective remedy (KUNKEL, 1984).

They recognized that it had a "deeper" action on the nervous system than any other herb and used it for hysteria, epilepsy convulsions, and such serious mental illnesses as schizophrenia.

In 1973, ninety-two wooden tablets were discovered in a 2nd century tomb in northwestern China. Among the herbs listed there was baical skullcap. Other prescriptions were noted as well, including decoctions, tinctures, pills, and ointments.

This Chinese variety of skullcap has a long and central place in Chinese herbal medicine and used to treat "hot and damp" conditions as dysentery and diarrhea.

In "Flora Republicii Populare Romîne" VIII, [SĂVULESCU & al., 1961] were described 8 *Scutellaria* native species, which are presented in the table 1.

Another author [BORZA, 1968] in "Dicționar etnobotanic" mentioned only 3 species (*Scutellaria altissima* L., *Scutellaria galericulata* L. and *Scutellaria hastifolia* L.), which are very common for Romania.

In the last period [DONIȚĂ & al., 2005] in "Habitatele din România" described the presence of *Scutellaria altissima* in Moldo-Muntenian pedunculate oak-lime-hornbeam ash forest, Câmpia Dunării, Podişul Central Moldovenesc and [AKEROYD & ANDREW, 2006] in "Roşia Montană: a case for protection rather than destruction", identify *Scutellaria hastifolia* [www.rosiamontana.ro).

The results obtained in the world concerning the best value of some *Scutellaria spp*. as medicinal [JOSHEE & al., 2002], cosmetics products [NALAWADE & TSAY, 2004] or ornamental justify the objectives of our research.

Materials and Methods

The investigation and conservation of the native *Scutellaria* spp. it is needed for improve the Romanian germplasm. In Romania the grasslands especially, and associated flushes and mires, proved to be species-rich and of great botanical interest, as well as often superb spectacles of colorful wildflowers. *Scutellaria* as a genus has numerous medicinal uses but in Romania it is no cultivate, growing only spontaneous or in collections in the Botanical gardens.

Nowadays in Romania no research were do concerning *Scutellaria* native species, and it is very important to known the possibilities to multiply this species for introduce in culture in order to see the medicinal compounds and then for can use as medicinal plant or in ornamental purpose.

Studies concerning the main medicinal compounds among Romanian *Scutellaria* spp. were not yet doing in Romania. Also in Romania were not used tissue culture methods for produce *Scutellaria* spp.

The purpose of this study is to identify the *Scutellaria* species for can introduce in various culture - gardens landscape, medicine and also for use in a future breeding projects in order to improve their characteristics and obtain the Romanian varieties with high quality.

We collected seeds of *Scutellaria* species from Romanian Botanical Gardens (*S. alpina* L., *S. albida* L., *S. altissima* L., *S. rubicunda* Hornem.*)* and from abroad Botanical

Gardens (*S. supina* L., *S. baicalensis* Georgi.). In 21 May 2009 the seeds were sown in greenhouse. The plantlets were rise between 10 to 15 June 2009 (Fig. 1). When the plantlets have 3 leaves (24-30 June) were moved in individual pots.

Results and Discussions

The percent for rise of the studied species was the next: *S. alpina* L. -5 %, *S. albida* L. - 90%, *S. altissima* L. - 85%, *S. rubicunda* Hornem. - 10%, *S. supina* L.- 65%, *S. baicalensis* Georgi. - 95%.

Through the vegetative period we made some observations and determinations of main morphological characteristics of *Scutellaria* species (Fig. 2). On the base of the results obtained, we can describe the studied species.

Scutellaria alpina L. it is an herbaceous perennial plant with a oblique rhizome, the stem is high up to 15-35 cm. The leaves are ovate, length between 15-30 mm, width up to 15 mm. The flowers are grouped in compact spikes, having a corolla purple violet with neck yellow white.

Scutellaria albida L. is a perennial growing to 20-35 cm, having an erect stem. It is in flower from June to August. The flowers are hermaphrodite and are pollinated by bees and flies. Inflorescences are raceme, with hairy, the corolla colored in yellow, length up to 15-18 mm.

Scutellaria altissima L. The stem is usually 30-100 cm high. The leaves are ovate. Flowers blue violet, unilateral, all on same side of stem, ceasing well below top of stem. The blooming is in June-August.

Scutellaria baicalensis Georgi is a perennial plant, growing to 40-80 cm high. The flower is move violet. Blooming time is in August, and seed ripen in September. The rhizome of this species contains flavonoids**,** it is used in traditional medicine (HUI & al., 2002).

Scutellaria supina L. present woody rhizome, with a stem sometimes violet, high to 10-45 cm, simple or branched, pubescent. The leaves are ovate with a length to 1-4 cm, dens inflorescence with a length 2-3.5 cm, yellow or golden yellow, flowering in the summer.

Scutellaria rubicunda Hornem. is a perennial plant that is flowering in June-August, having a stem with a violet spike; the stem is branched with ovate leaves. The high of plants is up to 50 cm.

Conclusions

Regarding the studies concerning *Scutellaria* species introduced in experimental field to Floriculture Department at University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, we can conclude that they had a good percent of rise except the species *S. alpina* L. and *S. rubicunda* Hornem.

It was follow the main morphological characteristics of each species because they did not studied yet in Romania.

In this fall the *Scutellaria* species will be planted outside in the field where we will monitor their behavior in Transylvania conditions in order to be used for analyzing their chemical compounds. Also, we will follow the possibilities for use of them in landscape design and also in public and private gardens.

Acknowledgement

The authors are grateful to Dr. Nirmal Joshee, researcher of Fort Valley State University Georgia, USA, to make available the seeds of some *Scutellaria* species and information's too.

Tab. 1
Scutellaria species native in Romania

No. crt.	*Scutellaria* species	Native area in Romania
1.	*Scutellaria galericulata* L	Bistrița, Turda, Reghin, Sibiu, Oradea, Arad, Olăneşti, Turnu Măgurele, Vatra Dornei, Hârşova, Ceahlău, Medgidia
2.	*Scutellaria hastifolia* L.	Năsăud, Bistrița, Sighişoara, Făgăraş, Sibiu, Oradea, Arad, Turnu-Severin, Craiova, Brăila, Delta Dunării
3.	*Scutellaria altissima* L.	Câmpia Turzii, Cluj, Braşov, Alba Iulia, Băile Herculane, Călimăneşti, Cozia, Craiova, Cheile Bicazului, Fălticeni, Delta Dunării, Bârlad
4.	*Scutellaria alpina* L.	Mountains: Rodnei (Ineu); Iezer-Păpuşa (Dâmbovicioara); Făgăraş (Capra Budei in Cheia Gegiu); Retezat (Piule); Cernei (Arjana , Plugova)
5.	*Scutellaria supina* L.	Cheile Turzii, Băgău, Ciumbrud, Lopadea, Lopadea Nouă, Odverem, Ocnişoara, Blaj
6.	*Scutellaria columnae* All.	Caraş-Severin: Danube valley; Gura Văii-Vârciorova
7.	*Scutellaria orientalis* L. var. *pinnatifida* Rchb.	Stânca Tohani; Tulcea (Niculițel, Piatra Roşie Caugagia, Babadag, Babadag-Codru, Cheia - Măcin, Culmea Pricopanului); Constanța (Gura Văii, Fântânița-Murfatlar, Cheia-Târguşor, Hagieni, Dumbrăveni, Gura Dobrogei - Palazul Mic)
8.	*Scutellaria albida* L.	Vârciorova, Porțile de Fier

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Fig. 1. *Scutellaria* species after rise

Fig. 2. *Scutellaria altissima*

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ORNAMENTAL SPECIES USED IN WATER GARDENS FROM SOUTH KOREA

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Abstract: Aquatic plants (hydrophytic plants or hydrophytes) are plants that have adapted to live in or on aquatic environments. Because they are living under the water require numerous special adaptations, aquatic plants can only grow in water or permanently saturated soil. Aquatic vascular plants can be ferns or angiosperms (from a variety of families, including monocots and dicots). As opposed to plants types such as mesophytes and xerophytes, hydrophytes do not have a problem in retaining water due to the abundance of water in its environment. This means the plant has less need to regulate transpiration (indeed, the regulation of transpiration would require more energy than the possible benefits incurred).

The Korean vascular flora contains 217 families, 1.045 genera, 3.034 species, and 406 infraspecific taxa [CHONG-WOOK PARK, 2007].

In Mokp'o region (South Korea), in 1995, was identified hydrophytes species composed by 11 orders, 22 families, 23 genera, 38 species, 9 varieties, total 48 taxa. These were composed by 22 taxa emerged plants, 15 taxa floating-leaves plants, 8 taxa submerged plants and 3 taxa free-floating plants [JEONG WOO-GYU & al., 1995].

The same research collective, in 1996, in Paksil, Yundang (South Korea) swamp region was identified hydrophytes species composed by 11 orders, 22 families, 31 genera, 41 species, 10 varieties; it represents 12.1% of total plants. These is composed of 25 taxa emerged plants, 15 taxa floating-leaves plants, 9 taxa submerged plants and 3 taxa free-floating plants [JEONG WOO-GYU & al., 1996].

This paper contains the classification of water plants and a brief description of some aquatic species used in Korean ancient and modern gardens in order to introduce in our country.

Key words: hydrophytes, hygrophytes, flowering species, wetland, characteristics

Introduction

Water gardens were favorites of the Moors, for whom water was a symbol of life and purity. Early Asians, too, valuated water gardens as an aid to meditation and delight in breeding rare fish. In ancient times, Chinese nobility would spend their afternoons lolling in small boats on water gardens while servants floated tea filled cups to them on lily pads. The Renaissance Italians, water was a toy. They loved ornate fountains and whimsical sprays and installed them throughout their estates [VERONICA L. FOWLER & H. BEYER, 1999].

Today, hydrophytes garden have more popularity, even in our yards. Modern homeowners find the water features and beautiful and peaceful addition to the landscape (Fig. 1).

Many species of aquatic plant are invasive species in different parts of the world.

Typical water garden plants are classified after habit and biological characteristics, in 5 main categories: floating, submerged, marginal, waterlilies and oxygenators. After the

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origin and placement area, they can be: wetland and swamp species [DUMITRAŞ & al., 2008].

Floating species float in the water, are not anchored to the soil, their leaves and blossoms are on the surface, their roots dangling loose beneath. In a pond community, they receive more sunlight than submerged plants. In water gardening, these are often used as a provider of shade to reduce algae growth in a pond. These are often extremely fast growing/multiplying. The floater group, which includes *Azolla caroliniana, Trapa natans, Marsilea quadrifolia, Euryale ferox, Salvinia natans,* provides shade and often food for fish or wildlife. Some species are natural water filters (*Eichhornia crassipes, Lemna minor, Pistia stratiotes*).

Lemna minor is simple free-floating thalli on the water surface. The plant is small, not exceeding 5 mm in lengt, with a single root hanging in the water. *Lemna minor* has an invasive character, in this case it can be removed mechanically, by the addition of herbivorous fish or treated with a herbicide. It propagates mainly by division, and flowers are rarely produced; when produced, they are about 1 mm diameter, with a cup-shaped membranous scale containing a single ovule and two stamens. The seed is 1 mm long, ribbed with 8-15 ribs (Fig. 2).

Submerged plants are those that live almost completely under the water sourface, sometimes with leaves or flowers that grow to the surface such as with the water lily. These plants are placed in a pond or container usually 30-60 cm below the water surface. Some of these plants are called oxygenators because they create oxygen for fishes that live in a pond. Examples of submerged plants are: *Elodea canadensis, Hippuris vulgaris, Aponogeton distachyos, Orontium aquaticum*.

Nelumbo nucifera is an aquatic perennial plant. In different conditions its seeds may remain viable for many years, with the oldest recorded lotus germination being from that of seeds 1300 years old recovered from a dry lakebed in northeastern China [http://en.wikipedia.org/wiki/Nelumbo_nucifera]. Common misconception is referring to the lotus as a water-lily (*Nymphaea*), an entirely different plant as can be seen from the centre of the flower, which clearly lacks the structure that goes on to form the distinctive circular seed pod in the *Nelumbo nucifera*. It should also be noted that water-lilies come in various colors, whereas the lotus has flowers only in hues of pink, or white [www.wikipedia.org].

The roots of lotus flower are planted in the soil of the pond or river bottom, while the leaves float on top of the water surface. The flowers are usually found on thick stems rising several centimeters above the water. The plant normally grows up to a height of about 150 cm and a horizontal spread of up to 3 meters, but some unverified reports place the height as high as over 5 meters. The leaves may be as large as 60 cm in diameter, while the showy flowers can be up to 20 cm in diameter (Fig. 3).

Marginal plants are shallow-water plants grown in pots or shelves and they live with their roots in the water and the rest of the plant above the surface. These are usually placed so that the top of the pot is at or barely below the water level. The function of marginal plants is almost always purely ornamental. They add color and form and help the water garden blend visually into the rest of the landscape. Examples of these are: *Iris sibirica, Iris pseudacorus, Iris levigata, Caltha palustris* var. *palustris, Acorus calamus, Butomus umbellatus, Lobelia chinensis, Mentha aquatica, Sagittaria trifolia, Pontederia cordata, Persicaria amphibia*.

Caltha palustris var. *palustris* grows in wet, boggy places, such as marshes, fens, ditches and wet woods. It becomes most luxuriant in partial shade, but is rare on peat.

The plant is an herbaceous perennial growing to 80 cm tall. The leaves are rounded to kidney-shaped, 3-20 cm across, with a bluntly serrated margin and a thick, waxy texture. Stems are hollow. The flowers are yellow, 2-5 cm diameter, with 4-9 (mostly 5) petaloid sepals and many yellow stamens; they are borne in early spring to late summer and is very valuable to insects at this time as they provide nectar and pollen to them (Fig. 4).

It is sometimes considered a weed in clayey garden soils, where every piece of its root will survive and spread. In warm free-draining soils, it simply dies away.

A **wetland** is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others. The water found in wetlands can be saltwater, freshwater, or brackish.

Wetlands are considered the most biologically diverse of all ecosystems. Plant life found in wetlands includes semiaquatic plants as: *Astilbe rubra*, *Colocasia esculenta*, *Typha latifolia, Alisma plantago-aquatica* var. *orientalis, Sium suave, Lysichiton americanus, Lysimachia thyrsiflora, Saururus chinensis* and grasses: *Scirpus fluviatilis, Triadenum japonicum, Juncus effesus* var. *decipiens, Juncus gracillimus, Eleocharis acicularis* var. *longiseta, Eleocharis mamillata* var. *cyclocarpa, Carex biwensis.*

Alisma plantago-aquatica var. *orientalis* grows in shallow water, and consists of a fibrous root, several basal leaves 15-30 cm long, and a triangular stem up to 1 m tall, with a branched inflorescence bearing numerous small flowers with three round or slightly jagged, white or pale purple, petals (Fig. 5).

The word *alisma* is said to be a word of Celtic origin meaning “water”, a reference to the habitat in which it grows. Early botanists named it after the *Plantago* because of the similarity of their leaves [FRANCIS, 2006].

Water lilies or *Nymphaea* is a genera with 50 species which has a cosmopolitan distribution. They are considered by many to be the jewels of the pond. Rooted in pots at the bottom of the pond, water lilies and their look-alike cousins, lotuses, send up leaveas to float on the surface. They shade the water and keep it cool. There are two kinds of water lilies: tropical and hardy. Tropical water lilies grow from tubers and are profuse bloomers with yellow, white, pink, red, blue and purple blooms that stand on stems above the water surface. The flowers are very fragrant (*N. gigantea*, *N. capensis*).

There are two kinds of tropical water lilies: night bloomers and day bloomers [http://www.victoria-adventure.org/waterlilies/intro.htm].

Hardy water lilies grow from rhizomes and are somewhat less showy. Their blossoms are smaller and most float on the water surface. They live for years even in the coldest climates; can survive through freezing winters in the pond and filling your pond with gorgeous blossoms lying just at the water's surface from April until October (*N. pygmaea, N. alba, N. sphaerocarpa, N. tuberose, N. odorata, N. flava*).

Most water lilies open for three days in succession, closing at night. Night blooming tropical open those three days but from evening to mid-morning. In warmth and health, they can produce clusters of flowers from a single plant [http://www.victoria-adventure.org/waterlilies/intro.html].

Nymphaea alba grows in water from 30-150 cm deep and likes large ponds and lakes. The leaves can be up to thirty centimeters in diameter and they take up a spread of 150 cm per plant. The flowers are white and they have many small stamens inside (Fig. 6).

The red variety which is in cultivation came from lake *Fagertärn* (Fair tarn) in the forest of Tiveden (Sweden) where they were discovered in the early 19th century. The discovery led to a large scale exploitation which nearly made it extinct in the wild before it was protected [www.wikipedia.org].

Some water plants are called "**oxygenators**" because they add oxygen to the water garden during the day and absorb carbon dioxide during the night. Nutrient-rich water in full sun is the perfect situation for algae growth.

As a purifier, the submerged plants compete with algae by removing unwanted and excess nutrients from the water, which helps prevent algae, build up [www.garden-pond-filters.com/garden-plant-oxygenatorplants.htm].

Oxygenating plants have very weak stems that can't support themselves; therefore, spend their lives completely under the water's surface. Instead of getting their nutrients through their roots in the soil, they get them directly through their leaves. Although most of these plants grow completely under water, some have flower stalks that rise above the water surface.

Usually, this plants are sold in bunches; a good way to decide how many bunches to buy is to get about one bunch for every surface of water. All of these plants are easily propagated by taking 20-30 cm cuttings from the new growth during the summer [www.watergardens.suite101.com].

The oxigenator group includes: *Hydrilla verticillata*, *Cabomba caroliniana, Ceratophyllum demersum, Eleocharis acicularis, Fontinalis antipyretica, Myriophyllum spicatum, Potamageton octandrus, Potamogeton fryeri, Ranunculus aquatilis, Utricularia vulgaris* and *Vallisneria spiralis*.

Hydrilla verticillata is an aquatic oxigenator plant with yellowish rhizomes growing in sediments at the water bottom at up to 2 m depth. The stems grow up to 1–2 m long. The leaves are arranged in whorls of two to eight around the stem, each leaf 5–20 mm long and 0.7–2 mm broad, with serrations or small spines along the leaf margins; the leaf midrib is often reddish when fresh. It is monoecious (sometimes dioecious), with male and female flowers produced separately on a single plant; the flowers are small, with three sepals and three petals, the petals 3–5 mm long, transparent with red streaks. It reproduces primarily vegetatively by fragmentation and by rhizomes and turions (overwintering buds), and flowers are rarely seen (Fig. 7).

Hydrilla has a high resistance to salinity (>9-10 ppt) compared to many other freshwater associated aquatic plants.

In all water gardens the clarity of water and the health of plants depends on a balanced ecosystem. One of the most common sings of imbalance in a water garden is free-floting algae, which makes the water green and murky [FOWLER & BEYER, 1999].

Algae are found in all ponds. There are hundreds of species of algae that can grow in garden ponds but they are only usually noticied when they become abundant. Algae often grow in very high densities in ponds because of the high nutrient levels that are typical of garden ponds. Generally alga attaches itself to the sides of the pond and remains innocuous. Some species of algae, namely the dreaded 'blanket weed' can grow up to 30 cm a day under ideal conditions and can rapidly clog a garden pond. On the other hand, free floating algae are microcopic and are what cause pond water to appear green.

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Fig. 1. *Hydrophyte garden*

Fig. 2. *Lemna minor*

Fig. 3. *Nelumbo nucifera*

Fig. 4. *Caltha palustris* var. *palustris*

Fig. 5. *Alisma plantago-aquatica* var. *orientale*

Fig. 6. *Nymphaea alba*

Fig. 7. *Hydrilla verticillata*

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THE VEGETATION AROUND OSOI LAKE (BACĂU COUNTY)

OPREA ADRIAN [1], SÎRBU CULIȚĂ [2]

Abstract: A study about the flora and vegetation of the Osoi lake in Goşman-Tarcău Mountains (Eastern Carpathians, Romania) was made. Some of the vascular plants, previously cited in region, have been confirmed by us. Others species has not been identified, as the next ones: *Sparganium minimum*. We've made, also, a study over the communities settled down in and around this lake. Thus, we identified some associations, unmentioned before our study in the vegetation of Osoi lake, namely: *Thelypteridi-Alnetum glutinosae* Klika 1940, *Salicetum cinereae* Zólyomi 1931, *Typhetum angustifoliae* Pignatti 1953, *Carici pseudocyperi-Menyanthetum* Soó 1955, and *Junco inflexi-Menthetum longifoliae* Lohmeyer 1953.

Key words: plant communities, Osoi lake, Goşman-Tarcău mountains.

Introduction

This year (2009), we have made a field trip survey in the southern part of Goşman-Tarcău Mountains, in order to follow the trace of a pretty rare plant species in the flora of Romania, namely *Sparganium minimum* Wallr. (*S. natans* L.) [GOREA L., 2003]. Thus we reached the surroundings of Comăneşti town and Asău village, and finally the Osoi lake, where this plant has been cited from, few years ago [GOREA L., 2003].

The Osoi lake (called also "Lacul fără Fund") is located in the northern part of Comăneşti town and in the western part of Asău village. It is a natural lake, having a surface of ca 2 ha, situated in the southern part of the Goşman-Tarcău Mountains (Eastern Carpathians), in north-west part of Bacău county (Romania) (Fig. 1).

Geographic coordination: N 46º27'40,32"/E 26º22'48,42"/687 m.

The region of Comăneşti-Moineşti-Asău is intensely inhabited, being traversed by important roads and railways connecting Moldavia by Transylvania, along the Trotuş river valley. This area has mountainous features, being separated by the subCarpathians hills on the eastern side by Tazlăul Sărat valley.

Geology: the Goşman-Tarcău Mountains is overlapping on the flysch area on the outer part of Eastern Carpathians. The rock substratum are of Cretaceous and Palaeogene ages. There are a great variety of petrographic facies, like the next ones: clayes, marles, conglomerates, limestones, all of them having a major tectonics in drifting of alluvial deposits. The surface rocks are, in general, acid rocks (it explain the vast majority of the brown acid soils into the region), poor in calcic and ferro-magnesic minerals. The Osoi lake is located on the Preluca Tâlharului summit, delimited by the Asău river on the east side and Trotuş river on the west side. The substratum of this large summit is made by the *Gritstone of Tarcău*.

Relief: the area of Goşman-Tarcău Mountains belong to the middle mountains, concerning their altitude among other mountains in the Carpathian chain. The maximum

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altitude is of 1305 m, on Goşmanul Peak, but the altitudes at Asău and Comăneşti have hilly features, with altitudes between 500m and 600 m. Their relief energy vary between 600m and 800m in the central area and between 400m and 600m toward the eastern and western parts. All the interfluves are wavy, having blunted summits and gently backs.

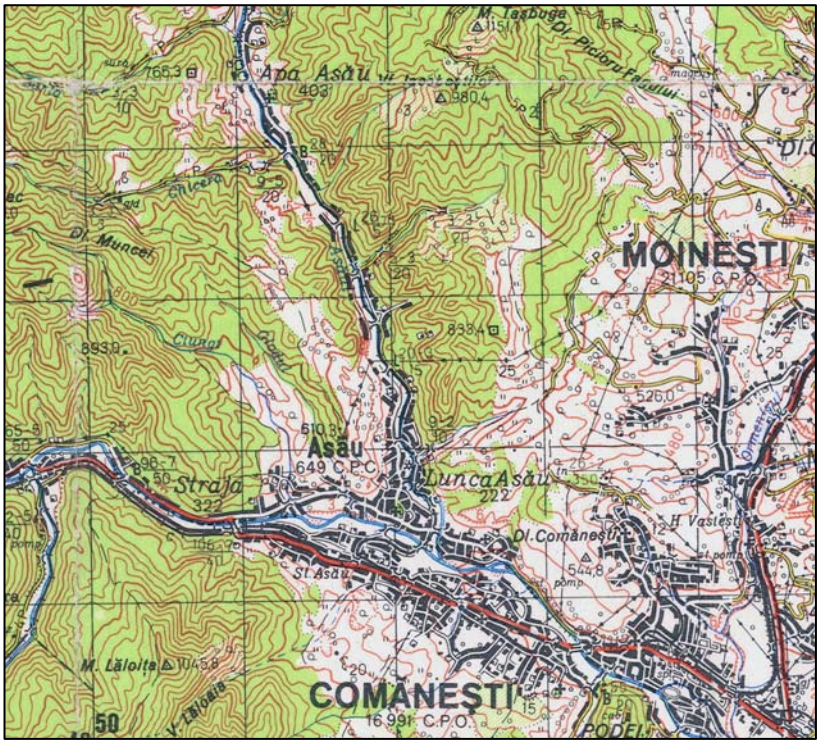

Fig. 1. Physico-geographic map of Comăneşti – Asău region (from DRAGOMIR & al., 1981)

Hydrography: the entire hydrographic net is tributary to Asău and Trotuş rivers. Those two river basins are characterized by the lack of the winter high floods, but the floodings are present during the summer time, especially in July and August. Their supplying through the rains is prevalently, with showers having torrential features. The water supplying of the rivers are supraterraneous (70-80%) and subterraneous (20-30%). The waters of Osoi lake has a double origin: from the springs as well as from pluvial and nival precipitations. The waters are oligomesotrophic, having a pH moderately to weak acid.

Climatology: the closest meteo station is at Tg. Ocna, thus we can presume that climatic data are more or less the same in surroundings of the Osoi lake. The climate has temperate-continental features, with the next characteristics: the yearly average temperature is of 8.4 ºC; the average temperature of the coldest months (January and February) is of –4 ºC, and the average temperature of the warmest months (July and August) vary between 16 ºC and 19 ºC. The dominant winds are coming from west and north-west, with a foehnisation of the air masses reaching the slope bases towards the east and south-west aspects. Frequently fogs along the valleys during the cold seasons are to be met.

The greatest cloudiness period is registered between May and June (6.5 – 7.5) and the smallest cloudiness period is in August and September (5 – 5.6). The average length of the sun shine is of ca 1800 hours/year.

Precipitations: the yearly average is of 690 mm at Asău, most of them falling between May and June (ca 380 mm), the most rainy month being June (with 150-170 mm); the dryest month is December (30 mm).

Most of the winds are registerd along the Asău valley. The average relatively humidity of the air is of 79%.

The area of Preluca Tâlharului summit (where the Osoi Lake is situated) has a humid climate, and the yearly average of precipitations surpassing the potential evapotranspiration with 10% to 40%; but the drought periods are rare and quite shorts.

Soils: the soils has hydromorphic characteristics in the area of Osoi lake.

Vegetation of this region is dominated by the beech communities on the sunny slopes (Ass. *Pulmonario rubrae-Fagetum* (Soó 1964) Taüber 1987) and by the spruce communities on the shady ones (Ass. *Hieracio rotundati-Piceetum* Pawł. et Br.-Bl. 1939). The meadows are dominated by the phytocoenoses of the Ass. *Festuco rubrae-Agrostietum capillaris* Horvat 1951 (Fig. 2).

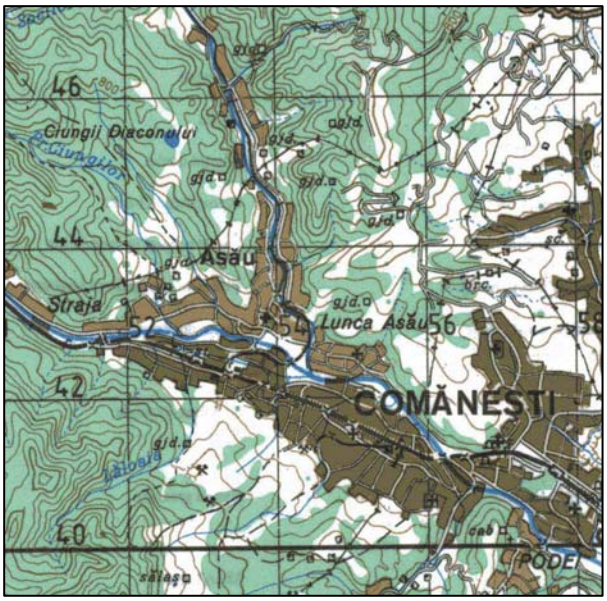

Fig. 2. Vegetation map of Comăneşti area–(from DRAGOMIR & al., 1981

History: [BRÂNDZĂ, 1879-1883], cited some plant species from the village of Asău, namely: *Taxus baccata* and *Ribes alpinum*.

[GRECESCU, 1898] cited from the same place other plants: *Equisetum sylvaticum*, *Caltha palustris*, *Scorzonera humilis*.

[IACOVLEV, 1961] cited *Pinus sylvestris* from the Asău hill.

Lately on [MITITELU & BARABAŞ, 1969, 1974] cited other plants from the same locality and in surroundings: *Brassica nigra, Rubus saxatilis, Galium rotundifolium, Vallisneria spiralis, Agrostis canina*.

[GOREA, 2003] made her PhD in the region of Asău, Camenca, and Tărhăuş water basins, where from she cited other plants in the surroundings of Osoi lake, as the next ones, growing in marsh and water: *Alisma plantago-lanceolata, Alnus glutinosa, A. incana, Bidens tripartita, Blysmus compressus, Callitriche cophocarpa, Caltha palustris, Cardamine pratensis* subsp. *matthiolii, Carex davalliana, C. distans, C. echinata, C. serotina, C. vesicaria, C. vulpina, Catabrosa aquatica, Ceratophyllum demersum, Cyperus flavescens, C. fuscus, Dactylorhiza incarnata, D. maculata, Dryopteris carthusiana, Eleocharis palustris, Epilobium palustre, Equisetum palustre, Eriophorum latifolium, Frangula alnus, Galega officinalis, Galium palustre, Glyceria plicata, Juncus effusus, J. inflexus, Lemna minor*, *Lychnis flos-cuculi, Lycopus europaeus, L. exaltatus, Lythrum virgatum, Mentha aquatica, M. longifolia, Menyanthes trifoliata, Myosotis sparsiflora, Myriophyllum verticillatum, Polygonum hydropiper, Potamogeton crispus, P. pectinatus, Ranunculus repens, R. sceleratus, Rumex palustris, Salix cinerea, Scirpus setaceus, S. sylvaticus, Sparganium erectum* subsp. *neglectum, S. minimum, Stellaria palustris, Thelypteris palustris, Triglochin palustre, Typha shuttleworthii, Utricularia vulgaris, Veronica angallis-aquatica, V. beccabunga* etc. On the Asău hill, she also cited: *Juniperus communis* and *Impatiens parviflora* (this last species has also been cited from Preluci and Lunca Asău). From Asău villages, she cited *Althaea rosea* and *Armoracia rusticana* (as subspontaneous plant species). From the villages of Beleghetul Mare and Tărhăuş is cited *Sisyrinchium angustifolium*. In the same PhD thesis, the author [GOREA, 2003] cited some communities from the Osoi lake, namely: Ass. *Lemnetum minoris*, Ass. *Batrachio trichophylli-Callitrichetum cophocarpae*, Ass. *Carici echinatae-Sphagnetum*, Ass. *Carici flavae-Eriophoretum latifolii*, Ass. *Typhetum shuttleworthii*, Ass. *Caricetum vulpinae*, Ass. *Caricetum vesicariae*, Ass. *Eleocharitetum palustris*, and Ass. *Bidenti-Polygonetum hydropiperis*.

Having in mind those vascular plants already cited in various papers and many others identified by us in the field survey, we can made an assumption that this region does belong to the Euro-Siberian floristic region, Central European East-Carpathian Province, and the Circumscription of Tarcău-Tazlău-Nemira Mountains.

Methodology

The plant nomenclature follow "Flora Europaea" (http://rbg-web2.rbge.org.uk/FE/fe.html). The vegetation was studied using the principles of Central-European geobotanical school of surveying the vegetation (Braun-Blanquet Central European School/School Zürich-Montpellier [BRAUN-BLANQUET, 1964]). We made relevées on definetely surfaces, ordering the plants according to various systems in use into the Romanian references [SANDA & al., 1983].

The phytocoenologic framing of the vegetation follow various authors [SANDA & al., 1997] and [COLDEA, 1991], [COLDEA (ed.) & al., 1997].

The abbreviations used in this paper have the next significations:

CLAS. PAL. = the code of each natural habitat, sensu "Classification of the Palaearctic habitats" [DEVILLERS & DEVILLERS-TERSCHURENS, 1993] (after "Interpretation Manual of European Union Habitat", following the Habitat Directive 92/43/EEC, v. EUR 27/2007).

Results & discussions

a. **Results**

Though we made a special field survey over that region, we are not able to say that some of plants, like: *Sparganium minimum* [GOREA, 2003] are still existing in the Osoi lake or its surroundings. We think this plant is missing now due to the alteration in water regime of Osoi lake, namely a strong and rapidly silting from the edges toward the centre of it (it worth to mention that in the past this lake had about 29 m in depth and almost the entire surface of water was free of vegetation; nowadays, the water depth is much more reduced, as well as the free water surface – there are a thick and compact stratum of vegetation, made of floating vegetation islet, which advance from the edge towards the centre of the lake; right now, approximately a 1/3 of the water surface is free of the vegetation, only – Fig. 3).

Fig. 3. Osoi lake (vue on left side) (photo A. Oprea)

We can confirm some of the associations already cited by [GOREA, 2003] from Osoi lake. But in our field survey we identified other plant communities having a much more dominance (coverage) in the vegetation of that lake.

Thus, the vegetation spread on the western and part of the southern edges of Osoi lake is edified by the phytocoenoses with *Alnus glutinosa* and *Theylpteris palustris*. On the same edge of the Osoi lake, there is installed, on relatively small areas, communities with *Salix cinerea*. The other part of the southern edge and the eastern edge is edified by the plant communities with *Typha angustifolia* and *Theylpteris palustris*. The inner communities are edified by a dense vegetation with *Menyanthes trifoliata* and *Thelypteris palustris*. This last communities made as a matter of fact those already mentioned floating vegetation islets, very characteristic here, reminded us to the Danube Delta Biospere Reserve vegetation. Only on the eastern outer edge one could discover some small communities with *Juncus effusus* and *Juncus inflexus*. On the northern edge there are some trifling patches with *Lemna minor* and *Callitriche cophocarpa* [GOREA, 2003].

We used the next framing of the plant communities, from the phytocoenotic point of view:

ALNETEA GLUTINOSAE Br.-Bl. et Tx. 1943
Alnetalia glutinosae Tx. 1937 em. Th. Müll. et Görs 1958
Alnion glutinosae Malcuit 1929 em. Th. Müll. et Görs 1958
Thelypteridi – Alnetum glutinosae Klika 1940
Salicion cinereae Th. Müll. et Görs 58
Salicetum cinereae Zólyomi 1931
PHRAGMITI – MAGNOCARICETEA Klika in Klika et Novák 1941
Phragmitetalia Koch 1926
Phragmition communis Koch 1926
Typhetum angustifoliae Pignatti 1953
Magnocaricetalia elatae Pignatti 1953
Magnocaricion elatae Koch 1926
Caricenion rostratae (Bálátová - Tuláčková 1963) Oberd. et al. 1967
Carici pseudocyperi – Menyanthetum Soó 1955
MOLINIO – ARRHENATHERETEA R. Tx. 1937
Potentillo – Polygonetalia R. Tx. 1947
Potentillion anserinae R. Tx. 1947
Junco inflexi – Menthetum longifoliae Lohmeyer 1953

b. **Discussions**

Ass. ***Thelypteridi – Alnetum glutinosae*** Klika 1940

The phytocoenoses with *Alnus glutinosa* represent those communities situated along the flooded meadows of rivers, in the plain and hill regions in Southern-Eastern part of Romania. The phytocoenoses are located in depressions, having an excess of humidity and the water table just under the soil surface.

In Romania, this association has also been cited from the Biosphere Reserve of Danube Delta, in Erenciuc lake edges [MITITELU & al., 1997; SANDA & al., 1999], but also from other regions.

In the area of Osoi lake, the coverage of the tree stratum, edified by *Alnus glutinosa* vary between 70% and 95%. The other species has a small coverage of the soil surface (between 5% and 20%). In the shrub layer there are other species, sporadically spread, like: *Viburnum opulus*, *Picea abies* (juvenile trees), *Betula pendula*. Among the herbaceous species, some of them have a greater coverage (e. g. *Carex vesicaria* and *Scirpus sylvaticus*) (Tab. 1).

Tab. 1. Ass. ***Thelypteridi – Alnetum glutinosae*** Klika 1940

Surface of relevée (sq. m)	100	100	100	100	100	
Tree layer coverage (%)	80	95	90	85	70	
Shrubs layer coverage (%)	1	1	1	1	1	V
Herbaceous layer coverage (%)	20	5	10	10	10	
No. of relevée	1	2	3	4	5	
Char. ass.						
Alnus glutinosa	5	5	5	5	4	V
Thelypteris palustris	+	+	+	+	+	V
Alnion et Alnetalia glutinosae						
Carex remota	+	-	+	+	+	IV
Salix cinerea	+	+	+	-	-	III
Frangula alnus	+	+	+	-	-	III

Viburnum opulus	+	-	+	+	-	III
Cardamine amara	+	-	+	-	+	III
Dryopteris carthusiana	+	+	-	-	-	II
Poa palustris	+	-	+	-	-	II
Athyrium filix-femina	+	+	-	-	-	II
Phragmito-Magnocaricetea						
Lysimachia vulgaris	+	+	-	+	+	IV
Scirpus sylvaticus	1	-	+	+	1	IV
Carex vesicaria	1	+	+	1	-	IV
Typha angustifolia	+	+	-	-	+	III
Galium palustre ssp. palustre	-	+	+	-	+	III
Scutellaria galericulata	-	+	+	+	-	III
Eupatorium cannabinum	+	-	+	-	+	III
Solanum dulcamara	+	-	+	+	-	III
Carex acutiformis	-	+	+	+	-	III
Carex riparia	+	-	+	+	-	III
Equisetum palustre	+	-	+	+	-	III
Sparganium erectum subsp. erectum	+	-	-	-	+	II
Caltha palustris	+	-	+	-	-	II
Carex echinata	-	+	-	-	-	I
Carex paniculata	+	-	-	-	-	I
Bidentetea						
Polygonum hydropiper	+	-	+	+	+	IV
Bidens tripartita	+	-	+	-	-	II
Alisma plantago-aquatica	+	-	-	-	-	I
Ranunculus sceleratus	+	-	-	-	-	I
Molinio-Arrhenatheretea						
Carex pallescens	-	+	+	-	-	II
Agrostis stolonifera	+	-	+	-	-	II
Eriophorum latifolium	+	-	-	-	-	I
Aliae						
Betula pendula	+	-	-	+	1	III
Picea abies (juv.)	+	-	-	+	+	III

Place and date of relevées: Osoi lake, 28th of June, 2009

Ass. ***Salicetum cinereae*** Zólyomi 1931

This is a very disputed association as concerning its coenotaxonomic position. It is given under the name *Calamagrostio-Salicetum cinereae* Soó et Zólyomi (1934) 1955 in some papers [e. g. COLDEA, 1991; SANDA & al. 1980; 2001], while in others [e. g. OROIAN, 1998] under the name *Salicetum cinereae* Zólyomi 1931; other authors [e. g. CHIFU & al. 2006] considers those two names as synonymous. We think the phytocoenoses from the vegetation of Osoi lake could be framed under the name *Salicetum cinereae* Zólyomi 1931, since *Calamagrostis canescens* is missing in the floristic structure on the wholly.

Likewise, *Salicion cinereae* alliance, from *Salicetalia auritae* order, is framed by some of the authors [e. g. MUCINA & al. 1993; SANDA & al. 2001] in *Alnetea glutinosae* class (like we did in this paper), while other authors [e. g. POTT, 1995; RODWELL & al. 2002; CHIFU & al. 2006] in *Franguletea alni* class.

This association has been cited in all the regions, from the Danube Delta [SANDA *et al*., 1999] to the mountain valleys of the Carpathian Mountains [COLDEA, 1991].

In our study we identified that only a relatively small surface of Osoi lake is occupied by the phytocoenoses with *Salix cinerea*, on the north-west part of it, in those places where the water layer does not exceed 20-30 cm in depth. Grey willow made communities with coverages between 85% and 90% of the ground surface, in this case. The characteristic species, *Salix cinerea*, is also the dominant one in our phytocoenoses. The

characteristic species for the higher coenotaxa is lacking at all at the Osoi lake. But there are plants from other coenotaxa, like *Carex acutiformis*, *Carex riparia*, and so on, from the vegetation of marshes (*Phragmiti-Magnocaricetea*), or *Alnus glutinosa*, *Thelypteris palustris*, etc. from the vegetation along the rivers (*Alnion incanae*) (Tab. 2).

Tab. 2. Ass. ***Salicetum cinereae*** Zólyomi 1931

Surface of relevée (sq. m)	50	50	50
Tree layer coverage (%)	90	85	80
Herbaceous layer coverage (%)	35	10	3
No. of relevée	1	2	3
Char. ass.			
Salix cinerea	5	5	5
Salicion cinereae et Alnetalia glutinosae			
Thelypteris palustris	2	+	+
Alnus glutinosa	+	+	-
Frangula alnus	+	+	+
Phragmiti-Magnocaricetea			
Scirpus sylvaticus	2	1	+
Carex riparia	+	+	+
Lythrum salicaria	+	+	+
Menyanthes trifoliata	+	+	+
Carex acutiformis	+	+	-
Aliae			
Utricularia vulgaris	+	+	-

Place and date of relevées: Osoi lake, 28th of June, 2009

Ass. ***Typhetum angustifoliae*** Pignatti 1953 (Syn.: *Typhetum angustifoliae* Soó 1927; *Typhetum angustifolio-latifoliae* Schmale 1939 p.p.)

The phytocoenoses of this association are settled down on the southern and eastern edge of the Osoi lake, only. The coverage are between 85% and 90% in our relevées.

The characteristic species, *Typha angustifolia*, is also the dominant one, having coverage indices between 65% and 85%. Other plants with a greater frequence are: *Thelypteris palustris* and *Lysimachia vulgaris* from al. *Magnocaricion elatae* (the vegetation from the same aquatic conditions) or *Equisetum arvense* and *Juncus effusus* from cl. *Molinio-Arrhenatheretea* (the vegetation of the zonal wet meadows) (Tab. 3).

Tab. 3. Ass. ***Typhetum angustifoliae*** Pignatti 1953

Surface of relevée (sq. m)	30	30	30	30
Coverage (%)	85	85	90	75
No. of relevée	1	2	3	4
Char. ass.				
Typha angustifolia	4	4	5	4
Glycerio-Sparganion				
Sparganium erectum subsp. erectum	+	-	+	-
Magnocaricion elatae				
Lysimachia vulgaris	+	+	+	1
Thelypteris palustris	2	2	-	1
Scutellaria galericulata	-	+	+	-
Phragmiti-Magnocaricetea				
Lythrum salicaria	+	-	+	+
Galium palustre subsp. palustre	+	-	+	+
Carex riparia	-	+	+	+
Scirpus sylvaticus	+	-	-	+
Carex vesicaria	+	+	-	-

Alisma plantago-aquatica	+	-	-	-
Potametea				
Callitriche cophocarpa	+	-	-	+
Alnion glutinosae				
Alnus glutinosa (juv.)	+	+	-	-
Salix cinerea (juv.)	-	+	-	-
Frangula alnus (juv.)	-	+	-	-
Molinio-Arrhenatheretea				
Equisetum arvense	+	+	+	+
Juncus effusus	+	-	+	+

Place and date of relevées: Osoi lake, 28th of June, 2009

Ass. ***Carici pseudocyperi – Menyanthetum*** Soó 1955

Phytocoenoses of this association have been described from various regions in Romania, especially in the mountains area, where they are settled down along the valleys, occuring in bogs and marshes; sometimes the phytocoenoses with buckbean (*Menyanthes trifoliata*) are met also in the hilly areas, out of the mountains (e. g. in the Nature Reserve Lozna-Dersca, Botoşani county, or in Bahna Mare-Bălăneşti, Neamț county, and so on).

The communities with *Menyanthes trifoliata* are predominantly around the inner edge of Osoi lake, being the most prevalently vegetation in here, made also the floating vegetation islets, with a quite thick stratum of vegetation and rhizomes, so that it can even sustain a man upon it. The characteristic species is *Carex pseudocyperus*, a constantly species in our relevées; *Menyanthes trifoliata* is the dominant species, with coverages between 85% and 100% of the ground soil and water layer. This association has also been mentioned from Osoi lake [GOREA, 2001], but in the coenotic nucleus of association presented in the phytosociologic table the characteristic plant, *Carex pseudocyperus*, is missing at all. Nevertheless, we have identified this species, in all of our relevées (Tab. 4).

Tab. 4. Ass. ***Carici pseudocyperi – Menyanthetum*** Soó 1955

Surface of relevée (sq. m)	20	20	20	20	20	V
Coverage (%)	100	80	100	100	90	
No. of relevée	1	2	3	4	5	
Char. ass.						
Menyanthes trifoliata	5	4	5	5	5	V
Carex pseudocyperus	+	+	+	+	+	V
Magnocaricion elatae						
Carex riparia	+	1	+	+	+	V
Carex vesicaria	+	-	1	+	-	III
Thelypteris palustris	-	1	+	-	-	II
Scutellaria galericulata	-	-	+	-	+	II
Carex paniculata	-	-	-	+	-	I
Magnocaricetalia elatae et *Phragmiti-Magnocaricetea*						
Lysimachia vulgaris	+	+	+	+	-	IV
Lycopus europaeus	+	+	-	-	+	III
Typha angustifolia	+	+	-	+	-	III
Lythrum salicaria	-	-	+	+	-	II
Galium palustre subsp. palustre	-	+	+	-	-	II
Sparganium erectum	1	-	-	-	+	II
Glyceria nemoralis	+	-	-	+	-	II
Eleocharis palustris	+	-	-	-	-	I
Typha latifolia	-	-	+	-	-	I
Bidention						
Alopecurus aequalis	+	+	-	-	+	III
Alisma plantago-aquatica	+	-	-	+	-	II
Molinio-Arrhenatheretea						

Lysimachia punctata	+	-	+	+	-	III
Lythrum virgatum	+	+	-	-	-	II
Juncus effusus	-	-	-	+	+	II
Salicion et Salicetalia						
Salix purpurea subsp. purpurea	-	+	+	-	-	II
Salix cinerea	-	-	-	+	-	I
Alnion glutinosae						
Frangula alnus	-	-	+	+	-	II
Alnus glutinosa	-	-	-	+	-	I
Aliae						
Utricularia vulgaris	+	+	+	+	-	IV
Callitriche cophocarpa	+	+	+	-	-	III
Eriophorum latifolium	-	-	-	+	+	II
Lemna minor	+	+	-	-	-	II
Veronica scutellata	+	-	-	-	-	I

Place and date of relevées: Osoi lake, 28th of June, 2009

Ass. ***Junco inflexi – Menthetum longifoliae*** Lohmeyer 1953 (Syn.: as. *Mentha longifolia – Juncus inflexus* Passarge 1964)

The phytocoenoses of this association are settled down as a narrow strip on the eastern edge of the Osoi lake, only. The phytocoenoses are established on soils having waters in excess, on water bogging soils, or even swampy soils (being flooded during the spring time), with a weak acid *p*H at the surface. The edificator species of the association, *Juncus effusus*, made densely clusters, among them being placed small clusters of *Juncus inflexus*, as well as *Mentha longifolia*, here and there. On some spots other species could became dominant into the phytocoenoses (e. g. *Agrostis stolonifera* subsp. *stolonifera, Galium palustre* subsp. *palustre*, *Ranunculus repens*, or *Lysimachia nummularia* etc.). Because the soil is humid all the time there are to be met a lot of hydro- and hygrophilous plants, from *Phragmiti-Magnocaricetea*, as they are: *Sparganium erectum*, *Juncus articulatus*, *Typha angustifolia*, *Lycopus europaeus*, etc. (Tab. 5).

Tab. 5. Ass. ***Junco inflexi – Menthetum longifoliae*** Lohmeyer 1953

Surface of relevée (sq. m)	20	20	20
Coverage (%)	95	95	85
No. of relevée	1	2	3
Char. ass.			
Juncus effusus	5	5	4
Juncus inflexus	-	+	2
Mentha longifolia	+	+	+
Potentillo-Polygonetalia et *Molinio-Arrhenatheretea*			
Ranunculus repens	+	+	+
Agrostis stolonifera subsp. stolonifera	+	+	+
Mentha aquatica	+	-	+
Lysimachia nummularia	+	+	-
Rumex conglomeratus	+	-	-
Molinietalia			
Scutellaria galericulata	-	+	-
Equisetum palustre	-	+	-
Bidention			
Alisma plantago-aquatica	-	+	+
Bidens tripartita	-	+	+
Phragmiti-Magnocaricetea			
Juncus articulatus	+	+	+
Sparganium erectum	+	+	-
Typha angustifolia	+	-	+
Galium palustre subsp. palustre	+	+	-

Carex vesicaria	+	-	+
Carex riparia	+	-	+
Lycopus europaeus	-	+	-
Aliae			
Callitriche cophocarpa	+	+	-
Veronica scutellata	+	-	-

Place and date of relevées: Osoi lake, 28th of June, 2009

Concerning the framing under the Habitat Directive 92/43/EEC the vegetation of this lake could be done like this:

- 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae, Salicion albae*). CLAS. PAL.: 44.3, 44.2 şi 44.13 (ass. *Thelypteridi – Alnetum glutinosae* Klika 1940; ass. *Salicetum cinereae* Zólyomi 1931);
- 6430 Hydrophilous tall-herb fringe communities of plains and of the montane to alpine levels. CLAS. PAL.: 37.7 şi 37.8 (ass. *Typhetum angustifoliae* Pignatti 1953; ass. *Junco inflexi – Menthetum longifoliae* Lohmeyer 1953);
- 7140 Transition mires and quaking bogs. CLAS. PAL.: 54.5 (ass. *Carici pseudocyperi – Menyanthetum* Soó 1955.)

Conclusions

- There have been identified phytocoenoses belonging to five associations on and around Osoi lake, which have not been cited before our study in there
- The dominant vegetation of the Osoi lake is made by the phytocoenoses of the next associations: *Thelypteridi-Alnetum glutinosae* Klika 1940, *Salicetum cinereae* Zólyomi 1931, and *Carici pseudocyperi-Menyanthetum* Soó 1955
- Other two associations, namely *Typhetum angustifoliae* Pignatti 1953, and *Junco inflexi-Menthetum longifoliae* Lohmeyer 1953, has a lesser coverage in the vegetation of the Osoi lake
- Three vascular plant species, namely *Sparganium minimum, Blysmus compressus,* and *Carex davalliana*, has not been identified in the Osoi lake waters as they were cited in the references
- Those five plant's communities could be framing onto three natural habitats, as they are: 91E0*, 6430, and 7140.

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DESCRIPTION OF SOME SPONTANEUS SPECIES AND THE POSSIBILITIES OF USE THEM IN THE ROCKY GARDENS

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Abstract: In Romania's spontaneous flora are reported over 3759 species of plants, of which 3136 species are spontaneous [CIOCÂRLAN, 2000], 23 have been declared nature monuments, 74 are extinct, 39 endangered, 171 are vulnerable and 1253 are rare. Characteristic grassland species is approximately 37% of total existent plants in Romania, and alpine species is 14%. It was identified a total of 57 endemic taxons (species and subspecies) and 171 subendemic taxons [www.wikipedia.org].
The floristic ranges adapted to the unfavorable conditions dictated by nature, with the possibility to use in rocky gardens, are: *Campanula carpatica* Jacq., *Dianthus callizonus* Schott et Kotschy, *Gentiana acaulis* L., *Leontopodium alpinum* Cass., *Phlox amoena* Sims., *Saxifraga oppositifolia* L., *Sedum alpestre* Vill., *Sempervivum montanum* L., *Viola odorata* L. Species that grow on alpine meadows in the spring until late autumn, recommended in landscape arrangements are: *Adonis vernalis* L., *Carlina acaulis* L., *Paeonia tenuifolia* L., *Primula elatior* Hill., *Primula veris* L., species that impress through form and the chromatic variety.
This paper contains a brief description of some native species used or recommended for rocky gardens.

Key words: decorative species, flora, spontaneous, plants characteristics

Introduction

Rocky alpine plants are associated, usually with groups of rocks, which are caused the name of plants. These flower species are small size species, with high resistance to environmental conditions (drought), with procumbent and repent port and creeping grass growing. Generally, alpine plants keep hairy leaves and large flowers. Rarely the leaves are skinny and glossy.

The most used floral species are the medium shaped ones, with a high resistance for weather conditions (dry weather), with side poles and rug type growth. Rarely can we see plants with skinned and shiny leaves.

Rocky gardens housing weather-resistant and decorative plants, providing them natural conditions that they need to live. Generally, the flowering plants which are used in rocky gardens have a short growing season, are species that form small stems, leaves reduced in size, have high intensity colors of flowers and do not require complicated maintenance work [CANTOR & POP, 2008].

A species known and appreciated is ***Adonis vernalis*** L. (Pheasant's Eye, Spring Pheasant's Eye, Yellow Pheasant's Eye and False Hellebore), a xero-thermophilic survival, which has a thick rhizome in the soil, a stem 10-30 cm high, bearing leaves pinnate-side, hair-shaped and divided. Pheasant's eye have a solitary flower which appears in April in the top of the stem, with golden-yellow petals (Fig. 1).

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Adonis vernalis L. prefers sunny places. It can often meet in grass on steep slopes with south or south-west aspect, especially on calcareous soils. This flower rise from the plains to the mountains, the specific areas within dry grass, bathed in sunlight.

The plant is protected in some areas of the country (Suceava County). It is used more for its decorative qualities, but also for medicinal properties due to the calming effect in heart diseases [http://www.bioterapi.ro/dictionar/index_botanic/].

Campanula carpatica Jacq. (Carpathian Harebell, Tussock Bellflower), is a perennial species alpine which is forming colored flowers (white, blue or blue-lavender), solitary or grouped on a semi high stem 20-30 cm. Flowering occurs in summer. Carpathian bell grow spontaneously in the Carpathians, exhibitions prefer sunshine, but tolerate and shadow (Fig. 2).

Carlina acaulis L. (Stemless carline thistle, Dwarf carline thistle, or Silver thistle), is a stem less plant. The spiny, pinnatilobate leaves grow in a basal rosette approximately 20 cm in diameter. The flowers are produced in a large (up to 10 cm) flowerhead of silvery-white ray florets around a central disc [DRĂGULESCU, 1996]. The disc florets are tubular and yellow-brown in colour. To protect the pollen, the head closes in wet weather, a phenomenon folklore holds to presage forthcoming rain. The flowering time is between August and September (Fig. 3).

Dianthus callizonus Schott et Kotschy (Carnation of Piatra Craiului) grow spontaneously on limestone formations of Piatra Craiului. This species was discovered over 150 years by Schott and Kotschy botanists [DRĂGULESCU, 1996], rises in a single region of the world, relatively narrow, and is a real wealth of the flora of Romania (Fig. no. 4). Grow mainly on the western slope of the massif, in alpine meadows and subalpine rocky grass and rocks. Carnation presents smooth stem, with solitary flower, 10-20 cm high. Leaves are lanceolate-linear with rough edge, often arranged as a rosette [OLTEAN-COSMA, 1967]. Flowers are red-carmine with a white-frosted circle in the center, decorated with red or pink rays (Fig. 4). Bloom in the period of July-August.

There are two endemic species in the Carpathians, *Dianthus spiculifolius* Schur. and *Dianthus tenuifolius* Schur. that are most beautiful than the famous carnation of Piatra Craiului. The first one can be used also in rocky gardens.

Gentiana acaulis L. (syn. *Gentiana kochiana* E.P.Perrier & Songeon, *Gentiana excise* C. Presl) named stemless gentian, is an early spring perennial species, increased spontaneously in Retezat mountaines. Genus name means “trumpet” and the species is translated as “stemless”.

It is a perennial plant, growing on acidic soils. Its height is 2 cm and spread is 10 cm or more. The leaves are evergreen, 2-3.5 cm long, in a basal rosette, forming clumps. The trumpet-shaped terminal flowers have a blue colour (Fig. 5) with olive-green spotted longitudinal throats. They grow on a very short peduncle, 3-6 cm long. The flower stem is often without leaves, or has 1 or 2 pairs of leaves. It likes full sun, is fully hardy and flowers in late spring and summer.

The species is unfailing in alpine gardens and rocky gardens, is used for walls and steps floral decoration.

In Romania are growing twenty-two species of *Gentiana* L., three species from that is employed in traditional folk medicine (*G. asclepiadea* L., *G. lutea* L., *G. punctata* L.). It is used their roots, in different diseases [ARDELEAN & MOHAN, 2008].

Species appreciated and loved, which is recommended for alpine garden decor is ***Leontopodium alpinum*** Cass. (Edelweiss). The popular name comes from German edel (meaning noble) and weiss (meaning white). The scientific name, *Leontopodium*, means

"lion's paw" and is derived from the Greek words leon (lion) and podion (diminutive of pous, foot) [www.en.wikipedia.org/wiki/Leontopodium_alpinum]. The species, generally has a height of 5-20 cm, leaves linear-lanceolate. Leaves and flowers are covered with white hairs and appear woolly (tomentose). Flowering stalks of Edelweiss can grow to a size of 3–20 cm (in cultivation, up to 40 cm). Each bloom consisting of five to six small yellow flower heads (5 mm) surrounded by leaflets in star form. The flowers are in bloom between July and September (Fig. 6).

This species grows on limestone cliffs in alpine regions, rarely in subalpine regions. May is known as Queen's flower. In our country, this plant can be found in the Maramureş Mountains, Vrancea, Făgăraş, Retezat, Bihor, Cozia, Ceahlău, Godeanu and other mountain massive.

Paeonia tenuifolia L. (Steppe Peony, Fern-leaf Peony) is a rare and protected plant specific for grass areas, warm sunny south-western and south-eastern Romania's regions. As a curiosity, this lovely plant, occurs in the steppe zone, to Transylvania, at Zau de Câmpie, where there is a nature reserve created for this peony. Because of habitat protected, today, here meet most of the steppe peony specimens in our country.

Thought its interesting foliage, light green, very fine in texture; the pinnate leaves, with narrow segments linear, 1-5 mm wide (resembled those of dill) and modest size (10-30 cm, rarely 50 cm), steppe peony is easily distinguished other peonies. Blooming occurs between in the second part of April - the first decade of May (takes 10 days). Flowers are about 2 to 3 inches in diameter, single, with 5 to 10 petals of satiny blood red to deep crimson, with a showy cluster of yellow anthers in the centre. The flower is semi-cupped and upwards-facing, one per stem (Fig. 7).

Cowslip (***Primula veris*** L. syn. *Primula officinalis* Hill.) is the most common species of the genus; it is a low growing herbaceous perennial plant with a rosette of leaves 5-15 cm long and 2-6 cm broad. The golden yellow flowers with campanulated calyx are produced in the spring between April and May; they are in clusters of 10-30 together on a single stem 5-20 cm tall, each flower 9-15 mm broad. Red-flowered plants do occur, very rarely. In the soil has a cylindrical rhizome (Fig. 8).

All parts of plant (rhizome, leaves and flowers) are useful in traditional medicine [ARDELEAN & MOHAN, 2008].

It may be confused with the closely related *Primula elatior* Hill. (oxlip) which has a similar general appearance although the oxlip has larger, pale yellow flowers more like a primrose, and a corolla tube without folds.

Primula elatior Hill. (True Oxlip) is an herbaceous perennial plant, found in nutrient-and calcium-rich damp woods and meadows. The species has an oblique rhizome, strong, and a high stem of 10-30 cm, ovate leaves arranged in rosettes. Decorate with bright yellow flowers and a corolla tube without folds, arranged in a cluster with 10-12 small flowers (Fig. 9). *Primula elatior* Hill. blooms in March-May.

In Romania are growing 12 species of primrose, most of them occur in restricted areas or even are floral rarities. The most rarely is *Primula baumgarteniana* Degen et Moesz, named after J. Ch. G. Baumgarten, a botanist who wrote and published the first comprehensive book about Transylvanian flora.

Today this primrose is called *Primula wulfeniana* Schott subsp. *baumgarteniana* (Degen & Moesz) Ludi [http://untreaty.un.org/unts/120001_144071/26/8/00021909.pdf].

Saxifraga oppositifolia L. (Purple Saxifrage or Purple Mountain Saxifrage) grow spontaneously on rocky places from Ciucaş, Maramureşului, Rodnei, Ceahlău, Piatra Mare, Postăvaru, Bucegi, Piatra Craiului, Făgăraş, Parâng, Retezat [http://muntiicarpati.org/]. It is

a low-growing, densely or loosely matted plant growing to 3–5 cm high, with somewhat woody branches of creeping or trailing habit close to the surface. The leaves are small, rounded, scale-like, opposite in 4 rows, with ciliated margins. The flowers are solitary on short stalks, petals purple or lilac, much longer than the calyx lobes, red at first, then pass in purple (Fig. 10). Bloom in early spring and take until late summer, especially in cool areas. This species grows and develops well at altitudes above 1000 m.

It is a popular plant in alpine gardens, though difficult to grow in warm climates.

From among the succulent species with evergreen leaves, are ***Sedum alpestre*** Vill. (Stone Crop) and ***Sempervivum montanum*** L. (Houseleeks or Liveforever), two species commonly used in rocky gardens, floral walls.

Stone crop (Fig. 11) has a size of 5-8 cm, with ascending stem and many small succulent, linear-cylindrical leaves, with both sides nearly flat, forming decorative carpets. The plants have water-storing leaves. This species has golden yellow flowers, with narrow petals, arranged in terminal cluster [PRODAN & BUIA, 1961]. The flowering period is July-August. Stone crop grows spontaneously on the cliffs in the mountainous and alpine region of Carpathian Mountains.

Houseleek (Fig. 12) is a perennial, small sized (5-15 cm) plant, with delicate appearance. The name "*Sempervivum*" has its origin in the Latin *Semper* ("always") and *vivus* ("living"). *Sempervivum* are called "always living" because this perennial plant keeps its leaves in winter and is very resistant to difficult conditions of growth. The plant has a rosette appearance, made up from succulent and fleshy green leaves. The flower is like a star, pink-purple, arranged in terminal clusters that occur in July-August. Species decorate mainly by leaves. After flowering, the plant dies, usually leaving many offsets it has produced during its life.

In the World there are about 500 species of violet (*Viola* L.), from that in Romania grown over 30 (and 20 hybrids). The most common species is ***Viola odorata*** L. (Sweet Violet, English Violet, Common Violet, or Garden Violet), called because of its fragrance. This species grows through the bushes, in meadows and forest edges, on the plains and hills. The leaves are cordate, oval or ovate, 1.5-3 cm in diameter; flowers consist in 5 purple-closed petals, rarely whitish with spur. The species blooms from March to April.

Due to remarkable appearance of a rocky or alpine gardens make time to get other connotations. It can provide, while a healthy atmosphere and they offer relaxing spaces. The necessary elements such as gravel and rocks with flower plants reproduce in miniature the natural environment of mountain areas.

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Fig. 1. *Adonis vernalis*

Fig. 2. *Campanula carpatica*

Fig. 3. *Carlina acaulis*

Fig. 4. *Dianthus callizonus*

Fig. 5. *Gentiana acaulis*

Fig. 6. *Leontopodium alpinum*

Fig. 7. *Paeonia tenuifolia*

Fig. 8. *Primula veris*

Fig. 9. *Primula elatior*

Fig. 10. *Saxifraga oppositifolia*

Fig. 11. *Sedum alpestre*

Fig. 12. *Sempervivum montanum*

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USE OF WASTE WATER OF LIVESTOCK IN ORDER TO OBTAIN BIOMASS FODDER CHEAP

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Abstract: The aim of this work was the combination of two directions for use of algae: algae biomass obtaining fodder minor and wastewater purification. Subject research have served cianofite species of algae: *Nostoc gelatinosum, N. flagelliforme and Anabaena propinqua.* As nutrient medium were used wastewater from livestock complexes (poultry and pigs) with a rich content of organic substances. Investigations carried out indicate that the largest quantity of biomass of *Nostoc flageliforme* is achieved in the cultivation with wastewater by 1% from pig complexes - 13.2 g / l, *Nostoc gelatinosum*-1% -68 g / l. and *Anabaena propinqua*-5%-8.8g/l.

Main words: edaphic algae, agrophytocoenoses, ecobiomorphs.

Introduction

One of the difficulties of zootechnics branch which was intense developed in Moldova is insufficient supply of feed resources and biologically active substances that are imported at very high prices. At the same time in ponds and soil of Moldova were discovered over 300 species of algae that have a lot of valuable biochemical contents, have a reproductive capacity of tens and even hundreds times greater than that of plants growing. [ŞALARU, 2001] In addition, biomass of some species are rich in protein, carbohydrates, lipids, etc., which can easily be grown on an industrial scale. But biomass produced on mineral medium is expensive, becoming economically insufficient. Thus arose the need to develop technologies for mass cultivation of some species of algae to use as a nutrient medium wastewater from livestock complex given the fact that biomass produced can be used as a supplement feed for animals that produce the same sewage placed in nutrient medium [GONZÁLEZ & al. 1997; MALLICK, 2002].

Material and methods

The purpose of our research served cianofite algae species *Nostoc gelatinosum, N. flagelliforme* and *Anabaena propinqua.* These strains were selected in pure culture from the ground occupied samples crops of wheat and sunflower in Cimishlia district. Cultivation and preservation of pure cultures was performed on solid and liquid mediums: for *Nostoc gelatinosum* and *N. flagelliforme* – Gusev 1 and for *Anabaena propinqua* – Fogg, temperature 25 ºC in laboratory conditions. To achieve the proposed objects we used as a

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nutrient medium waste water from livestock (poultry and swine) in concentrations of 1%, 5%, and 10%. Algal biomass inoculated was of 4 g.

Results and discussions

Due to the combination of capabilities and autotrophy, the heterotrophic nutrition of these species grow and develop in heavily polluted waters, with a rich content of organic matters. As a result of chemical analysis of these waters was determined that the concentration of NH_4 is 118.6 mg/dm^3, 0.51 mg/dm^3 of NO_2, 1.8 mg/dm^3 of NO_3, and 4 mg/dm^3 of PO4 in waters from poultry complexes, and the waste waters from pig complexes has 26.3 mg/dm^3 concentration of NH_4, 0.03 mg/dm^3 of NO_2, 1.1 mg/dm^3 of NO_3, and 67. 5 mg/dm^3 of PO_4.

Investigations shows that in all experimental variants algae grow and develop, but with some differences, probably given the physiological and concentration of biogenic substances. The best developed strain of *Nostoc gelatinosum,* was in the average variable addition waste waters with 1% concentration, resulting in the largest amount on medium of poultry-waste waters and of 68.04 g in the pig-waste waters 34.8 g compared with mineral medium Gusev (3.28 g) (Fig. 1). So the environment obtained on addition with 1% poultry manure is the most cost-effective.

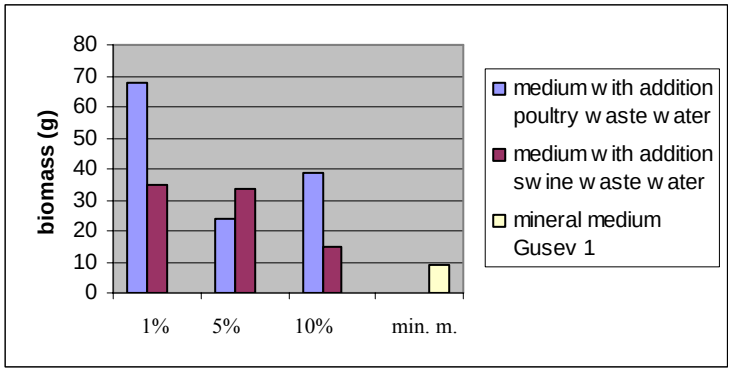

Fig. 1 Biomass algae *Nostoc gelatinosum*, grown on average by addition of waste waters from livestock complexes for 20 days (g / l).

Increase of algae biomass to mineral medium is observed with experimental variant strain of *Anabaena propinqua,* resulting in a double quantity. Thus, the option of 5% of waste waters from poultry complexes algal biomass was 8.899 g and the lowest increase is observed in the 1% (Fig. 2).

If we were to compare the development of the two types of environment, then the best environment is to increase addition of manure poultry. The experiments carried out with involvement of the algae strain *Nostoc flagelliforme* shows that the algae grows mostly on these types of environments (Fig. 3).

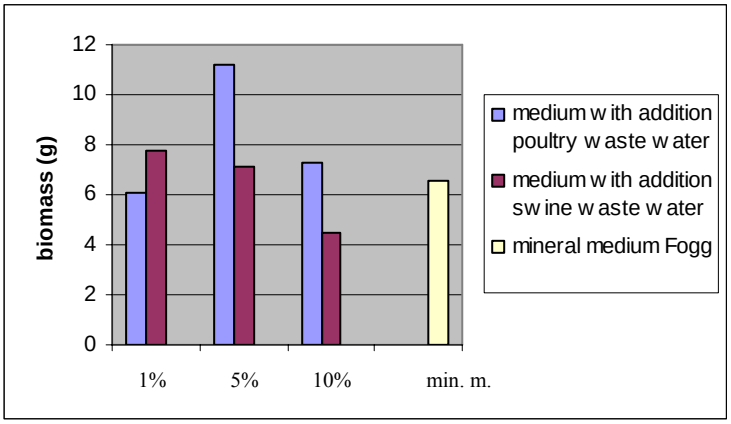

Fig. 2 Biomass algae *Anabaena propinqua* grown on average by addition of waste waters from livestock complexes for 20 days (g / l)

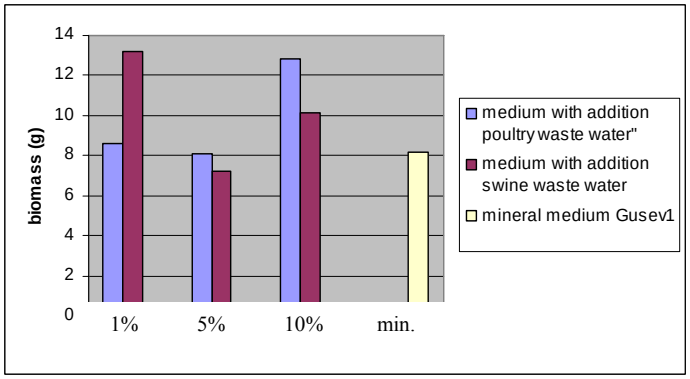

Fig. 3 Biomass algae grown on average by *Nostoc flagelliforme* with addition of waste waters from livestock complexes for 20 days (g / l).

As we see in figure 3 the amount of algal biomass of *Nostoc flagelliforme* summarized in environments addition of waste waters is higher in comparison with nutrient media (8.068 g). 13.2 g is the mass of the largest amount of algal biomass obtained in the cultivation environment on addition of manure poultry diluted 10 times. So the optimal environment for growing algae may be proposed at the water with addition of pigs waste.

Conclusion

As a result, there could be use the wastewater as a nutrient medium for algae growth matrix in order to obtain a quantity of algal biomass with high content of proteins, carbohydrates and fats. Biochemical contents of these algae did not differ significantly from those grown on nutrient medium. Research data confirm that algae *Nostoc gelatinosum, N. flagelliforme* and *Anabaena propinqua* can be used to develop methods of treatment waste water and to obtain algae biomass, which can be used as a source forage for animals with great economic efficiency. Replacement of the mineral medium with addition of manure causes algal biomass have a smaller sinecost.

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THE SUBSECTION FOR *SIGHTLESS PEOPLE* IN "ANASTASIE FĂTU" BOTANIC GARDEN, "ALEXANDRU IOAN CUZA" UNIVERSITY OF IASI

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Abstract: The Subsection for Sightless People belongs to the Ornamental Section and started in the autumn of 1991. In 2008 we tried to reorganize this subsection, first of all by enriching the collection of species exposed to the visitors, introducing a new model of labels and using especial props for the plants. Many species from *Lamiaceae* family have been chosen, characterized by a high level of essential oils, volatile phenolic compounds, alkaloids, balsams, tannins, liberating strong-scented odors, which facilitate their recognition by the sightless persons. At the same time, a lot of *Asteraceae* species are displayed, while in the autumn the sightless people enjoy the numerous chrysanthemum varieties from the Botanic Garden's collection. All of the specimens bear labels with information in Latin and Braille System.

Key words: Braille system, sightless people

Introduction

This year all sightless people celebrated the bicentenary of the birth of Louis Braille (4 January 1809 – 6 January 1852) which is the inventor of the writing system that bears his name, Braille System. Combined with new technologies, today Braille offers better access to written information than ever before.

At the beginning, most people thought that blind persons could never learn to read, because the only way to read was to use the eyes. Louis Braille got blind from the age of three. He desperately wanted to read. He understood that most of the thoughts, feelings, and ideas were almost impossible to express because of his disability. That is why he intended to find out a key to learn, write, express… in a single word 'communicate', for him and for other blind persons.

As a blind person, Louis learned to adapt and learned to lead an otherwise normal life. He went to school with all his friends. He was both intelligent and creative. He did not want to let his disability slow him down. When he grew older, he went to Paris, to improve his education. He heard of a school that was especially for blind students. He went there to find himself a solid education. There, Louis read all fourteen books for the blind in the school library.

These books had large letters that were raised up off the page. The books were large and bulky. He could feel each letter, but it took him a very long time to read a sentence. It took a few seconds to understand each word and by the time he reached the end of a sentence, he almost forgot what the beginning of the sentence was about.

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Louis believed there must be a better way for a blind person to read, quickly and easily as a sighted person. He spent a lot of time working on an alphabet made up entirely of only six dots (two columns consisting of three dots each one). The position of the different dots would represent the different letters of the alphabet. This way, Braille system born.

Discussions

The Subsection for Sightless People belongs to the Ornamental Section [MITITIUC & TONIUC, 2006.; MITITIUC & al., 2003]. It started in the autumn of 1991 and it is situated on the left part of the administrative pavilion, on the alley which guides us to the Exhibition Greenhouse.

The Botanic Garden of Iasi initiated this subsection thinking that the beauty of the plants can be understood using the tactile and olfactory senses which substitute the visual one in the partially or totally sightless people.

In 2008 we started to reorganize this subsection, first of all by enriching the collection of species exposed to the visitors. Most of the species belong to *Lamiaceae* family, which consists of more than 400 species all over the world; all species can be easily recognized by their squared stems in cross section, oppositely and decussated leaves and their typical flowers with petals fused into an upper lip and a lower lip. All body superficies or only the leaves are covered by trichomes or glands [NICOLAE & OPREA, 2007] which secrete scented etheric oils, phenolic volatile compounds, alkaloids, balsams, tannins that can be easily recognized by the sightless people. The species belonging to the *Lamiaceae* family are as follows: *Stachys officinalis* L., *Hyssopus officinalis* L., *Lavandula angustifolia* Mill., *Melissa officinalis* L., *Ocimum basilicum* L., *Rosmarinus officinalis* (L.), *Salvia sclarea* L., *Salvia officinalis* (L.), *Salvia officinalis* L. *'Icterina'*, *Salvia officinalis* L. *'Purpurea'*, *Satureja hortensis* L., *Mentha viridis* L., *Origanum vulgare* L., *Nepeta mussinii* Spreng. ex Henckel, *Nepeta cataria* var. *citriodora* L., *Monarda citriodora* Cerv. ex Lag., *Monarda dydima* L., *Stachys byzantina* C. Koch, *Agastache mexicana* (H. B. K.) Lint. et Epling, *Glechoma hederacea* L. *'Variegata'*.

At the same time, a lot of species belonging to the *Asteraceae* family are displayed: *Achillea millefolium* L., *Anthemis tinctoria* L., *Artemisia absinthium* L., *Artemisia dracunculus* L., *Calendula officinalis* L., *Tanacetum vulgare* L., *Tanacetum parthenium* (L.) Schultz, *Chrysanthemum balsamita* L., *Tagetes patula* L., *Echinacea purpurea* (L.) Mnch., *Santolina chamaecyparissus* L., *Santolina virens* Mill. Other species exposed to the visitors: *Pelargonium zonale* (Hart.) (*Geraniaceae* family), *Tropaeolum majus* L. (*Tropaeolaceae* family), *Celosia cristata* L. (*Amaranthaceae* family), *Cerastium tomentosum* L. (*Caryophyllaceae* family), *Verbena hybrida* Voss. *'Red'* (*Verbenaceae* family).

All these species have been carefully chosen for the visitors, so that they could recognize them by feeling the shape of the plant (some plants are tall, others are short, some plants form small bushes), plant texture (some plants bear rigid hairs, while others have smooth hairs which cover especially the leaves) and fragrance (most of the species belong to *Lamiaceae* family).

All species cultivated on the Sightless People Alley are situated on woody props, so that they come closely to the hand of the visitors. All species bear labels (written in Latin and Braille System) where the visitors can find information about the plants (scientific and the common name, the usage and the chorology of the plants presented in this subsection).

First of all, we had labels made on transparency films; now we had labels engraved in plexiglass; all information can be easily understood by the visitors due to the typical book shape of the label.

Other species which are to be exposed on the alley: *Agastache foeniculum* Pursh (Kuntze), *Agastache rugosa* Kuntze, *Ocimum lamiifolium* Hochst., *Ocimum basilicum* L. var. *piperitum*, *Ocimum basilicum* L. *'Citriodorum'*, *Ocimum tenuiflorum* L., *Ocimum basilicum* L. 'Opal', *Ocimum basilicum* L. *'Green Pepper'*, *Ocimum basilicum* L. *'Anis Blanc'*, *Ocimum kilimandscharicum* Guerke, *Salvia lavandulifolia* Vahl., *Salvia tiliifolia* Vahl., as well as *Iberis odorata* L.

Chrysanthemum, known as 'autumn flower', is a plant of honor, symbolizing handsomeness and tenderness.

When our Botanic Garden prepares for the autumn season, the Alley for the Sightless People presents to the visitors numerous varieties of *Chrysanthemum indicum* L., as follows: *Chrysanthemum indicum* L. *'Elda White'*, *Chrysanthemum indicum* L. *'Elda Yellow*', *Chrysanthemum indicum* L. *'Elda Orange'*, *Chrysanthemum indicum* L. *'Tivisa Lilac'*, *Chrysanthemum indicum* L. *'Rubin'*, *Chrysanthemum indicum* L. *'Conaco Yellow'*, *Chrysanthemum indicum* L. *'Conaco Bronze'*, *Chrysanthemum indicum* L. *'Natalie'*, *Chrysanthemum indicum* L. *'Camina Red'*, *Chrysanthemum indicum* L. *'Modena Pink'*, which are traditional varieties in our garden, delighting by their shape, colures and discreet fragrance.

Each exemplar bears plexiglass label with information in Latin and Braille System.

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Explanation of plates:

Plate I: Fig. 1: Panel of the Subsection
Fig. 2: Sightless People Alley
Fig. 3: *Tropaeolum majus* L.
Fig. 4: *Tagetes patula* L.
Fig. 5: *Salvia officinalis* L. *'Icterina'*
Fig. 6: *Santolina chamaecyparissus* L.

Plate II: Fig. 7: *Nepeta mussinii* Spreng. ex Henckel
Fig. 8: *Calendula officinalis* L.
Fig. 9: Plexiglas label
Fig. 10: *Salvia officinalis* L. *'Purpurea'*
Fig. 11: *Cerastium tomentosum* L.
Fig. 12: *Verbena hybrida* Voss. *'Red'*

Plate III: Fig. 13: Sightless People Alley with chrysanthemum
Fig. 14: *Chrysanthemum indicum* L. *'Elda Orange'*
Fig. 15: *Chrysanthemum indicum* L. *'Camina Red'*
Fig. 16: *Chrysanthemum indicum* L. *'Modena Pink'*
Fig. 17: *Chrysanthemum indicum* L. *'Tivisa Lilac'*
Fig. 18: *Chrysanthemum indicum* L. *'Elda White'*

PLATE I

Fig. 1

Fig. 2

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Fig. 4

Fig. 5

Fig. 6

PLATE II

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PLATE III

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Fig. 14

Fig. 15

Fig. 16

Fig. 17

Fig. 18

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ADAPTATION OF WOFOST MODEL FROM CGMS TO ROMANIAN CONDITIONS

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Abstract. This preliminary study is an inventory of the main resources and difficulties in adaptation of the Crop Growth Monitoring System (CGMS) used by Agri4cast unit of IPSC from Joint Research Centre (JRC) - Ispra of European Commission to conditions of Romania.
In contrast with the original model calibrated mainly with statistical average yields at national level, for local calibration of the model the statistical yields at lower administrative units (macroregion or county) must be used. In addition, for winter crops, the start of simulation in the new system will be in the autumn of the previous year. The start of simulation (and emergence day) in the genuine system is 1st of January of the current year and the existing calibration was meant to provide a compensation system for this technical physiological delay.
Proposed approach provides a better initialisation of the water balance (emergence occurs after start of simulation), as well as a better account for impact of wintering conditions, but obviously a new calibration for all cultivar dependent parameters is necessary. For the preoperational run, the localized model will use the weather data available till the last day available and the missing data from the rest of the year will be replaced either by the daily values of the long term averages or by the values from a year considered similar with the current one.
Proposed adaptations permit a better use of information available on local scale and the localized model may be the core of a regional system for crop monitoring and in the same degree as the original system it can be used as tool for specific researches, such as studying the impact of climate changes.

Key words: crop growth monitoring, CGMS, WOFOST model, phenology, climate change

Introduction

Crop Growth Monitoring System (CGMS) is currently operationally used by the Monitoring Agricultural Resources Unit (MARS) of Institute for Protection and Security of the Citizen from the Joint Research Centre (JRC) Ispra of European Commission.

The central element of CGMS is represented by a version of WOFOST [SUPIT & al. 1994] projected by ALTERRA (Wageningen) company at the request of MARS unit for monitoring of the main crops (winter wheat, spring barley, grain and fodder maize, sunflower, dry beans, potatoes, sugar beet, and rapeseed) for whole Europe, as well as for evaluating food security problems in the main risks areas of the world. It was also used to evaluate the impact of climatic changes on agricultural production (Fig. 1). In the last years operational models like WARM (for rice) and LINGRA for pastures and grassland productivity monitoring were added. The main customers are General Direction for Agriculture of European Commission and EUROSTAT, but there are a lot of scientific studies which used

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the infrastructure of CGMS, its modified WOFOST model or outputs of that model. The system is continuously improved and almost each year calls for tender for research projects aiming the improvement of one or another component of the system are posted.

CGMS is structured on three levels. The first level is dedicated to agro-meteorological aspects [MICALE & GENOVESE, 2004] and has a main product a meteorological database updated daily for each of the 25 × 25 km (50 × 50 km in the previous version and public applications) cells grid covering the whole surface of Europe.

The meteorological data, together with soil data, species and cultivar dependent coefficients as well as crop calendars are used in the next level by the WOFOST, LINGRA or WARM models [LAZĂR & GENOVESE, 2004]. Fig. 3, presenting the low level of the simulated winter wheat biomass under non-irrigated conditions, is an example of the model outputs. The remote sensing data (Fig. 2) are used to confirm this situation. The model used operationally by JRC is not optimised for the simulated yields. The results of simulation (development stage, LAI, relative soil moisture, total biomass, and storage organs biomass in potential and water limited conditions) in various combinations are used in a complicated statistical platform (level 3 of CGMS) to detect the most similar years with the current year for the target area. The de-trended statistical yields from these years are weighted with a similarity index and averaged to propose several possible forecasts to the country analyst. Unfortunately, the elements of this level are the most difficult to transfer to new users.

Besides the advantage of using a methodology confirmed on European level [VAN DIEPEN & BOOGARD, 2009], this system, which may be free downloaded, represent a research instrument which, with required adaptations, may be applied in various studies concerning the relationship between plant, soil and atmosphere. In addition there is the idea that the model could be easier tuned up for a less extended geographical area.

Although a large part of the required input data may be picked up freely from various internet sources, several difficulties are expected to occur in this process. Elaboration of an inventory of available resources and discussion of the expected problems is the first logical step on the path of system adaptation.

This preliminary study shows and discuses the main difficulties related to a possible adaptation of the model from Crop Growth Monitoring System (CGMS) to Romanian conditions.

Materials and methods

The version 9.2 of the CGMS model was downloaded from < ftp://mars.jrc.ec.europa.eu/CGMS >. The "User's manual" and a technical documentation are included in the installation kit. The version 8.0, documented by [SAVIN & al. 2004] is also available on the same site.

The internet sources able to provide (in an accessible format,) time series of data, long enough for calibration for all Romanian territory were identified for each category of input data. The possible local data providers and national competence sources were also mentioned.

Results and discussions

For level one, the daily meteorological data (maximum and minimum temperatures, precipitation, solar global radiation and potential evapotranspiration) for each cell (50 × 50 km) of the grid, but for a limited number of years, and grid cells may be obtained from a special JRC site <http://marsimg.jrc.it/datadistribution/ExtractGrid.php> on written request.

Due to the fact that WOFOST model may run also with 10 days or monthly weather data, one could try to pick up the 10 day averages of weather data from the meteorological maps (Fig. 2) saved as CSV files (option included in the graphical user interface) from the site of MARSOP project <http://www.marsop.info>. An alternative information source may be represented by the weather data recalculated with a global circulation atmosphere model. Ten days averages from ERA40 may be downloaded from another JRC site < http://marsimg.jrc.it/datadownload/index.php>, but the data are delivered in two grids (cells with size of one degree or, for a shorter time series, with cells sized at a quarter degree) which are different from the grid in which data are available in MARSOP site. For the last two alternative sources a sensibility study for the WOFOST is first necessary. The only internal possible provider identified is the National Meteorological Agency, but the data cost is relatively high.

The second level uses, besides the weather data, a description of the soil profiles and cultivar dependent coefficients. The soil information, harmonized at European level in a format CGMS compatible [BARUTH & al. 2006] may be accessed from < http://eusoils.jrc.ec.europa.eu/library/data/sinfo > after fulfilling a registration procedure. Crop calendars for various areas of the new member states and some phenological data were collected in the MOCA project [KUCERA & GENOVESE, 2004]. Filling of the table „VARIETY_PARAMETER_VALUE" from CGMS database is difficult both to the lack of data for calibration and optimisation of the coefficients determining the physiological behaviour of the cultivar. For version 8.0, for the whole European space, only ten winter wheat "cultivars" were initially used to explain the intraspecific differences in crop behaviour. In many cases, the only available solution for a very large geographical area consists in adjustment of anthesis and maturity days by changing two coefficients indicating the thermal requirements, till the timing for these two events indicated by an expert opinion is reached. These thermal requirements are calculated with thermal thresholds characteristic for each simulated crop. After that, the model may be forced towards one of parameters combinations that simulate with an acceptable accuracy the yield for the target administrative unit and keeping also the other simulated crop variable (like leaf area index and biomass) in the physiological range. Agri4cast realised a calibration platform named CALPLAT able to optimise calibration process, avoiding for example the risk for selection of a local minimum. For calibration of the winter wheat, we propose the use of a more complex model (accounting for photoperiod and vernalisation) like Ceres-Wheat from DSSAT platform for which there are already several calibrated Romanian cultivars from different periods [LAZĂR, 2000].

The beginning of simulation for the winter cereals in the original system is on 1st of January of current year. The same day is used for simulated emergence. The use of sowing day in October will bring the necessity of new calibration. The new calibration presumes larger thermal requirements for the interval between emergence and flowering. This choice received an additional justification (especially for the areas in Eastern Europe) through introduction in the WOFOST [LAZĂR & al. 2005] of a module for simulation of the frost damages from the CERES model [RITCHIE, 1991].

For the local calibration of the model it is advisable to use the statistic yield reported at county level or at macroregion level rather than yield for the national level. The intersection in a geographical informatics system of the grid cells with the geographic boundaries of the soil units, with the information regarding the presence of arable land (CORINE Landcover or PELCOM) and with boundaries of the administrative units will be necessary.

For preoperational run, the localized instance will use the weather data available till that moment and the missing data till the end of the vegetation season will be filled with the daily data from the long term average or from the most similar year detected by a cluster or principal component analysis, using the facilities implemented in version 9.2.

The proposed adaptations will permit a better use of information available on local scale, and the localised model may represent the core of a local system for yield monitoring or an instrument for studying the impact of climate change on phenology and productivity of the crops. An example in this sense is the use of WOFOST model from CGMS for assessing the impact of climate variations observed in the period 1975-2003 on winter wheat phenology [GENOVESE & al. 2004]. These changes induced a three week reduction of the duration between sowing and flowering in some areas of western Europe.

Transfer of level three is very difficult due to the fact that the statistical analysis system is complex and the component COBO (Control Board) runs in an ORACLE environment and its replication is costly. After the assimilation of the first two levels it will be possible the design of local yield forecasting system if the elements included in version 9.2 will not be enough.

One may notice the possibility of parameterization of WOFOST model for simulation of phenology and growth for various annual herbaceous wild species, but a considerable amount of knowledge regarding the target plant is necessary.

Conclusions

The WOFOST model and the Crop Yield Monitoring System built around it is an interesting tool for study the plant-soil-atmosphere interactions.

The adaptation of the system for Romania seems possible and the sources for preliminary calibration were indicated.

The performance improvement of the WOFOST in the new adaptation may come from the calibration procedure and in case of winter crops from the simulation of the impact of the winter conditions.

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List of illustrations

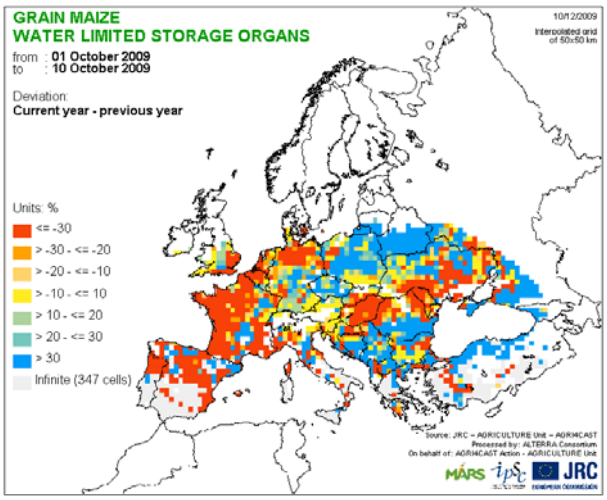

Fig. 1

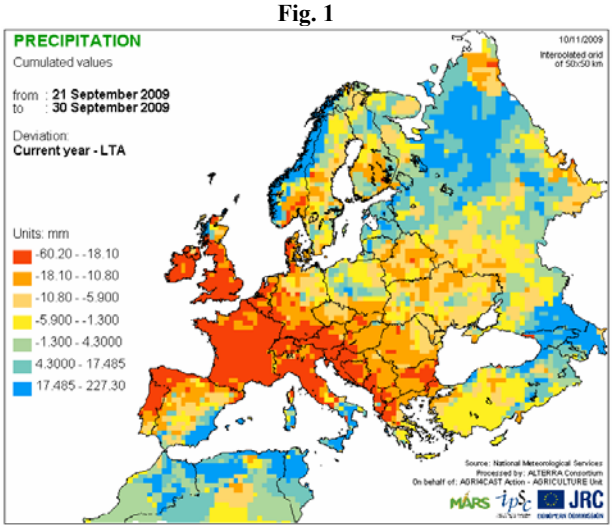

Fig. 2

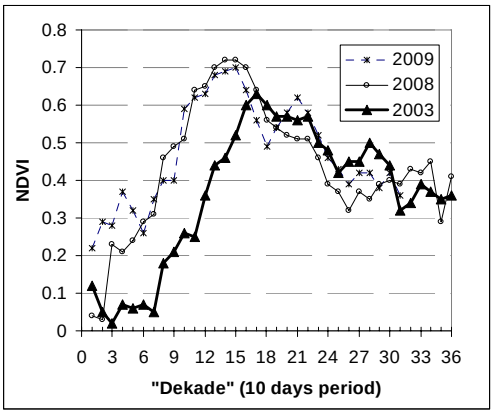

Fig. 3

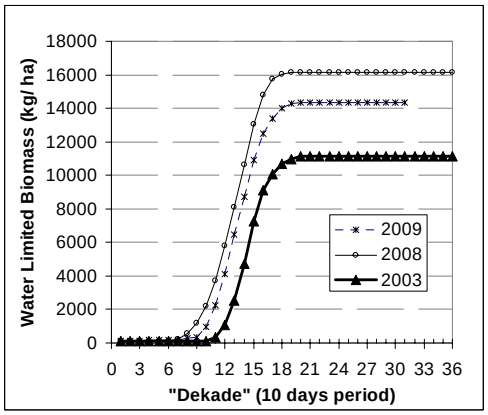

Fig. 4

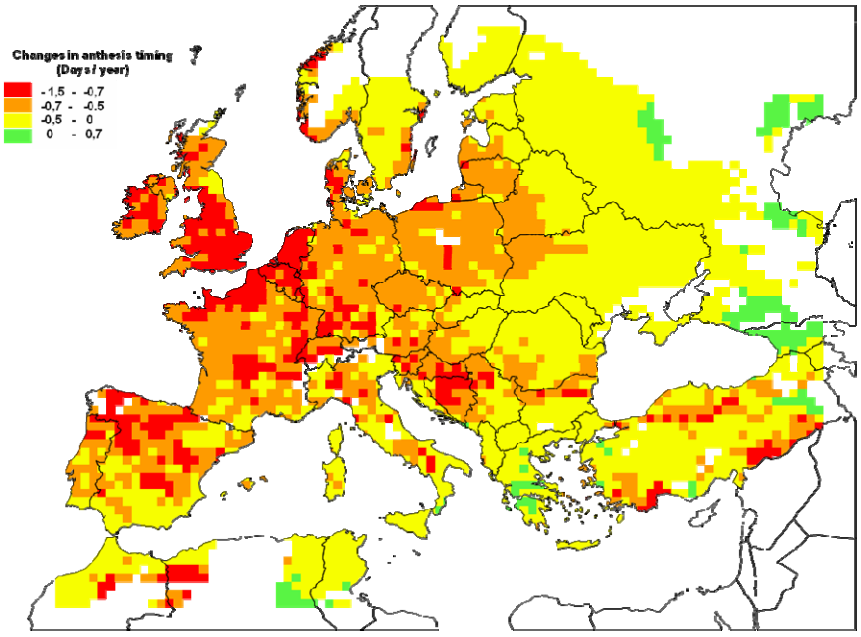

Fig. 5

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THEORETICAL CONSIDERATIONS UPON THE ORIGIN AND NOMENCLATURE OF THE PRESENT ROSE CULTIVARS

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Abstract: The rose cultivars are inter-specific hybrids with polyphyletic and heterogeneous origin. The present rose cultivars are the result of introgressive hybridization, where the fertile hybrids from F1 are repetively crossbreeding with one of the parental species or with both species.

Key words: present rose cultivars, introgressive hybrids

The systematic framing of the present rose cultivars is almost always defficitary because of their heterogeneous origin. The literature abounds in classifications upon horticultural criteria, while the classifications upon botanic criteria are quite poor, although Word Federation of Rose Societies, through its periodic publication: Modern Roses XI (2000), as well as the handbook of botanic names [ZANDER, 1984], in conformity with the International Code of Botanical Nomenclature (2000) are framing the present rose cultivars in the gender *Rosa* L. "Hybrid Cultivars", without mentioning the name of the species. However, *Rosa hybrida* L., *Rosa tea* (*hybrida*), *R. floribunda* etc, after the model of *R. tea* Savi (syn. *R.* x *odorata* Sweet) are still present in prestigious publications.

We have to mention from the beginning that the rose cultivars are inter-specific hybrids with polyphyletic and heterogeneous origin (if we cite only a few examples: teahybrids, polyanths, climbing roses). In all specified cases, the genitor species are quite numerous: (3)5-10 and even more [ALOISI & JACOB, 1995; DE L. C. & al., 1999; ENCKE, 1958; GRISVARD & CHAUDIN, 1964; KRÜSSMANN, 1986; LORD, 2003; PETERSON, 1983; RUSU, 1973].

Informally, the name of the cultivar has been denizened, because of the fact that by vegetative multiplication the characters propagate themselves unmodified.

The case of the present rose cultivars is specific to other important ornamental plants, too, as follows: *Begonia* L., *Bougainvillea* Comm. ex Juss. corr., *Canna* L., *Cattleya* Lindl., *Clematis* L., *Dendrobium* Sw., *Dianthus* L., *Hosta* Tratt., *Iris* L., *Paphiopedilum* Pfitz., *Pelargonium* L'Herit ex Ait., *Rhododendron* L., *Sempervivum* L., *Tulipa* L., *Vriesea* Lindl. [ENCKE, 1958; GRISVARD & CHAUDIN, 1964; LORD T., 2003; ZANDER R., 1984].

In those genera, including *Rosa* L., there are some species which could present infraspecific taxa (cultivars or hybrids, under the case), on one hand, and interspecific hybrids with more than 3 parental species, on the other hand. Many times, the origin of the latter is unknown, because of the fact that some hybrids homologated or used in the amelioration are the result of free pollination, so the paternal form in unknown or because of the fact that they are allowed not to declare the parental form when homologating the cultivars or hybrids [BREMER & al., 2000; CEAPOIU, 1988; DE L. C. & al., 1999, DEBENER & al., 2000; YOUNGJU & BYRNE, 1996; KRÜSSMANN, 1986; LEVIN, 1979; ORNDUFF, 1969; ZANDER, 1984].

As we mentioned above, interspecific hybridizations had played an important role in the evolution of cultivated roses. Their evolution process had been developed during a

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few centuries, but the first reviews upon amelioration in roses had taken part in the second part of the amelioration process, after 1860. These reasons had made many scripts of rose evolution, being possible a great number of diagrams. Although these diagrams are different one to another, they contain common taxa (important as species) which are considered to play an important role in shaping their genefond. Here follow some of the most famous diagrams which present the evolution of old and modern roses [ALOISI & JACOB, 1995; DEBENER &, 2000): Levy (1938), Hurst C. C. (1941), Morey D. H., (1953), Wylie Ann (1954), Wilding J. H. (1959), Young N. (1960), Thomas G. S. (1964), Saakov S. (1965), Sieber J. (1968), Robinson E. E. (1969].

So, the species which contributed no doubtfully in the formation of cultivated hybrid roses are as follow: *Rosa chinensis* Jack., *R.* x *odorata* Sweet, *R. gigantea* Coll. ex Crép., *R.* x *damascena* Mill., *R. gallica* L., *R. centifolia* L., *R.* x *alba* L., *R. moschata* Herrm., *R. multiflora* Thunb., *R. foetida* Herrm., for the Hybrid Perpetual roses Hybrid Tea, Cluster-Flowered, Polyantha, Patio, Ground Cover and some park roses, *R. rugosa* Thunb., *R. wichuraiana* Crép., *R. rubiginosa* L., for the old English roses, and *R. multiflora* Thunb., *R. moschata* Herrm., *R.* x *kordesii*, *R. arvensis* Huds., *R. sempervirens* L., *R. wichuraiana* Crép., *R., setigera* Michx., *R. banksiae*, *R. filipes*, *R. gigantea*, *R. helenae* Red et Wills., *R. laevigata*, *R. longicuspis* Bertoloni, *R. rubus* Léveille et Vaniot, *R. soulieana* Crép. for the Climbing roses.

In all cases, beside the typical species used in hybridizations, a few infraspecific taxa have been repetitively used in order to fix all wanted characters, as follow: *R. chinensis* var. *semperflorens* (Curtis) Koehne, *R. chinensis 'Minima'*, *R.* x *odorata* Sweet *'Hume's Blush Tea-Scented China'*, *R.* x *odorata* Sweet *'Parkes Yellow Tea-Scented China'*, *R.* x *odorata* Sweet *'Fortune's Double Yellow'*, *R. damascena 'Autumn Damacs'* (syn. *R. damascena semperflorens* (Loisel et. Michel) Rowley), and later (the end of the 19th century and in the 20th century) some of the rose cultivars more used in amelioration (crossbreeding respectively) are as follow: *'Baroness Rotschild'* (Pernet Perre, 1968), *'Baronne Prévost'* (Desprez, 1842), *'Frau Karl Druschky'* (Lambert, 1901), *'La France'* (Guillot, 1867), *'Soleil d'Or'* (Pernet-Ducher, 1900), *'M-me Caroline Testout'* (Pernet-Ducher, 1890), *'Crimson Glory'* (Kordes, 1935), *'M-me A. Meilland* (Meilland, 1945), *'Independence*' (Kordes, 1950) etc. Beside the cited species, *R. canina* L., *R. pimpinellifolia* L., *R. multibracteata* Hemsl. et Wils., *R. roxburghii* Tratt., *R. laevigata* Michx., *R. bracteata* Wendl., *R. moschata 'Nepalensis'* (*R. brunonii* Lindl.), *R. sinowilsonii* Hemsl., *R. maximowicziana* Regel, *R. banksiae* Ait. fil., *R. filipes* Rehd. et Wils. have played a less important role [DE L. C. & al., 1999; KORDES, 1956; KRÜSSMANN, 1986; PATERSON, 1983; WAGNER, 2002].

More than one century has passed to group in a single hybrid the capacity of repeat-flowering of *R. chinensis* with the rusticity and frost resistance of *R. gallica*, the coriaceus foliage of *R. chinensis*, *R.* x *odorata*, the fragrance of *R.* x *odorata* and *R. damascena*, in the first half of the 19th century, constituting the horticultural group of Hybrid Perpetual. In order to complete this objective, *R. chinensis* and *R. gallica* have been frequently used in retro-crossbreedings. As a sequel, the present rose cultivars are the result of introgressive hybridization, where the fertile hybrids from F1 are repetitively crossbreeding with one of the parental species or with both species [Băra I., 1989]. As a parenthesis, the present rose cultivars are tetraploids, few of them are triploids and fewer are bi- or pentaploids (Fig. 1 and Fig. 2) [CAIRNS, 2000; KORDES, 1956; KRÜSSMANN, 1986].

In a short review of items number of roses, are present:

– botanic species, most of them carrying infrataxa: *R.* x *alba'Reine de Danemark'*, *'Felicité Parmentiér'*, *R. pimpinellifolia 'Single Cherry'*, *'Altaico'*, *R. foetida 'Bicolor'*, *R. foetida 'Persian Yellow'*, *R. gallica 'Officinalis'*, *'Versicolor'*, *'Cardinal*

Richelieu', *'Violacea'*, *R. centifolia 'Cristata'*, *'Fatin Latour'*, *R. damascena 'Trigintipetala'*, *'Versicolor'*, *R. rugosa 'Frau Dagmar Hastrup'*, *'Roserare de L'Haÿ'*, *R. chinensis 'Viridiflora'*, *R. multiflora 'Veilchenblau'*, *R.* x *odorata 'Maman Cocket'*, *'Mrs. Herbert Stevens'* etc; the cited cultivars have been created through other methods, excluding interspecific hybridization; most of the literature upon horticulture [CAIRNS, 2000; HESSAYON, 1988; LEVIN, 1979; ORNDUFF, 1969] improper includes these infrataxa in the category of cultivated hybrids; from genetic point of view, they are infrataxa of the mentioned species and taking into account the literature [GRISVARD & CHAUDIN, 1964], from taxonomic point of view, they belong to the mentioned species.

– cultivated hybrids, which consist of old garden roses: Bourbon Roses (*'Boule de Neige'*, *'Zephirine Drouhin'*, *'New Down'*), Noisette Roses (*'Blush Noisette'*, *'Gloire de Dijon'*, *'Maréchal Niel'*), Portland Roses (*'Duchess of Portland'*, *'Rembrandt'*), Hybrid Perpetual (*'Frau Karl Druschky'*, *'Président Briand'*) and modern garden roses: Hybrid Tea (*'La France'*, *'M-me Meilland'*, *'Kordes Perfecta'*), Cluster-Flowered (*'Independence'*, *'Märkenland'*, *'Laminuette'*), Polyantha (*'Masquerade'*, *'Orange Triumph'*), Ground Cover (*'Nozomi'*, *'Schneewittchen'*), Dwarf Cluster-Flowered (*'Anna Ford'*, *'Queen Mother'*, *'Festival'*), Ramblers (*'Blaze'*, *'Féliciré et Perpétué'*, *'Kaptain Kidd'*, *'Dorothy Perkins'*) and Climbers (*'M-me Meilland-Clb'*, *'Westerland'*), English roses (*'Graham Thomas'*, *'William Shakespeare'*), cultivars created after 1869.

Here follow two diagrams of rose evolution (Fig. 1 and Fig. 2)

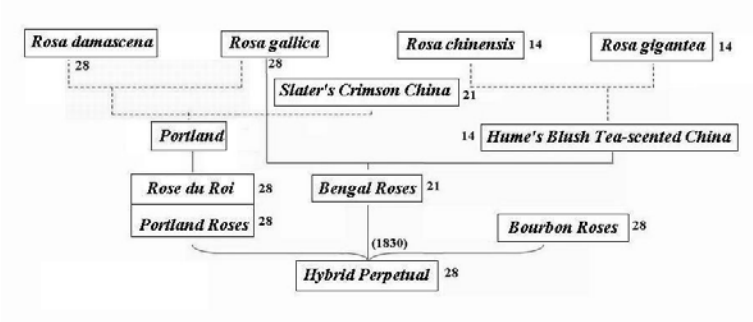

Fig. 1: Evolution of Hybrid Perpetuals by Wylie Ann (1954) [14]

Portland Roses: They are hybrids of *R. damascena* and *R. chinensis* var. *semperflorens*, created in Italy, a few time before those of Bourbon Group. They are small shrubs, bearing fragrant double flowers in shades of pink to red.

'Slater's Crimson China' syn. *R. chinensis var. semperflorens* called as Moon Rose, Bengal rose, forms bushes with few branches and red small and less numerous prickles, dark red semi-doubled flowers, discovered in Calcuta, in 1789.

'Hume's Blush Tea-Scented China' is an infrataxon of *R.* x *odorata* and presents a very important characteristic: the fragrance of the flowers, which is similar to that of the tea leaves. It was brought in England in 1809, then it was introduced in France and used in amelioration; it does not exist anymore today.

Bourbon Roses: The first Bourbon Rose was a hybrid between *R. chinensis* and *'Damask Rose'* that occurred naturally on the Ile Bourbon. Most of them are shrubs of 1.2-2 m, a few have climbing habit, highly perfumed and many of them present repeat-flowering characteristics. Hybrid Perpetual Roses: Becoming proeminent during the reign of Queen Victoria, this group has a complex parentage, involving several rose groups, including Bourbon Roses and China Roses. Growing 1.2-2 m tall, they are repeat flowering and bear large, double, usually fragrant blooms in shades of pink to red.

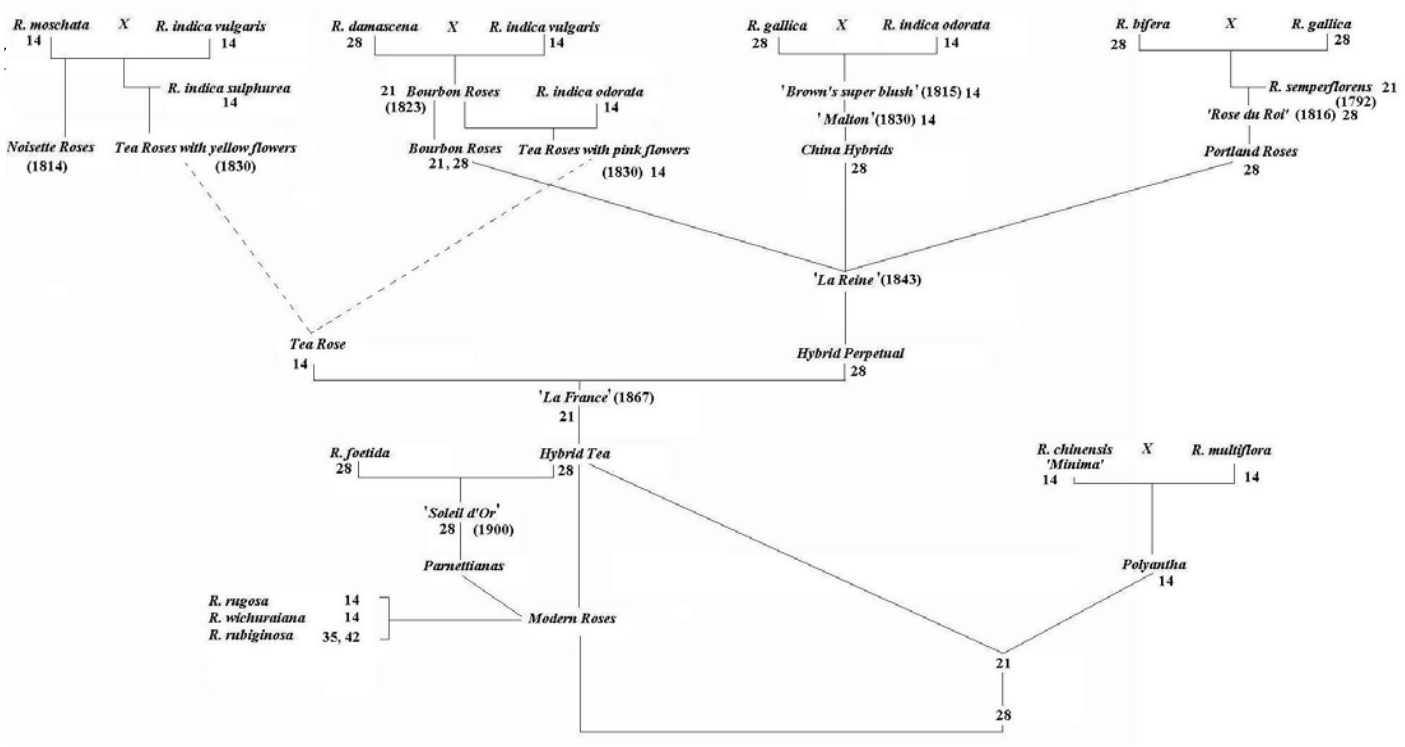

Fig. 2: The origin of cultivated roses by Aloisi Suzanne and Jacob Y. (1995) [1]

R. indica vulgaris syn. *R. chinensis*
R. indica odorata syn. *R.* x *odorata*
R. indica sulfurea syn. *R.* x *odorata* var. *ochroleuca* syn. *'Parkes Yellow Tea-Scented China'*
R. bifera syn. *R. damascena semperflorens* syn. *'Autumn Damasc'*
R. semperflorens syn. *'Slater's Crimson China'*

Noisette Roses: They represent an old group of roses, created in the United States of America and used in hybridization in France; they are hybrids of *R. moschata* and *R. chinensis*, bearing small, delicate flowers, with repeat-flowering characteristics.

Tea Roses (tea-scented) syn. *R.* x *odorata*: Are hybrids of *R. chinensis* and *R. gigantea*. They are erect plants which bear perfumed flowers in shades of white to red, including yellow, reminding tea scent. The plants are sensible to frost and have repeat flowering characteristic.

'Parkes Yellow Tea-Scented China', probably *R.* x *odorata* var. *ochroleuca* Lindl., was brought in 1824 in England; it bears light-yellow doubled flowers; it does not exist anymore today.

'Autumn Damask' syn. *R.* x *damascena* var. *semperflorens*, known as *'Quatre saisons'*, it bears pink flowers which bloom in the autumn.

Tea Hybrids: They are considered to be a distinct rose group coming from the hybridization of cultivars which belong to Hybrid Perpetuals and Tea Roses (tea scented). They are short erect plants (up to 1.5-2 m) with big perfumed solitary flowers or grouped in racemes pauciflowered.

Polyantha Roses: They are hybrids of *R. multiflora* and *R. chinensis 'Minima'*, short shrubs with small flowers grouped in multiflowered inflorescences. Later, a few cultivars belonging to this group crossbred with Tea Hybrids. They bear thin branches, from erect to sarmentuous or prostrates.

Climbing Roses: The Climbing Roses represent a very heterogeneous group, regarding their habitus and botanic origin. This group is comprised of Rambler, Noisette, Boursault, Climbing Tea and Climbing Bourbon Roses. The cultivars belonging to this group bear long branches, sometimes sarmentuous, other times semi-erect and rigid, repeat flowering or not, with big or small flowers.

In conclusion, the origin of the present rose cultivars is only partially defined, because their amelioration has started in the 17th century, while the preoccupations regarding plant hybridization have started later, in the next century and the ones doing amelioration have not blurt out their methods. Retrospective hybridization by modern methods depends on the specific introgressive hybridization and heterosis effect.

World Federation of Rose Societies (WFRS) recommends, starting with 1979, the model: *Rosa* L., followed by the horticultural group, cultivar's name, author's name and the year of homologation.

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IMPORTANCE OF FUNGAL COLLECTIONS FOR MYCOLOGY IN THE FRAME OF BIOLOGICAL TEACHING

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Abstract: The paper presents the importance of fungal collections for mycology, for systematical studies upon fungi taxa, for preservation of fungi species, for information transfer of the taxonomical data from a generation to another generation or elaboration of scientifical papers etc. A list of the most important collections from entire world and from our country is also presented.

Key words: fungi, collections, mycology, herbarium.

[HAWKSWORTH & MOUND, 1991] reported that the existence of collections representing the main component of the transfer system used for manipulation of information about biodiversity.

Now, there are registered only 11.500 taxons from all 345.000 taxons of known fungi, representing only 3% from their total and only 0.8% from their estimate number, approximately 1.5 millions [HAWKSWORH, 1991; TĂNASE & ŞESAN, 2006; ŞESAN & TĂNASE, 2006].

The importance of these collections [CONSTANTINESCU, 1972, 1978; HAWKSWORTH, 1991; STOICA & colab., 2002; KIRK & colab., 2001/republished 2004; TĂNASE & ŞESAN, 2006; ŞESAN & TĂNASE, 2006 etc.] was been evidenced into following directions:

- priority of preservation of species with a major importance for ecosystem biodiversity (*keystone species*);
- collections existence assures the time and materials for specialists of this domain;
- the bringing up to date of binary classified list for all taxon types;
- the assurance of information transfer concerning taxonomical data from a generation to another;
- the initiation and improvement of knowledge about these for specialists in this domain;
- the realisation of biological material changes;
- analysis of biological material;
- the comparison of information from different sources;
- elaboration of scientific paper for reviews which publish this kind of information;
- to form deposits for a huge quantity of information concerning distribution and ecology of fungi.

The collecting an preservation of fungi for mycological collections [CONSTANTINESCU, 1972, 1978; TĂNASE, 2002; KIRK & colab., 2001/2004, p. 120; ŞESAN & TĂNASE, 2004] is an important desideratum for biodiversity conservation.

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The dried macromycetes specimens kept carefully preserve their microscopic structure. This aspect makes them adequate for important mycologic collections or those used for their scientific and didactic purpose.

For the specialists who collect fungi, especiually mushrooms, for a collection, they have to follow some instructions:

- *preservation* has to be realized without affecting the specie continuity inside of collecting area;
- *quality of preserved material* – this material have to be collected in successive stages of development, including the stages with mature spores; it is recommended to collect only young and mature exemplars (cap, stalk, ring, volva, and gills), without free larva and snails. The mushrooms could be collected especially during spring, summer and autumn. Sporiferous bodies will be cleaned, throuing soil particles. It is recommended to be avoid an excessive manipulation because this material is very fragile (many elements used for identification could be destroyed).
- *quantity* – it will be collected enough biologic material only where this is possible; the collecting have to be done into substrate for a minimum deterioration of their structure.
- *notes about collecting areas* – have a major importance for species identifications; this information have to mentioned specific characteristics of fungi/mushrooms, especially those one which are deteriorated through drying process (dimensions, form, colour, texture, taste, smell etc.). The notes have to registered information about collecting area, association mode of individuals. It is recommended that collecting to be realized together with substrate, especially for parasite species. Species of lignicolous mushrooms, which growing up usually on wood, will be collect with their substrate. The same recommendations are available for saxicolous lichens.
- *colour photos* – will be done for all collected individuals, and these photos will be added to the „notes about collecting area" to completing information about: fungus/mushroom characteristics, their distribution and ecology.
- *necessary equipment* – is composed by a basket, paper bags or waxed paper bags used for mushrooms wrapping, each of them in different bags, especially for individuals with large sporiferous bodies; also, the collecting will be done in metallic or plastic boxes for mushrooms with medium dimensions, and in tubes or small boxes for little mushrooms. There is no recommended the depositing of mushrooms in plastic bags. For separation of mushrooms away from their substrate we have to use knives, scissors, mallet, all of them adequate for this kind of actions.

Chemical characters of pulpous mushrooms have a very important role in their macro- and microscopic determinations [TĂNASE, 2002; KIRK & colab., 2001/2004, p. 120; ŞESAN & TĂNASE, 2004].

The ferrous sulphate ($FeSO_4$) is used both as aqueous solution 10% and as crystals. The using of crystal depends on age and texture humidity (pulp, flesh) which are already tested. This is used for deterioration of some species from *Russula* and *Boletus* genera.

Phenol (phenol acid in aqueous solution 2%) is used for identification of some species of the genera as: *Russula, Amanita* and *Cortinarius*. The positive reactions could be common with a brown colour, but there could be registered intense reactions which coloured in red or black the tissues of some fungi/mushrooms.

The ammonia is used as aqueous solution. Reactions are coloured in red, yellow up to purple.

Sodium and potassium (5 or 10%) are used for identification of some species from *Cortinarius* taxon.

Guajac tincture generating positive reactions coloured in blue (sometimes purple) more or less intense, but sometimes, these reactions could be slow. This mixture could not be preserved during many months. This substance has either a positive reaction for *Russula vesca* Fr. or a negative reaction for *Russula fragilis* (Pers.) Fr.

The formol (as formaldehyde) determins a red colour, more or less intense, for mushroom texture (pulp, flesh).

The iodine is used either as iodine tincture or as Melzer reactive (chloral iodine). It reacts with pulp of some species from *Boletus* genus and colouring these in blue up to purple. This could be used for macroscopic identification of amyloidic spores directly from mushroom lamellae (gill) (if only the number of spores is sufficient). The presence of starch generates a reaction coloured in dark-blue.

Sulphurformol (a mixture composed by formol and sulphuric acid) and TL4 (basis for Thallium) are oxidative substances which generate intense colours as: blue, yellow, green or purple; but, all the time they are used for determination of individuals from species of *Tricholoma*, *Lactarius* and *Cortinarius*.

Sulpurvanillin (a mixture composed by H_2SO_4 and few vanillin granules) is used in microscopy and it generating reactions coloured in red or blue for species from *Russula* genus.

All characters, which were been evidenced from macroscopic point of view, have to be mentioned into „notes about collecting area" (excessively presence of cellular liquid, latex secretion, and changing of initial colour of sporiferous bosies after division into sections).

Also, it is recommended to realize a sporogame. The most simple technique used is as following: for a mushroom, we separate stem from cap; after that, we put the cap with hymenophore down on a white paper. We cover the cap with a glass tube or a Petri plate for keeping the humidity, and, after few hours, spores are positioned down on paper where they are fixed through pulverizing with a special solution (a mixture composed of 1:4 colophony and turpentine).

The sporogame could be obtained quickly during area exploration through a perforated paper sheet. We pass the mushroom stem through this aperture and, after that, we fold this paper together with the mushroom cap. This obtained product is preserved into a bag. The sporogame could be preserved into the Herbarium, inside of a transparent cellophane envelope, together with its own dried sample.

It is recommended to use standard methods for sporogames, because of spore colours are very unstable and they are easily changing. The standard method involves analysis of some sporiferous bodies closed into a box during 1/12 hours, depending on their size. Spores are collected on microscopic lama; they were been dehydrated during 15 minutes into a plastic container with sylicagel. And, after that, spores colour will be compared with a colour code from specialized literature.

The most important mycological collections are by two types (based on *Dictionary of the Fungi*, 9-th edition – KIRK & colab., 2001/2004, p. 447):

(1) *genetic resources collections* (q.v.[4]; *cultures collections*) are kept either as living material or in an *inactive metabolic stage* (which could be relieving);

[4] **q**(uod) **v**(ide) – **q.v.** = which that means

(2) *collections with dry materials*, including dried specimens from: plants, rocks, other substrates, dried cultures, microscopic preparations, coloured plastic files, drawings, pictures, preparations for studies concerning ultrastructure etc.

A dried collection is a part from an Herbarium (q.v.), but mushrooms are not plants and they have to be preserved in a different way. The word „herbarium" used for mycological collections is not correct, but it is using by International Mycological Institute Kew, UK. Usually, we use this word as herbarium / mycological collection / exsiccata.

The information concerning to deposits into both types of mycological collections is more often found in databases which are accessible for all persons who are interested in this domain.

Abbreviations used by the most important collections are keeping during a long period of time, even the name of some institutions were been changed. Therefore, some of the most used abbreviations are:

BPI – US National Fungus Collection (Beltsville, Md, USA), founded in 1869, as part of United States Department of Agriculture (USDA), Agricultural Research Service (ARS);

DAOM – Canadian National Mycological Herbarium (Ottawa, Canada), founded in 1929, as part of Centre for Land and Biological Resources Research, Agriculture Canada; **CCFC** – genetic resources collection;

IMI – International Mycological Institute Kew, Surrey, UK: Imperial Bureau of Mycology 1920-1929; Imperial Mycological Institute 1930-1947; Commonwealth Mycological Institute 1948-1985; CAB International Mycological Institute 1986-1990, part of CABI Bioscience, from 1992, at Egham, Surrey, UK;

K – Royal Botanic Gardens Kew, Surrey, UK, founded in 1841;

L – Oderzoekinstituut Rijksherbarium/Hortus Botanicus, founded in 1575, which is a part of Leiden University (Holland).

LE – Komarov Botanical Institute, St. Petersburg, Rusia, founded in 1714, by Academy of Science from Russia;

UPS – Botanical Museum, Uppsala University, Sweden, founded in 1785;

UPSC - genetic resources collection.

Collections of living materials have acronyms elaborated by International Association of Plant Taxonomy which are – usually – kept and recognized by all specialized publications.

In 1890, František Kral organized in Prague, the first collection of bacteria and fungi from all around the world, which existed until 1911. Unfortunately, many of microorganism taxons were lost [STOICA, VASSU & SĂSĂRMAN, 2002].

Referring to the most important collections from Europe, recognized by the whole world, are collections from: International Mycological Institute, Great Britain and Centraalbureau voor Schimmelcultures (CBS), now Centre of Mycological Biodiversity, from de la Utrecht University - Holland (placed formerly in Baarn, Holland).

The reference collection from IMI (International Mycological Institute) Great Britain is characterized by following aspects:

– databases which including host distributions and variability of taxons, and where are registered all permanent results of the most recent studies concerning cariotype, chromatographic and electrophoresis profiles;
– studies concerning phylogenetic relationships, based on biological molecular techniques, PCR / DNA sequence etc.;

- different methods for permanent preservation of collections: into tubes with medium, into liquid nitrogen, through lyophilization etc.;
- living materials is very important for biochemical systematic studies, identification and screening of properties useful for humans;
- realization of changes, donations, assurance of authorized reference duplicates etc.;
- organizing the lists of species, host plants, cultures, areas, basic forms etc.;
- initiation of the scientific catalogue named *Species Fungorum*;
- courses for specialists in different domain as following: about taxons which are rare and very difficult to identify, knowing the identification clues, knowing the most recent information about expert systems which working assisted by computer, courses of bio-systemic at different level, specialists, practicing specialists, researchers after PhD stages etc.; learning materials, pictures, video tapes, TV channels etc.; catalogues, maps, identification lists.

If all species of fungi would be registered into IMI collection, this should have a depositing space by 70 Km long.

CBS (Centraalbureau voor Schimmelcultures) Utrecht (Holland) (formerly situated in Baarn), is the oldest fungi collection (including yeasts) from the world. It was initiated in 1903 as a proposal of Botanists International Association.

Since 1968, CBS is included into Royal Academy of Arts and Sciences, and it is subsidized by Govern of Holland. Since 2000 (November) it has the residence into Utrecht University, where are reunited both fungi collection from Baarn and bacteria collection from Technology University from Delft. In 2001, CBS had 50,000 fungi and bacteria cultures [DINULESCU, 2001]. Recently, CBS included into its inventory the *Basidiomycetes* specify for woods collection from Götteborg University.

In 2004, CBS celebrated 100 years of existence and activity, pointed through a Symposium in Trippenhuis (Amsterdam, Holland) during 13-14 of May 2004, named „*CBS Centenary: 100 years of Fungal Biodiversity and Ecology*".

With this special occasion, specialists of this domain presented 52 scientific papers which were been published in two volumes of *Studies in Mycology*, nr. 50, 2004, 580 pp., authors CROUS P.W., SAMSON R.A., GAMS W., SUMMERBELL R.C., BOEKHOUT T., HOOG G.S & STALPERS J.A. There were been described 118 taxons, 2 new families and 17 species, two new combinations and a new name.

This institution signed, together with some other 180 countries, The Convention of Biology Diversity (CBD). In fact, CBS was been reorganized in 2000 and it was named Centre of Mycological Diversity (Mycodiversity) and, after that, it was transferred from Baarn to Utrecht and was been included into University.

The collection is keeping as following: in tubes, on agarized media; in lyophylisated amphula, through freezing in liquid nitrogen at -130ºC; in tubes covered by oil.

Fungi cultures lists edited by CBS (2001) was been published in 35-th edition and it included a large number of pages (681 pp.).

CBS has databases with very important number of information concerning to: filamentous fungi, yeasts, bacteria, actinomycetes, *Aphyllophorales*, *Fusarium*, anamorphous – telemorphous etc.

Also, CBS deposits pattern-isolated since 1955. From 1981, CBS became authorized international deposit for: fungi (from 1981); yeasts, actinomycetes and bacteria (from 1984); plasmids and fagues (from 1991).

In USA, the most important collection was recognized by ATCC (American Type Culture Collection), founded in 1925. The predecessor of this collection was founded in 1899 by American Society of Bacteriology.

In Asia, one of the most famous collection of fungi are: GBCC (Gene Bank Culture Collection), Genes Bank from Tsukuba (Japan) and IFO Collection from Institute of Fermentation (Osaka, Japan).

The actual collections of microorganism cultures are assisted and supervised by specific software [CONSTANTINESCU & MOBERG, 1987 etc.]. Table 1 presenting the main collections recognized around the world.

Tab. 1. Culture collections of fungi recognized around the world (based on http://biodiversity.bio.uno.edu/~fungi/fcollect.html)

Nr. crt.	**Collections (in alphabetical order)**	**Abbre-viation**	**Organisms etc.**
1	**2**	**3**	**4**
1.	Agricultural Research Service Culture Collection (Peoria, IL, USA)	NRRL	*Penicillium; Aspergillus; Actinomycetes*
2.	American Type Culture Collection	ATTC	Filamentous fungi; Yeasts
3.	ARS Collections of Entomopahtogenic Fungi (USDA–ARS) (Ithaca NY, USA)	ARSEF	Entomophageous fungi
4.	Banque Européennes des Glomales	BEG	Micorrhyzant fungi from *Glomales* phylum for Europe
5.	Belgian Co-ordinated Collections of Microorganisms	BCCM	fungi; yeasts; bacteria; plasmids
6.	CABRI – **C**ommon **A**ccess to **B**iological **R**esources and **I**nformation	CABRI	European Collections (BCCM, CABI, CBS)
7.	**C**anadian **C**ollection of **F**ungal **C**ulture	CCFC	Over 10.000 fungi collections
8.	**C**entraal**b**ureau voor **S**chimmelcultures – The Netherlands	CBS	Filamentous fungi, yeasts, bacteria, actinomycetes, *Aphyllophorales, Fusarium,* anamorphous-telemorphous
9.	**C**ulture **C**ollection of **Bas**idiomycetes (Czech Republic)	CCBAS	Over 630 isolated fungi from 253 spp. from 115 species of *Agaricales, Aphyllophorales* and *Gasterales*.
10.	**C**zech **C**ollection of **F**ungi	CCF	~ 2000 isolated fungi
11.	**F**ungal **C**ultures, **U**niversity of **G**öteborg – Sweden	FCUB	Especially lignicol fungi
12.	**F**ungal **G**enetics **S**tock **C**entre (U.K. mirror site)	FGSC	*Aspergillus*; *Fusarium*; *Neurospora*; *Sordaria*; wild and mutants types; cloned genes; genes bank

Nr. crt.	Collections (in alphabetical order)	Abbre-viation	Organisms etc.
1	2	3	4
13.	Fungi Perfecti (Olympia, Washington, USA)		Equipments used for fungi cultures; books; dried comestible mushrooms; medicinal mushrooms; seminars about mushrooms cultivation (Paul Stamets); Photo Collection; fungi ultrastructure, especially ME scanning
14.	German Collection of Microorgansims and Cell Cultures	DSMZ	Filamentous fungi; yeasts
15.	GPDATA: Soil-borne fungi Institute of Arable Crops Research, Rothamsted, UK		
16.	Culture Collection of the Institute for Fermentation Osaka - Japan	IFO	
17.	International Culture Collection of Arbuscular and VA Mycorrrhizal Fungi	INVAM	*Glomales*
18.	Microbial Germoplasm Database		Fungi and other microoganisms
19.	Microbial Information Network of China		Cultures; herbarium; Mycosystema Review
20.	**M**icrobial **S**train **D**ata **N**etwork	MSDN	Microorganisms (included fungi); catalogues with culture collections
20a.	Czech Collection of Fungi (CCF)	CCF	
20b.	Moscow State University Yeast Database (MSU)	MSU	
20c.	National Bank for Industrial Microorganisms and cell Cultures Bulgaria (NBIMCC)	NBIMCC	
20d.	National Collection of Agriculture and Industrial Microorganisms Hungary (NCAIM)	NCAIM	
20e.	Peterhof Genetic Collection of Yeasts Russia		
20f.	**R**esearch **I**nstitute of Applied Microbiology Russia (RIAM)	RIAM	
20g.	Slovania filamentous fungi		

Nr. crt.	Collections (in alphabetical order)	Abbre-viation	Organisms etc.
1	2	3	4
20h.	Universidad National de Córdoba, Argentina (LAM)	LAM	
20i.	LE(BIN) Basidiomycete Collection Russia	LE(BIN)	
20j.	VKM Russia	VKM	
21.	**M**icrobial **S**train **D**ata **N**etwork: mushroom databases	MSDN	Public and commercial resources for mycologists
22.	Mycobase (LCP) Cryptogamy Laboratory (LCP) and Natural History Museum from Paris	LCP	4000 isolated fungi
23.	Spanish Type Culture Collection / La Colection Espanola de Cultivos Tipo (CECT)	CECT	Fungi Bacteria
24.	**U**nited **K**ingdom **N**ational **C**ulture **C**ollection – CABI Bioscience (anterior IMI) + National Collection of Yeasts (NCYC)	UKNCC NCYC	
25.	**U**niversity of **A**lberta **M**icrofungus **C**ollection and **H**erbarium - Canada	UAMH	Over 9500 isolated ascomycetes, hyphomycetes, fungi which producing human and animal diseases, micorrhyzant fungi
26.	Uppsala University Culture Collection Sweden	UPSC	Over 3000 isolated fungi
27.	**W**orld **D**ata **C**entre for **M**icroorganisms	WDCM	Over 400 collections registered from more than 50 countries

The techniques used inside to living cultures of microorganism's deposits, including fungi, are correlated with a Brevet Request, become a common fact around the world [STOICA, VASSU & SĂSĂRMAN, 2002].

For the guarantee of a complete recognition of an invention concerning microorganisms (including fungi) it was initiated Treaty from Budapest (1977). It was signed by World Intellectual Property – WIPO and it starting to act since 1980. This international organization included the culture collections into International Depositary Authority (IDA) as (micro) biological material depositor used for strain patents. The states which have signed the Treaty from Budapest decided that the basic principle used for obtained patents is to deposit the microorganisms into a single deposit IDA [STOICA, VASSU & SĂSĂRMAN, 2002].

A culture collection could become an IDA if it receives this noun from state which comes from, but this collection has to accomplish all demands from Treaty from Budapest Statutes. Until now, only 30 microbial collections obtained IDA Collection Statute. IDA Collections has to offer facilities for analysis, keeping alive and maintaining pure (free from contaminants) during a period about 30 years minimum [STOICA, VASSU & SĂSĂRMAN, 2002].

The all quality criteria used for microbial cultures were been imposed by Standards Committee of the World Federation of Culture Collections (WFCC) which mentioned these aspects both into *Laboratory Practical Guide* (GPLC) and *Guide of Proper Techniques used for Laboratory* (GBPL). These aspects are mentioned into this *Guide* and they were been applied to many experimental domains (medicine industry, different kinds of biotechnologies etc.).

GPLC Guide including:

- minimal endowments list necessary for activities developed into Culture Collections which permitting accumulations of certain data concerning: culture quality and current information about microorganism cultures; contacts lists of organizations which make acquisition, preservation, distribution and transport;
- standards concerning organization and specialists activities, infrastructure and scientific activity;
- control methods of quality for evidencing the defects of function or troubleshooting. A proper protocol including rigorous references, specific information, simple responsibilities and correct solutions for problems which appeared during research processes [STOICA, VASSU & SĂSĂRMAN, 2002].

Applications of GPLC Standard for Microorganism Collections (including fungi) generate many advantages:

- productivity increase and knowledge quality in the same time with decreasing of potential errors;
- work conditions improvement;
- efficient using of laboratory equipment;
- decreasing of utilities consumed into those institutions;
- optimizing of time and financial resources used for successive verifications;
- obtained results well done documented;
- transactions with authentic cultures etc.

Fungi collections preserved into herbarium. If we talk about herbarium/collections, these are institutions which functioning since over 400 years [SĂVULESCU & al., 1968; CONSTANTINESCU, 1978). These kinds of institutions accomplish the main roles into biological sciences development (for example, mycology). The most important idea from Constantinescu's article (1978) concerning herbarium/collections is that herbarium is instruments for biological researches.

Herbarium is used at different levels of living world investigations.

- at submolecular level where are used methods from physics and chemistry, the herbarium have no role;
- at molecular level where are used methods from chemistry and genetics, the herbarium are used for documentation and bibliography;
- at cell level, herbarium are very important for their preserved material which is used for study of cell structures;
- at organism level, herbarium have a major importance as information source which permit to know the organism biodiversity, relationships between them or between them and the environment, and some other aspects derivate from this kind of researches. Work methods used in those researches including areas studies, experiments in greenhouse and field conditions, and the extension of these results across time and space;

– at populations and species levels, herbarium containing information deposits concerning distribution, succession or their disappearance.

Until now, we could say that the most important herbarium role is referring to taxonomic domain, in all 5 phases of this science development: descriptive, floral-phytogeographic, systemic, bio systemic, ecologic.

Herbarium accomplishes the following functions:

– *it is precious information sources* – information sources in plant biology are formed by study object (organism), as primary element, and knowledge about it (scientific literature), as secondary element. As any other science, is very important to have the study object presented into an accessible form, and this is realized through collections. A collection [SMITH, 1969, mentioned by CONSTANTINESCU, 1978] is *„an essential documentation referring to general concepts from fundamental biology, which needs to be verified again and again with real, tangible and material evidences, but not with what somebody told about these objects”*. Herbarium contains a sum of data from taxonomy and other domains until identification moment. Herbarium seems to by a library, but, in contrast with scientific literature, herbarium materials containing a bigger quantity of information which could be adapted and completed during time depending on evolution of concepts and researches methods. Individuals from herbarium are samples of vegetal populations from a specific area and specific species from which these plants are just a part. Herbarium samples offering to us the scientific basis of studies concerning to: species variability phenomena, permitting to realize maps of species spreading and migration ways, giving us the possibility to make investigations on dissemination mechanisms and gene changes between populations etc. Herbarium is a secondary source for making maps processes which are based on chromosomes number etc.;

– *assurance of scientific material preservation for samples which have scientific and historical values* – it is compulsory for herbarium to collect and preserve *types* as objects from national patrimony; the Law of National Cultural Patrimony stipulates that national patrimony includes „pieces from nature which disappear or are very rare” and „preserved types”. This law stipulates that these institutions have to accomplish some obligations referring to preservations of biologic materials;

– *herbarium are taxonomical research centres and learning institutions* – the existence of an herbarium is essential for researchers and teachers from extended plant taxonomy domain [SHETLER, 1969, mentioned by CONSTANTINESCU, 1978];

– *herbarium is important for identification services* etc. Herbarium has comparative material used for identification. Specialists who working in a herbarium have to identify precisely and competent all organisms. These notions permitting to specialists from other domains to have access to stored information concerning its objects.

Herbarium structure was been developed during time. Now, it is compulsory to be equipped with computers and specific software, new solutions for stored material and deposits structures, fast finding of information etc.

The conclusion of this article elaborated by CONSTANTINESCU (1978) is drowing from SHETLES words (1969): *„The true herbarium value for science and society, from a strictly point of view, is priceless. Herbarium development is influenced by general level of education, science and economy as a global. A country, without traditions and mature scientific institutions, has neither developed herbarium nor scientific education institutions to support them”*.

Around the world, there are recognized few herbarium / mycological collections with major importance which are presented in the following Table 2:

Tab. 2. Mycological collections recognized around the world (in alphabetical order) (based on http://biodiversity.bio.uno.edu/~fungi/fcollect.html)

Nr. crt.	Collections (in alphabetical order)	Abbre-viation	Organisms etc.
1	2	3	4
1.	British Antarctic Survey Herbarium	AAS	lichens; macromycetes; alga; plants
2.	Collection Micro- et Macromycetum Natural History Museum of Hungary	BP	macromycetes; micromycetes; over 90,000 species and 66 types ; based on data for almost 20,000 macromycete species
3.	Cornell Plant Pathology Herbarium	CUP	400,000 spp. of phytopathogenic fungi etc.
4.	Dutch Herbaria: catalogue of type specimens		55,000 species of lichens and fungi are deposited in Amsterdam (AMD), Leiden (L), Utrecht (U) and Wageningen (WAG); fungi and lichens photos
5.	Farlow Herbarium Harvard University (MA, USA)	FH	fungi; lichens
6.	Forest Mycology and Mycorrhiza research team, Mycology Research Herbarium – US Forest Service Corvallis, OR.	OSUF	28.000 species
7.	Forest Pathology Herbarium Pacific Forestry Centre (Canadian Forest Service)	DAVFP	Fungi and Hosts Index from British Columbia (Canada); macromycetes
8.	Herbaria Online		Fungi
9.	Herbarium Hamburgense	HBG	fungi; lichens
10.	Herbarium Pacificum Bishop Museum Hawaii, USA	BISH	Species and types of fungi
11.	Index Herbariorum New York Botanical Garden		
12.	Julian H. Miller Mycological Herbarium Georgia University, USA	GAM	Fungi in arts; Myxomycetes; fungi from Georgia and Tropics; history of mycology
13.	Kriebel Herbarium Purdue University		Fungi from Indiana and Centre of USA
14.	MA Herbarium fungus type Real Jardin Botanico, Madrid, Spain		Dotideales; Sphaeropsidales; R. Gonzales Fragoso, R. Cifferi and F. Bubak collections
15.	Microbial Information Network of China		Mycological Herbarium; Mycosystema Review
16.	National Botanic Garden of Belgium – Herbarium	BR	Myxomycetes (E. Klopfenstein; N. E. Nannenga-Bremekamp)

Nr. crt.	Collections (in alphabetical order)	Abbre-viation	Organisms etc.
1	2	3	4
	Mycologicum		Living species A. Marchal Collections from Africa, Europe, Belgium
17.	National Herbarium of the Netherlands	NHN	Founded in 1999 from Leiden (L), Utrecht (U) and Wageningen (WAG) Herbarium
18.	New York Botanical Garden USA	NYBG	macromycetes; *Agaricales*; G. Massee collection; *Uredinales*
19.	New Zealand Fungus Herbarium	PDD	Fungi; bounded with NZ Fungi and Global Plant (Pest Information System)
20.	Oregon State University Herbarium USA	OSC	Fungi specimens
21.	Penn State Mycological Herbarium Pennsylvania USA	PACMA	Fungi
22.	Personal Herbaria of Professor Seaward		Lichens
23.	Royal Botanic Gardens Melbourne Australia		Fungi Maps of fungi
24.	Rutgers Mycological Herbarium Rutgers University, NY, USA	RUTPP	
25.	SUNY College of Environmental Science and Forestry Herbarium State University of New York College of Environmental Science and Forestry (Syracuse, NY, USA)	SYRF	Fungi
26.	Swedish Museum of Natural History Lichen Herbarium, Stockholm, Sweden	S	Lichens; macrofungi Elias Fries photos
27.	New York State Museum Mycological Collection: Herbarium NYS NY State Museum (Albany, NY, USA)		C.H. Peck Collection (1868-1913) – over 2.700 new described species (1868-1913)
28.	U.S. National Fungus Collections databases - USDA-ARS		Fungi on plants and plant products from USA; Guide for pathogenic fungi identification; List of species from Fungi National Collection (BPI); Index Syloge Fungorum (Saccardo); Index of fungi
29.	U.S. National Herbarium Lichen Type Specimens – Smithsonian Institution		lichens; lichenizated fungi from Guiana

Nr. crt.	Collections (in alphabetical order)	Abbre-viation	Organisms etc.
1	2	3	4
30.	University and Jepson Herbaria, University of California, Berkeley, USA		fungi; lichens
31.	University of Arizona Lichens database		Lichens from Sonoran Desert
32.	University of British Columbia Herbarium	UBC	over 14.000 fungi and 35.000 lichens
33.	University of Michigan Herbarium - USA	MICH	Over 9.000 truffle collections and macroascomycetes from West of America
34.	University of Minnesota Lichen Herbarium	MIN	Lichens
35.	University of Oslo, Lichen Herbarium Norway	O	Lichens
36.	University of Trieste, Lichen Herbarium Italy	TSB	Lichens

Also, there are known some other herbarium which included lichens and they are mentioned into Table 3.

Tab. 3. Lichens Herbarium recognized around the world
(based on http://biodiversity.bio.uno.edu/~fungi/fcollect.html)

Nr. crt.	Collections (in alphabetical order)	Abbreviation	Organisms etc.
1	2	3	4
1.	British Antarctic Survey Herbarium	AAS	lichens macrofungi
2.	Dutch Herbaria: catalogue of type specimens		55.000 standard species of fungi and lichens, deposited in Amsterdam (AMD), Leiden (L), Utrecht (U) and Wageningen (WAG) photos of fungi and lichens
3.	Farlow Herbarium Harvard University (MA, USA)	FH	fungi lichens
4.	Herbarium Hamburgense	HBG	fungi lichens
5.	Index Herbariorum New York Botanical Garten		
6.	National Herbarium of the Netherlands	NHN	Founded in 1999 from Leiden (L), Utrecht (U) and Wageningen (WAG) Herbarium
7.	Personal Herbaria of Professor Seaward		Lichens
8.	Swedish Museum of Natural History Lichen Herbarium, Stockholm, Sweden	S	lichens macrofungi Elias Fries photos
9.	U.S. National Herbarium Lichen Type Specimens –		lichens; lichenizated fungi from Guiana

	Smithsonian Institution		
10.	University and Jepson Herbaria, University of California, Berkeley, USA		fungi lichens
11.	University of Arizona Lichens database		lichens from Sonoran Desert
12.	University of British Columbia Herbarium	UBC	Over 14.000 fungi and 35.000 lichens
13.	University of Minnesota Lichen Herbarium	MIN	Lichens
14.	University of Oslo, Lichen Herbarium Norway	O	Lichens
15.	University of Trieste, Lichen Herbarium Italy	TSB	Lichens

The main mycological collections from Romania are: *Exsiccata Herbarium Mycologicum Romanicum* (acronym BUCM) from Biology Institute (Bucureşti), collection from The Botany Department from University of Bucureşti (BUC), The Botanical Garden Collection from Cluj-Napoca (CL) and The Plant Biology Department from „*Al.I.Cuza*" University of Iaşi (I) [CONSTANTINESCU, 1972].

Herbarium Mycologicum Romanicum (HMR) from Biology Institute (Bucureşti) founded by Tr. Săvulescu inside of Agronomic Research Institute of Romania Building (ICAR). In 1960, it was been moved into Academy of Romania Building and there it is situated now [NEGREAN, 1996]. It is considering the largest mycological collections from South-Est of Central Europe. Since 1975, BUCM was been declared an object from National Patrimony of Bucureşti with No. 2619 [NEGREAN, 1996].

Specialists from Romanian mycology domain, recognized as international authorities of these domain, acting during time into BUCM: Tr. Săvulescu, T. Rayss, C. Sandu-Ville, A. Racoviță, Al. V. Alexandri, Vera Bontea, Ana Hulea, O. Constantinescu, G. Negrean, M. Petrescu. BUCM is improving constantly based on their works and efforts. The development of this large collection could be presented in the following Table 4.

Tab. 4. Development of Mycological collection from BUCM (after NEGREAN, 1996)

Period	Years	Number of objects	Individuals/year	Total BUCM
1928-1957	30	26.000	866	26.000
1958-1969	12	10.000	833	36.000
1979-1980	10	28.000	2.800	64.000
1981-1990	10	56.000	5.600	120.000
1991-1996	6	15.000	2.800	137.000

Beyond the mycological collection, BUCM has a mycological library which containing: mycological catalogues, collections of international mycological reviews, a collection of maps (about 700), microscopic preparations (over 2000), abstracts concerning to Romanian Mycota (over 900), abstracts concerning to their countries mycota (over 3700), mycological objects, colour film-slides collection with macromycetes (over 900) etc.

The changing basis of BUCM is exsiccata *Herbarium Mycologicum Romanicum* (HMR), created by Tr. Săvulescu in 1928 and which is edited into 70 copies. Until now, there was been edited 63 fascicles (numbers), each of them presenting 50 different species. Exssicata spreads information about Romanian Mycobiota through mycological material

changes between this institution and more than 40 other institutions from Romania and abroad. BUCM becomes important as isotypes distributor [Negrean, 1996].

Many of those fungi species representing an adequate material could be used for experimental researches from microbiology, taxonomy and genetics domains, where this material is considered as experimental models.

From those species, we could mention: *Neurospora crassa* Shear & B.O. Dodge, *Coprinus cinereus* (Schaeff.) Gray, *Schizophyllum commune* Fr. (model used for genom study), *Allomyces macrogynus* (R. Emers.) R. Emers. & C.M. Wilson, *Phycomyces blakesleeanus* Burgeff, *Aspergillus nidulans* (Eidma) G. Winter [teleomorpha *Emericella nidulans* (Eidam) Vuill.], *Ustilago maydis* (DC.) Corda, *Saccharomyces cerevisiae* Meyen ex E.C. Hansen etc.

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THEORETICAL AND PRACTICAL ACTIVITIES CONCERNING THE DEVELOPMENT AT PUPILS OF CONSCIENCE CONCERNING THE PROTECTION OF FLORA FROM PROTECTED AREAS AND WETLANDS

AXINI MONICA[1,2], BERCU RODICA[2]

Abstract: The nature preservation is an major object which it must to concern the whole humanity in the conditions of important global transformations.
Because the scientific and practical importance, the protected areas and wetlands occupy a special place in the world preoccupations of nature conservation. These constitute an ecological balance of the actions and retroactions from flora, fauna and climate. For this reason, it is imperative their sensible conservation and capitalisation.
But, always, the man has intervened in their balance with the most negative results.
In conservation preoccupation of protected and wet ecosystems, its frames the theoretical and practical activities carried out in the line of pupils by *G.C.E.E.M*. during 2006 - 2009. The major purpose was the develop a conscience of young generation concerning the importance of the protected areas and wetlands in sustenable maintenance.
The present paper point same events went by the time of the Wetlands Day, of the Water Day and of during the spring and the summer.

Keywords: pupils, ecological education, wetlands, protected areas

Introduction

The projects adressed to middle school pupils (with age between 11–14 years) and high school pupils (with age between 15–18 years).

The purposes of projects was the developm a conscience of children concerning the protection and conservation of flora from protected areas and wetlands through: a) pupils examination concerning their knowledges about flora from protected areas and wetlands; b) delivering of conferences; c) lectures on flora of protected flora and wetlands; d) making study trips in various terrestrial and coastal protected lands from Constantza county; d) carrying out of pictures, drawings and grapfic arts competitions; e) drawing up, printing and the distribution of instructive teaching aids; f) seeing of documentary films [AXINI & BERCU, 2008; AXINI & al. 2008; CORNEANU & et al. 2005]

Results and discussions

Pupils examination. Pupils answers showed that they owned some knowledge about flora of protected areas and wetlands and nature, in general. But, they wish to know

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more about that and they will mixed up in projects concerning the knowledge, the protection and the rehabilitating of it (Fig. 1) [AXINI & al. 2008].

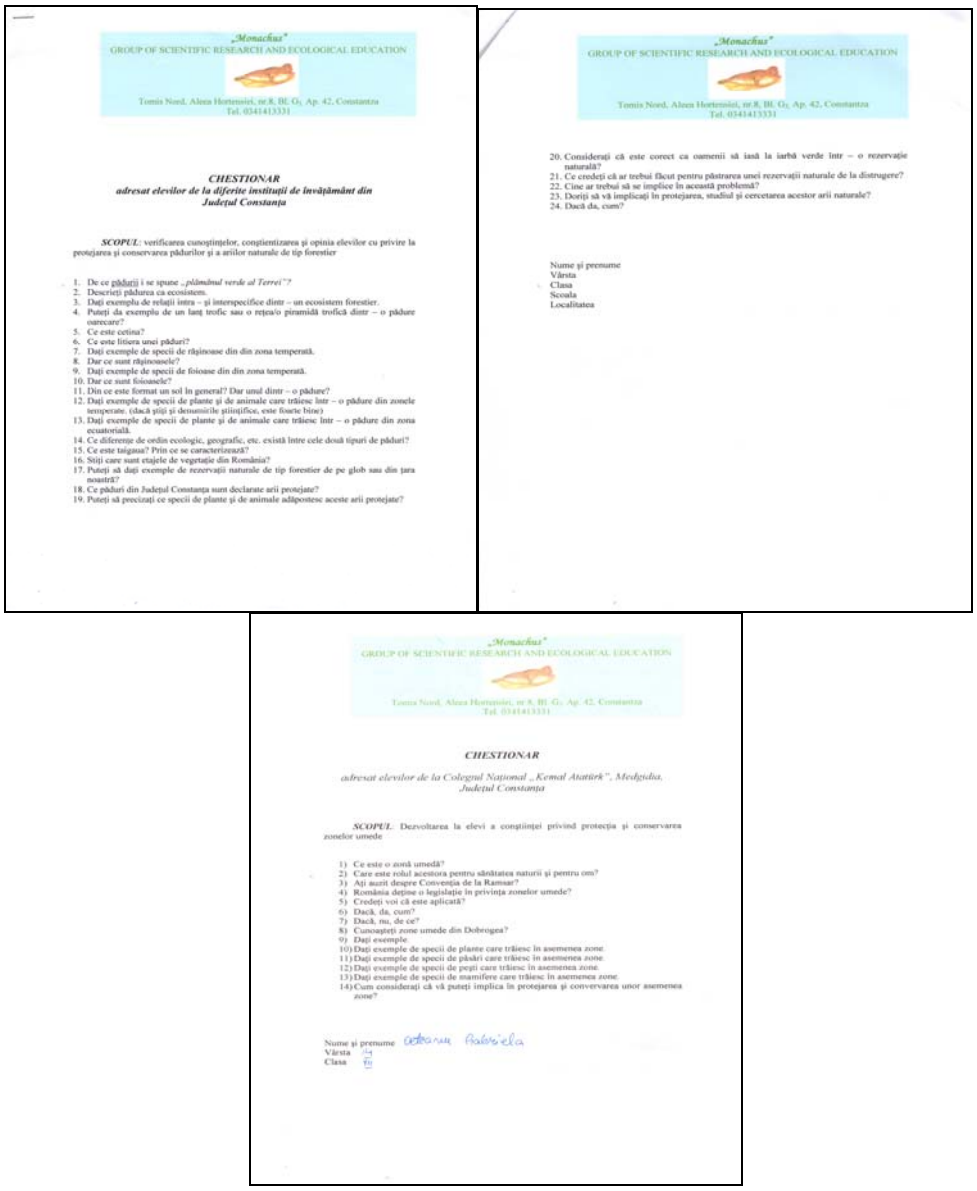

Fig. 1 –Pupils examination

Delivering of conferences. The participation in great number of pupils at conferences organized for they, showed their interest in theoretical and practical problems of nature in general and especially of flora, in these areas. The lectures were maked by specialists and pupils. The pupils met scientists, which know their preoccupations and science problems from nowadays (Fig. 2) [AXINI & al. 2008].

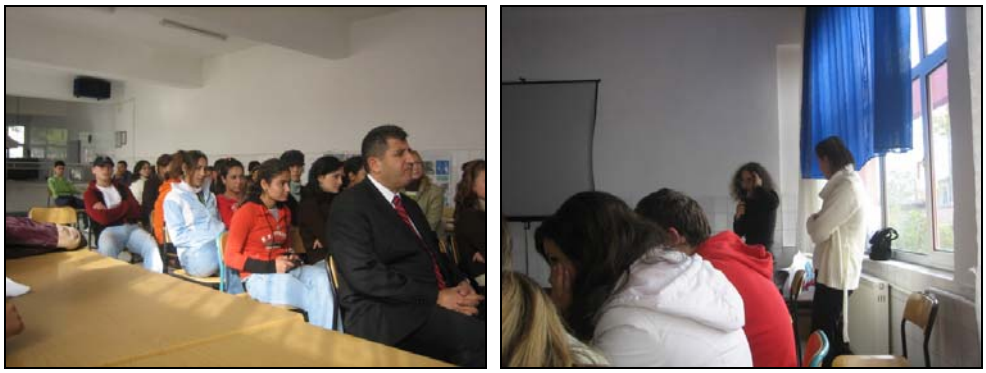

Fig. 2. Delivering of conferences

Lectures on flora of protected areas and wetlands. In other stage, the pupils participated to lectures on flora from the nature reserves and wetlands. They learned: what is a protected area and how/why is founded; how are the wetlands and nature reserves in Dobrudja; the plants species which habits in such places, their adaptations at environment as well these threats and the protection measures that it will be taked; the international and national legislation with reference from these and their application; their statute. The lectures ended with pupils questions showing their interes about nature and protected flora in particular (Fig. 3) [AXINI & al. 2008].

Fig. 3. Making lectures

Study trips in various terrestrial and coastal protected lands from Constanţa county. With such stock of knowledge concerning protected lands, children participated to study trips in various nature reserves from Constanța county (Fig. 3). The pupils received binoculars, cameras, cases for the measurement of physical and chemical parameters, botanical cases, etc. They achieved observations concerning the phenomenons which happened in these areas. They learned to collect and to identify plants from respective zones. They learned to make herbaria, to use different Flora Books to identify plant species. Finally, they understood the adaptations of plants to such environments and the need to protect them, proposing various conservation measures of those endangered and rare species, measures that could be put into practice in the future [AXINI & TOFAN, 2009].

Carrying out pictures, drawings and grapfic arts competitions. Its carryed out competitions of pictures, drawings and grapfic arts. The participants were a lot of middle school pupils from Constanța county schools and pre-school children from two nursery schools in Constanța town.

Drawing up, printing and distribution of instructive teaching aids. In the same projects, the pupils received teaching aids concerning the coastal lands: posters, leaflets, booklets, etc. In others projects, the pupils distributed the leaflets with coastal lands informations.

Seeing documentary films. The pupils saw documentary films concerning wild life of terrestrial and coastal nature reserves in Constanța county.

Granting of diplomae and prizes of participant pupils in projects. For the implication in conferences, we granted a number of: 6 excellent prizes, 7 prizes I, 6 prizes II, 6 prizes III, 11 mentions (Tab. 1). For participants to the competitions of making pictures, drawings and grapfic arts, we granted a number of: 4 excellent prizes, 3 prizes I, 5 prizes II, 4 prizes III, 2 mentions (Tab. 2). The great number of diplomae and prizes shows the passion of the pupils and their wish for the knowledge and the protection of nature from protected areas and wetlands, of flora in particular. In general, the diplomae were made and financed by G.C.E.E.M. As prizes we gave: popularity science books, atlases, posters, leaflets, instructive teaching aids concerning biology and ecology of those areas.

Tab. 1. Diplomae given to the pupils for the active participation to conferences

PRIZE	NUMBER OF PRIZES		NUMBER OF PUPILS		NUMBER OF PAPERS	
	Middle School	High School	Middle School	High School	Middle School	High School
Excellent Prize	2	4	2	13	2	3
Prize I	5	2	5	2	5	4
Prize II	5	1	5	1	5	1
Prize III	-	6	-	15	-	6
Mentions	4	7	4	10	5	2
TOTAL	**16**	**20**	**16**	**41**	**17**	**16**

Tab. 2. Diplomae given to the pupils for the active participation to making pictures, drawings and in graphic arts competitions

PRIZE	NUMBER OF PRIZES		NUMBER OF PUPILS		NUMBER OF PAPERS	
	Middle School	Middle School	Middle School	High School	Middle School	High School
Excellent Prize	4	-	4	-	4	-
Prize I	3	-	3	-	3	-
Prize II	5	-	5	-	5	-
Prize III	4	-	4	-	4	-
Mentions	2	-	2	-	2	-
TOTAL	**18**	**-**	**18**	-	18	-

The Foundation of J. T. R. Group

In 2007, was born the group of Junior Terrestrial Rangers (J. T. R.), formed by middle school pupils, with age between 11 – 15 years. This group is composed by one leader, one spokesman, one environmental reporter and group members. Their mission is to study and protect nature reserves, in general, the nature of Dobrudja, by lands studies, discussions with public and the distribution of teaching aids concerning nature informations, etc.

Future views

Such projects, in special those with practic parts, were a success. All this, it advices us to change them into programms which we are going to develop year by year. The direct beneficiaries will be pupils from others schools from Constanța county.

In future, we are going to involve more pupils in J. T. R. group, to expand their action area and to achieve experience changes with similar groups, both in our country and in others.

Some of high school pupils would be involved in research projects and they even will develop a scientific profession.

Collaborations

In all of these projects, we collaborated with:

1) Environment Protection Agency of Constanța county – advicers: Zoica Călătoiu, Mihaela Condur, and Marcela Popovici;

2) National Institut for Marine Research and Development "Grigore Antipa", Constanța, Romania – Strategy-Cooperation manager, Ph. D. Nicolae Papadopol, biologist Maria Moldoveanu, engineer Ph. D. Laura Alexandrov, engineer Ph. D. Tania Zaharia, and others;

3) Natural Sciences Museum Complex – general manager Decebal Făgădău, biologist Ph. D. Elena Şerbănescu, and biologist Adela Bologa;

4) The National Administration "Romanian Waters" "Dobrogea – Litoral" "Waters Directorate – Office leader Josefina Lipan;

5) The Romanian Naval League, Constanța Subsidiary – biologists Ph. D. Ioan and Florica Porumb, counter-admiral George Petre;

6) Consulate General of the Republic of Turkey, Constanța – general consul Haluk Ağca.

Collaborations with other schools from Constanța county:

1) "Dimitrie Cantemir" Middle School, Constanța – headmaster, teacher of history Teodora Maria Muşat, teacher of chemistry Marina Marinescu, teacher of geography Neriman Asan, teacher of drawing Bogdan Ionuț Ene, teacher of technological education Violeta Cojocaru;

2) "Decebal" Theoretic High School, Constanța – teacher of biology Romica Milea;

3) "George Călinescu" Theoretic High School, Constanța – teacher of drawing Bogdan Ionuț Ene;

4) "Omnia" High School, Constanța – teacher Ph. D. Carmen Atanasiu;

5) "George Emil Palade" School Group, Constanța;

6) Middle School, Crucea – teacher of Romanian language and literature Carmen Maria Dumitrescu;

7) "Nicolae Bălcescu" Theoretic High School, Medgidia – teachers of geography Anca Elena Bălaşa and Şeila Selim;

8) "Kemal Atatürk" National College, Medgidia – teacher of geography Şeila Selim, teacher of drawing Iuliana Neacşu, schoolmaster Eugenia Ungureanu;

9) "Spiru Haret" Middle School, Medgidia – teacher of biology Felicia Simion, teacher of plasticdrawing Iuliana Neacşu;

10) "Lazăr Edeleanu" School Group, Năvodari – teacher of biology Corina Tudoraş;

11) Middle School No. 3, Năvodari.

In all of these projects, we were financed by: S. C. Corona Trust S. R. L. Constanța, S. C. Proiect S. A. Constanța and Romanian Bank for Development – Groupe Societe Generale, Constanța.

Conclusions

The participation of pupils at theoretical and practical activities of the projects show their interest concerning the flora in the protected areas, by their knowledge and protection activities. They wish to participate at various projects and programmes concerning the study, the research and the reconstruction of such areas.

Such educational projects must be a constant preoccupation of scientists because the childrens are the ruling force which it guide us to a most clear and healthy nature.

Acknowledgments

We thanks all above – mentioned friends and fellow – workers both the pupils which were involved in these projects. We thank to those companies which financed these events.

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Happy Anniversary, Professor PhD. Tatiana Eugenia ŞESAN!

The time is irreversible sending us, sometimes too fast, up to different directions. This is a reason for a short stop during *The Big Passing*, even for few minutes. We have to give our thanks to a personality as special as she is. She opens new directions to knowledge for many generations. She honoured this profession through her devotion, hard and good work, respect, perseverance and her principles. ***Professor PhD. Tatiana Eugenia ŞESAN*** represents an example for many people who work together with her. At the same time, she is a real mentor for many young disciples who are all around and following her with love and respect.

Tatiana Eugenia FRĂŢILESCU, named ŞESAN after her marriage, was born in Bucharest, on 12th January 1944, under Capricorn sign. In 1950, she started to study at Central Girls School in Bucharest, near The Garden of Icon, where she has been educated by an elite of many important teachers. She graduated in 1961 with school-leaving examination.

In the autumn of the same 1961, she started her university education at University "Alexandru Ioan Cuza" from Iaşi - Faculty of Biology. She obtained her university diploma at Bucharest University in 1966. Both in high-school and university, she assimilated lots of scientific knowledge at a high level because of many special teachers and professors from the domain of biological sciences. All of them were true spiritual mentors for her, distinguished personalities, very important persons for students who came to learn at Faculty of Biology because of their passions.

She started the activity as preparator at Pedagogical Institute from Bacău – Faculty of Natural and Agricultural Sciences. After a while, she has been promoted as following: preparatory (1966-1970), assistant-lecturer (1970-1974) at Pedagogical Institute from Bacău, microbiologist (1974-1975) at The Milk Industrialization Factory from Bucharest, biologist in Mycology Team of Phytopathology Laboratory from Research Institute for Plant Protection (I.C.P.P.). During three decades at I.C.P.P. Bucharest, she was promoted as following: scientific researcher (CS) (1975-1989), similar with assistant-lecturer from university hierarchy, scientific researcher III (1989-1990), scientific researcher II (1990-1993) and scientific researcher I (1993-present).

Beginning with 2004, she is scientific researcher I at Research Centre MICROGEN from Bucharest University. Starting with 1990, she was back at university career as associate-professor at Bucharest University – Faculty of Biology, where she was responsible for Phytopathology course and practical-training. Afterwards, she was responsible for Mycology course, and, since 2004 she is Professor PhD for Mycology and Phytopathology at Bucharest University – Faculty of Biology.

She prepares teaching activities very carefully for many domains as follow: *Botany* (vegetal taxonomy, morphology and plant anatomy, plant physiology), *Biochemistry, Plant Protection, Technical for Teaching Materials Preparing for Biological Disciplines, Pedagogical Training, Agricultural and Biological Training* at Pedagogical Institute from Bacău, then *Phytopathology / Biology of Vegetal Pests, Researching Activity* for some Bachelor's and Dissertation papers, *Mycology*, first of all as associate-professor and, after

that, as Professor PhD at Botany Department from Bucharest University – Faculty of Biology. She was invited as lecturer at two important universities (Tanta and Alexandria) from Egypt (2003), where she presented conferences concerning to *Biological Control of Plant Diseases*.

She consulted many Romanian and foreign references and she is connected all the time to the scientific world. She followed many training-stages at Genetics Department (Cytogenetics) and Systematic Botany Department from Bucharest University. Afterwards, she followed many stages, during three and six months, for documentation and work at national and international scientific projects (Holland, 1993; 1995; 2000, project EU BIOSPORSUPRESS 33 00003.2).

During the last ten years, she has been working at scientific research projects RELANSIN 29 (manager), RELANSIN 1463, BIOTECH 121 and 272 (manager), CALIST, CEEX 38, CEEX 43, CEEX 75, CEEX 183, awarded through a national competition. Now, she is working at a few other scientific projects as follow: IDEI 1931 (manager), Project PN II-51078 (collaborator) and as member in International Programs ERASMUS and COST action 870.

During scientific career, she coordinated many scientific activities of young people through her practical-training handbooks, university and post-graduated courses; conferences for students from Agricultural Sciences and Veterinary Medicine University from Bucharest concerning both from Plant Protection or Plant Pathology Domains; she was responsible for researching-training of students from BIOTERRA University from I.C.P.P. Bucharest (2001); she was scientific coordinator for many dissertation papers of students from Master level, methodical and scientific papers elaborated by teachers from high-schools. All these students obtained maximum evaluation for them. She was requested as member in analysis team for foreign scholarships competitions and recommendations. She help all of us with lots of scientific references from Romanian and foreign literature etc.

Since 2000, she became scientific coordinator for Doctoral Program, in Natural Sciences Fundamental Domain, Biology Domain at Bucharest University – Faculty of Biology. She coordinates scientific activities for 15 doctoral students who are in different stages of their Scientific Preparing Program. Up to now, three PhD thesis were graduated under her guidance (one of them has been realized together with specialists from France), a post-PhD scientific paper (scholarship for a PhD from Senegal, during *Eugen Ionescu* Scholarship Program), and three PhD thesis presented inside of the Department which will have the public presentation in 2010. In the same time, she was requested as scientific referent for much than 20 PhD theses from other universities.

Mrs. Professor PhD Tatiana Eugenia ŞESAN is focusing her interest to many domain as follow: *Botany* (vascular plants, especially ruderal and segetal plants, with 2 taxa from vascular plants and 8 rare taxa for Moldavian Flora; 85 new taxa and 38 rare taxa for Bacău District; 21 taxa included into *Flora Exsiccata of Moldavia and Dobrogea*); *Biological and Biotechnological Study Concerning to Antagonistic Fungi, Biological Agents for Control of Plant Diseases, Introduction of Biological Elements Used for Plants Diseases and Weeds in Integrative Protection Systems of Cultures Against Diseases, Pests and Weeds; Pathology of Cultivated Plants; Seeds, Plantlets and Biological Material Pathology* (bean, soy-bean, peas, grey-pea, sugar-beet, conifers, vine)*; Forestry Protection, Seed Pathogens and Coniferous Plantlets; Signals for Pathogens / Antagonistic Fungi / New Hosts; Diseases Spreading Evaluation for Cultivated plants from Romania*, she continued the work of Prof. PhD Tr. Săvulescu; *Researches Concerning to General and Applied Mycology*; taxonomy and phylogeny of fungi, mycodiversity, preservation of

macromycetes diversity inside of natural ecosystems and agro-ecosystems diversity, elements of molecular biology (fungi in Genomic Era); *Researches concerning to mycotoxicology,* mycotoxines produced by main micromycetes genera and their impacts on people and animals health; *Microbiology / Medical Mycology; Researches Concerning to Cultural Inheritance Preservation; Biological and Biotechnological of Cultivated Mushrooms; Personalities and Scientific Events from Botany Domain, Plant Protection, Phytopathology, Mycology, Biological Control of Plant Diseases, Reviews* (for some scientific books).

From her many scientific activities, the one referring to antagonistic fungi and their usage for integrative preservation against plant diseases represents the most important domain for her scientific recognition. Her PhD thesis titled ***Biological Study Concerning to Antagonistic Fungi Against Pathogens Which Produce Plant Mycosis (1985)*** was included in the same domain. Through this subject, she was recognized as a pioneer of these kinds of studies together with important members of Romanian Phytopathology School founded by Acad. PhD Tudorel Baicu and PhD Vera Bontea (PhD Program Coordinator). In the same domain were been included more than 70% from her papers and books, three of them awarded very important distinctions.

The entire scientific activity includes a huge quantity of personal and original scientific results. Her scientific contributions were published up to now as follow: 19 books (1 chapter published abroad); more than 310 scientific contributions and 3 invention patents (two of them homologated – 1999, 2009 – ISI mentioned and the last one which will be homologated – 2009) (http://www.bio.unibuc.ro/~tsesan/index.html).

Her scientific papers were published in 41 Romanian reviews/volumes, as follow: *Romanian Agricultural Research*, *Romanian Archive of Microbiology and Immunology*, ISI quoted and in 23 reviews/volumes, as follow: *IOBC (International Organisation of Biological Control) Bulletin*, *Journal of Food Protection* (ISI) (*Journal of International Association of Food Protection*), *Phytopathologica* (Israel), *Phytopathologia Polonica*, *Bulletin of Polish Academy of Sciences*, *Acta Immunologica et Microbiologica Hungarica* (ISI), *Acta Horticulturae* (*Journal of International Society for Horticultural Science*) etc.

As an official argument for her appreciation, many of her scientific papers are mentioned both in the country and outside. With this special occasion, 83 from her scientific papers are mentioned abroad in 142 other scientific papers (*Dictionary of Fungi*, IXth, Xth eds., CABI, UK, 2001, 2008) and 17 of them are mentioned in 64 very important Romanian scientific papers and books. Besides, 7 scientific papers and 2 invention patents are ISI quoted and most of them are mentioned in The International Data Basis for Scientific Papers.

The most mentioned paper in Romania has been *Agricultural Phytopathology* (1996). It was mentioned in 22 other books from this domain, followed by a monograph titled *Sclerotinia sclerotiorum* (1998) which was been mentioned by 6 times.

Written books were been appreciate by academic community and they received good references in few very important reviews. The most important appreciations were published about the monograph titled *Sclerotinia sclerotiorum* (1998), which was analyzed and presented in 8 reviews, 2 of them in BDI (UK) and Hungary and 6 analyze in Romanian reviews.

As an official recognition for her scientific activity, 4 of her 19 published books were distinguished with important awards: *Tr. Săvulescu* Award of Romanian Academy (1988) received in 1991, for the scientific papers titled "*Bolile plantelor industriale. Prevenire şi combatere*, Ed. Ceres, Bucharest, 1988, authors: Lucreţia Dumitraş and Tatiana Şesan; *Tr. Săvulescu* Award of Romanian Academy (1998) received in 2000, for

the scientific papers titled *"Putregaiul alb – Sclerotinia sclerotiorum – Prevenire şi combatere"*, Ed. Ceres, Bucharest, 1998, authors: Tatiana Eugenia Şesan and Aurelia Crişan, ISBN 973-40-0427-1; *M. I. Constantineanu* Award of Ecosanogenesis Association from Romania, received in 1999, for scientific paper *"Limitarea populaţiilor de dăunători vegetali şi animali din culturile agricole prin mijloce biologice şi biotehnice în vederea protejării mediului înconjurător"* (collab.), Ed. DISZ TIPO – Braşov, 1997, ISBN 973-97290-7-x; *Emanoil Teodorescu* Award of Romanian Academy for 2006, received in 2008, for book titled *"Concepte actuale în taxonomia ciupercilor"*, Ed. University *Al.I. Cuza* Iaşi (collab. with C. Tănase), ISBN 973-703-156-3; ISBN (13) 978-973-703-144-0. Some other awards received by her are as follow: Diploma for Research Contract CEEX 38/2005 from Bucharest University on 7th of October (2006); Certificate of Award, *Who's who*, Personenenzyklopädien AG, Switzerland (2009).

She is corresponding member Academy of Agricultural Sciences and Forestry, corresponding member of Scientists Academy of Romania – Biology Section and member of some important national professional organizations and societies: National Society for Plant Protection, National Society of Mycology, Society for Biological Sciences, Ecosanogenesis Association from Romania (founding member, 1996), Phytosociology Society from Romania (2005), Friends of Roses (2007), Associations of Botanical Gardens from Romania (2008), Society of Mycology from Czech Republic (1998); Phytophatology Society from Poland (1999); International Organization for Biological Control of Noxious Animals and Plants, Working group Biological Control of Fungal and Bacterial Plant Pathogens) (2002); EMA (European Mycological Association - 2006). Since 2006, she is vice-President of National Society of Mycology. She is one of the founding members of this professional association and, through her scientific activity, contributing to its permanent development.

She was invited as guest at many international congresses organized in: Denmark, Holland, Turkey, Poland, Great Britain, Czech Republic, Greece, Switzerland, Austria, Israel, Hungary, France, Spain, Taiwan, south Africa, Russia. She was scientific reviewer in many important reviews from biology domain, as follow: *Mycological Research* (Great Britain), *Phytoparasitica* (Israel), *Phytopathologia Polonica* (Poland), *Biología* (Slovakia) and editors committee of some Romanian reviews (*Buletinul de Protecţia Plantelor*, *Analele ICPP/ICDPP Bucureşti*, *Plant Research Development*). She was both collaborator for the reviews *Sănătatea plantelor* (Romania) and *Phytopathologia Polonica* (Poland). She was invited as member in organization boards for many scientific meetings for specialists from Mycology and Phytopathology domains in Romania and Poland.

The art of taking photos has no secrets for her. And, because of that, it became a certain hobby for Professor PhD Tatiana Eugenia ŞESAN. Through the magic eye of the camera, she registered all special moments of our lives and scientific activities, special landscapes and imagines. All these photos were published, after 2001, in few exhibitions of artistic photography (*Curcubeul florilor*; *Taina florilor*; *Anotimpuri*; *Plantele – ştiinţă şi metaforă*; *Prin ochiul magic al naturii*) and exhibitions of mycological photography (*Ciupercile între viclenie şi adevăr I* and *II*; *Un univers insolit – ciupercile*; *Ciuperci lignicole*).

The 65th anniversary represents a special moment both for Professor PhD Tatiana Eugenia ŞESAN's life and the entire academic community. All of us want to wish her "Happy anniversary and that all her wonderful dreams become true!"

Cătălin TĂNASE, Ciprian Bîrsan

SELECTIVE LIST OF REPREZENTATIVE WORKS

I. BOOKS

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9. **Şesan Tatiana**, Crişan Aurelia, 1988, *Cercetări de biologie asupra ciupercii Coniothyrium minitans* Campbell - *specie hiperparazită nou semnalată în România* [*Researches on the biology of C. minitans* Campbell – *fungal hyperparasitic species newly recorded in Romania*] , *St. şi Cerc. Biol*., *Biol. Veget*., **40** (2): 71-77

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25. Oancea F., **Şesan Tatiana**, Constantinescu Florica, Dinu Sorina, Petrescu Andreea, 2009, Compoziţie pentru creşterea şi dezvoltarea plantelor [*Composition for the plant growth and development*], patent act no.: 122588 din 30.09.2009

First year of study (practical in Bârnova Forest, Iaşi, 1962)

Pedagogical Institute from Bacău (botanical practical with students, 1974)

The XIVth Conference on field culture protection, Podul Iloaiei (Iaşi), 1986

3rd IOBC / EFPP Workshop *Biological Control of Sclerotia-forming pathogens* – HRI, Wellesborne, Warwickshire, UK, 1994

Symposium *Biodiversity in European Plant Pathology at the turn of the centuries*, Poznan (Poland), 1999

3rd International Symposium on *Rhizoctonia*, University of Taichung, Taiwan, 2000

REVIEWS

1. OPREA Ad., SÎRBU C., 2009, *Diversitatea floristică a Munţilor Stânişoarei* (*Carpaţii Orientali*) [*Floristic diversity of Stânişoarei Mountains* (*Eastern Carpathians*)]. Iaşi: Edit. Univ. "Alexandru Ioan Cuza" (ISBN 978-973-703-429-8): 422 pp.
2. OPREA Ad., SÎRBU C., 2009, *Munţii Stânişoarei (Carpaţii Orientali). Studiu fitosociologic* [*Stânişoarei Mountains* (*Eastern Carpathians*). *A phytosociological study]*. Iaşi: Edit. Univ. "Alexandru Ioan Cuza" (ISBN 978-973-703-430-4): 219 pp.

In 2009, two romanian authors, dr. Adrian Oprea and dr. Culiţă Sîrbu, from University „Alexandru Ioan Cuza" and, respectively, University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", both of them form Iaşi, have succeed to written two valuable studies on a pretty large area (over 2000 km^2) from Eastern Carpathians.

Stânişoarei Mountains are situated in the medio-marginal to East part of the Eastern Carpathians, on flysch geological substrate, showing a great diversity of relief forms, hydrology, soil, as well as the microclimats. They are divided in individualized regional structures (as the following ones: Suha Mountains, Sabasa Mountains, and Neamţului Mountains), with a medium altitude over 800 m, and long anthropogenic influences (as fields usage, lot of localities, many churches and monasteries, communication routes, and so on) presenting, also, a large floristic and a pretty rich phytosociologic diversity.

There are known, so far, only partial papers on the phytodiversity of the Stânişoarei Mountains, dealing with quite specific botanic aspects, like: chorology of some vascular plants, floristic contributions around the towns of Piatra Neamţ, Gura Humorului, and Târgu Neamţ, as well as over the surroundings of „Izvorul Muntelui-Bicaz" lake; in other papers there are some data on vegetation of counties Suceava and Neamţ, or in a recently book on the vegetation of Moldavia region, it is presented some data of Stânişoara Mountains etc.

These books were written on the base of field surveys achieved along of four years (between 2005 and 2008) and numerous study hours in laboratories and libraries. These books showed, for the first time, a survey in assembly over the whole area of Stânişoarei Mountains, a floristic and in the same time, a phytosociologic study, both of them being synthetic and analytical, thoroughly, having, also, elements of conservation of the biodiversity and ecological reconstruction. Among the original contributions of these two books I shall emphasize the most important ones, as following:

- It is achieved, for the first time, an integrate conspectus of the vascular flora on the whole area of Stânişoarei Mountains, comprising thus 1408 plant species, irrespectively 44.9% of the vascular plants into the Romanian Flora. As a consequence of a critic analyses of the flora, the authors show that 100 taxa, previously quoted in this region in old papers, have not been identified again on the field, but, in turn, other 147 taxa were identified for the first time in Stânişoara Mountains. The floristic stock of the surveyed territory is reflected especially through the richness of some plant families, as the next ones: *Asteraceae* (185 plant species), *Poaceae* (108 plant species), *Brassicaceae* (72 plant species), *Lamiaceae* (71 plant species), *Rosaceae* (67 plant species), *Fabaceae* (66 plant species) etc. The authors confirm the presence for certain of the next two species:

Sparganium natans L. (*S. minimum* Wallr.) and *Crepis paludosa* (L.) Moench., on the territory of Moldavia.

- As concerning the live's form (bioforms) one can see that the hemi-criptophytes are prevalent in region, in terms of number of species (with 46%); the 2nd large category is represented by the therophytes and hemi-therophytes plants (25.8%); the 3rd category is represented by the geophytes (11.7%), which reflect, in general, a correspondence with the existing data of the whole region of Moldavia (Eastern part of Romania). In comparison with the situation from Suceava and Neamț counties, it is showed a slow growing of phanerophytes (0.6-0.8%) and hydato-helophytes (2.5%).
- The areal-geographic structure of flora in Stânişoarei Mountains illustrate the base stock of this, being dominated by the eurasian elements (34%), european elements (26%), and circumpolar elements (10%); to this is added other elements, in a much more reduced proportions, but having a major significance as concerning their chorology; 12 endemic taxa, ex.: *Asperula carpatica*, *Centaurea pinnatifida*, *Erysimum witmannii*, *Helictotrichon decorum*, *Hepatica transsilvanica*, *Hesperis oblongifolia*, *Primula elatior* subsp. *leucophylla*; 20 endemic taxa as pan-carpathians, ex.: *Achillea oxyloba* subsp. *schurii*, *Aconitum moldavicum*, *Campanula carpatica*, *Campanula serrata*, *Cardamine glanduligera*, *Centaurea phrygia* subsp. *melanocalathia*, *Dianthus spiuculifolius*, *Dianthus tenuifolius*, *Hieracium pojoritense*, *Poa rehmanni*, *Ranunculus carpaticus*, as well as a series of subendemics (so-called Dacian) taxa, ex.: *Cirsium furiens*, *Centaurea phrygia* subsp. *indurata*, *Dianthus collinus* subsp. *trifasciculatus*, *Melampyrum biharіense* etc.
- In the same time, the most recent data on the indigenuous flora show a pretty high proportion of the alien and cosmopolite species; all of the invasive plant species represent an alert sign concerning the vulnerability of the natural habitats, as they are: *Acer negundo*, *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Conyza canadensis*, *Echinocystis lobata*, *Impatiens glanduligera*, *Reynoutria × bohemica*, *R. japonica*, *Robinia pseudacacia*, *Xanthium orientale* subsp. *italicum*, *Xanthium spinosum* etc.
- Using ecological indexes of the vascular plants (Light - L, Temperature - T, Humidity - U, Reaction of the soil=pH - R, Nitrogen value of the soil - N) allowed the authors to make an ecological spectrum of the whole surveyed area, putting into evidence the sub-heliophylluous (Lm=7), meso-thermophylluous (Tm=6), mesophylluous (Um=5), neutrophylluous (Rm=7) and moderately nitrophylluous (Nm=5) characteristics of the vascular flora in Stânişoarei Mountains.
- Those details linked by the variability of the ecological factors were putted into evidence by the existence of important variations among the species into the territory, namely: there are sciophile plant species (e. g. *Epipogium aphyllum*), typical heliophilous species (e. g. *Erysimum witmannii*, *Galium anisophyllon* etc.), thermophyllous species (e. g. *Achillea setacea*, *Asyneuma canescens*, *Cotinus coggygria*, *Stipa lessingiana* etc.), micro-thermophyllous species (e. g. *Festuca carpatica*, *F. nigrescens*, *Centaurea pinnatifida*, *Silene zawadzkii*, *Saussurea discolor* etc.), hygro-hydrophylluous species (e. g. *Cirsium rivulare*, *Potamogeton natans*, *Veronica beccabunga*, *Lemna minor* etc.), calciphylluous species (e. g. *Androsace lactea*, *Arabis alpina*, *Scorzonera purpurea* subsp. *rosea*), acidophylluous species (e. g. *Nardus stricta*, *Lycopodium annotinum*, *Vaccinium myrtillus*, *Veronica officinalis*) etc.

- The original contributions of authors is demonstrated in the most pregnant mode, by their ideas in preservation of those indigenuous plant species of Stânişoarei Mountains. Thus, they have identified and characterized 152 taxa as being the rarest vascular plants on the surveyed area; the authors distributed them into different categories as the most vulnerable ones, as follow: 105 taxa are registered under the „Global Red List" (sensu IUCN, 1997), 98 taxa are registered under the „Red List of the Vascular Plants in Romania" (Oltean & al. 1994), 23 taxa are registered under various international regulations and directives concerning plants and natural habitats conservation (ex. Habitat Directive 92/43/EEC, Bern Convention, 1979), other 18 taxa being protected by various laws in force in Romania. Analyzing table no. 9 from the 1st book one can see there are needed immediately measures in order to preserve all of those endangered taxa by designation of other SCI sites (SCI = Sites of Community Importance on European Union level), which could assure the conservation at least the rarest plants in Stânişoarei Mountains, as they are: *Adenophora lilifolia*, *Angelica palustris*, *Asplenium adulterinum*, *Campanula serrata*, *Cypripedium calceolus* and so on. Nowadays, on the whole surveyed territory there is existing only a single SCI site, namely „Parcul Natural Vânători Neamț", which is a part of the pan-European Network 'Natura 2000'. Improving of this situation is much more important now, thanks to the fact on the area of Stânişoarei Mountains, there are some important plant species special designated under Bern Convention (1979) to be protected on the whole territory of Europe, as they are: *Abies alba*, *Achillea oxyloba* subsp. *schurii*, *Angelica palustris*, *Campanula patula* subsp. *abietina*, *Centaurea phrygia* subsp. *melanocalathia*, *Cirsium decussatum*, *Cirsium furiens*, *Cypripedium calceolus*, *Campanula carpatica*, *Helictotrichon decorum*, *Leucanthemum rotundifolium*, *Tanacetum macrophyllum*, *Typha schuttleworthii*.

In order to preserve the mountain flora and mountain natural habitats in an effective manner, the authors calls on for the first time in Romania to the method so called "conservation effectiveness indicator" (cf. Nowak, 2006), giving thus a series of new elements for a proper substantiation as well as for a biological diversity preservation in Stânişoarei Mountains region.

Having in mind the above mentioned elements, we can say those two books on flora and vegetation of Stânişoarei Mountains achieve a first botanic synthesis of this region, giving new and original data in this domain, applying a modern methodolgy; this way, we are glad to say that those two books could be considered as real monographies in the same series of „Alexandru Ioan Cuza" University Publishing House in Iaşi. By the scientific data, the elevated style, and a suitable manner of approaching, these studies will fill a gap into the specialty literature in Romania.

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03.03.2009 Szombathely

ŞESAN Tatiana Eugenia, TĂNASE C., 2009, *Fungi cu aplicaţii în agricultură, medicină şi patrimoniu* [*Fungi with importance in agriculture, medicine and patrimony*], University of Bucharest Press (ISBN 978-973-737-677-0): 305 pp.

The study *Applied Mycology I* appeals particularly to biology students, agronomists, human and veterinary medicine, as well as other readers who are interested in knowing different aspects about directions of fungi application. This study is designed in dissertation mode, being made by interuniversity collaboration; the authors have original contribution recognized on both national and international level. The same authors have collaborated to publish the following studies: *Ghid de recunoaştere a ciupercilor comestibile şi toxice* [*Identification guide of edible and toxic mushrooms*], which has been published in 2004, at GEEA Press from Bucharest (ISBN 973-7982-11-8); *Concepte actuale în taxonomia ciupercilor* [*Actual concepts in the fungal taxonomy*], which has been published in 2006, at "Alexandru Ioan Cuza" University Press (ISBN 973-703-144-X; 978-973-703-144-0), Iaşi: 510 pp., *Mycobiota – sisteme de clasificare* [*Mycobiota. Classification systems*] published in 2006 at "Alexandru Ioan Cuza" University Press (ISBN 973-703-177-8; 973-703-177-6), Iaşi: 251 pp. and *Ciuperci anamorfe fitopatogene* [*Anamorph phytopathogenic fungi*], University of Bucharest Press (ISBN 978-973-737-360-1): 265 pp., published in 2007.

The authors are professors of Mycology course in Faculty of Biology from University "Alexandru Ioan Cuza" Iasi and University of Bucharest. Experience from didactic and research activity is materialized in original aspects in this study focused on target methods of fungi selection and fungi characterization with socio-economic impact.

The Ist Chapter is about aspects regarding *Edible mushrooms culture* emphasizing their importance as well as aspects on their biology, ecology and technology of culture.

The IInd Chapter approaches actual problems on biodeterioration of materials. There are references about deterioration on wood, paper, parchment, pictures, inorganic substances, stone, glass, metals, soft materials, rubber, paints, adhesives and oil due to fungi. Also, there are references about species of fungi which destroy pieces of art and patrimony.

In the IIIrd Chapter, species of fungi which are important in human and veterinary medicine are characterized. We remark the novelty of this information with applications in diagnoses of diseases and also in healing them.

The IVth Chapter is about Aerobiology and the role of spores in breath diseases which bring in the vision of specialists numerous medical diseases hard to be healed.

The Vth Chapter presents species of macromycetes responsible of poisoning, but also frequently confusions between edible and poisoning mushrooms. For all the species, there are presented biological, ecological and biochemical aspects as well as their macroscopic and microscopic characteristics habit and seasonal dynamics. Of great importance are comparative tables regarding similarities and differences between edible and toxic species. The nomenclature of fungi mentioned in this book is under international rules and uses the latest classification of these organisms, with the permission of *CAB International* Press.

The VIth Chapter approaches subject of great actuality: *Mycotoxins and toxic mushrooms.* We remark the amount of information of great interest and write about original results obtained in different research projects.

We consider that by the subject focused on, this book responds to all the demands in this domain which came to complete a gap in the mycological literature and bring all the attention for specialists actually researches from countries with tradition in applied mycology domain. The work developed by Professor PhD Tatiana Eugenia ŞESAN and Professor PhD Cătălin TĂNASE is highlighted by a great documentation and approaches the majority of subjects in a modern vision which is closed to actually demands in this domain.

Senior Researcher PhD Alexandru MANOLIU
Biological Research Institute of Iasi

TĂNASE C., BÎRSAN C., CHINAN V., COJOCARIU Ana, 2009, *Macromicete din România* [*Macromycetes from Romania*], "Alexandru Ioan Cuza" University Press, Iaşi (ISBN 978-973-703-442-7): 563 pp.

Living organisms known as mushrooms or fungi, are spread all over the world, occupying the most various ecological niches (soil, air, water, living organisms or without life etc.), especially in wet and warm areas. The number of species is appreciated over 100.000, recently over 300.000.

They have been framed in the vegetal reign; recently they are framed in two or more reigns of organism. Usually, on practical appearance, they were divided in microscopic mushrooms (micromycetes), and macroscopic (macromycetes).

In Romania the micromycetes have been well studied in true specialty schools at Bucharest, Iasi, Cluj etc. There are many monographs and other publications in this area.

The group of macromycetes and especially edible and poisonous mushrooms were less studied and therefore publications in this area are in small number.

The analyzed work comes to complete a big empty in the specialty literature for the knowledge of macromycetes species, while more Romanian citizens collect and consume big mushrooms, with flashy consistency of natural ecosystems.

In the last years were reported serious cases with poisoning mushrooms especially at children and elder people in different areas of the country. In most cases it was about un-knowing edible mushrooms and the confusion that can be made with the poisonous mushrooms. Also, there weren't known some features of mushrooms, in part biological, chemical, biochemical, ecological etc.

Some edible species in youth state become toxic at maturity, others contain complex substances which can oxidize, becoming toxic if they aren't consumed fresh or immediately after they had been cooked. The mushrooms can assimilate toxic elements from the soil, which came indirect or direct of pollution, caused by man (with heavy metals, isotopes of some radioactive elements or toxic substances which were used in fight against animal pests in forests etc).

The study of Catalin TANASE, Ciprian BARSAN, Vasilica CHINAN and Ana COJOCARIU explains most of the problems reported by us.

We appreciate that authors have succeeded to explain most of the problems related with the importance of mushrooms in human nutrition, chimichal composition, prevention of accidents which can happen after consumption of some toxic mushrooms or which contain harmful substances etc.

We hope that this study, realized by specialists with high qualification, great masters on this group of organisms, through it's publication, will contribute to reduce at maximum the undesirable events caused by consumption of mushrooms.

Both text and illustration (original color photos) are exceptional at great authors' personalities.

The book appeal to biological students, ecologists, biochemists, agronomists, foresters, teachers, all the students and those who would like to know and to use this natural richness of Romania.

We underline once more the value of this study and necessity to be published soon and to be made in numerous editions.

10 April 2009

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University of Bucharest, The Faculty of Biology

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References
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References for papers in periodicals:

CIOCÂRLAN V. 2008. *Lathyrus linifolius* (Reichard) Bässler in the Romanian flora. *J. Plant Develop.*, **15**: 3-6.
MEHREGAN I. & KADEREIT J. W. 2008. Taxonomic revision of *Cousinia* sect. *Cynaroideae* (*Asteraceae*, *Cardueae*). *Willdenowia*. **38**(2): 293-362.

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BOŞCAIU N. 1971. *Flora şi Vegetaţia Munţilor Ţarcu, Godeanu şi Cernei*. Bucureşti: Edit. Acad. Române, 494 pp.
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JALAS J. SUOMINEN J. LAMPINEN R. & KURTTO A. (eds). 1999. *Atlas Florae Europaeae*. *Distribution of vascular plants in Europe*. Vol. **12**. *Resedaceae to Platanaceae*. Helsinki: Committee for Mapping the Flora of Europe and Societas Biologica Fennica Vanamo. Maps 2928-3270, 250 pp., ill (maps), ISBN 951-9108.
TUTIN T. G., BURGES N. A., CHATER A. O., EDMONDSON J. R., HEYWOOD V. H., MOORE D. M., VALENTINE D. H., WALTERS S. M. & WEBB D. A. (eds, assist. by J. R. AKEROYD & M. E. NEWTON; appendices ed. by R. R. MILL). 1996. *Flora Europaea*. 2nd ed., 1993, reprinted 1996. Vol. **1**. *Psilotaceae to Platanaceae.* Cambridge: Cambridge University Press, xlvi, 581 pp., illus. ISBN 0-521-41007-X (HB).

Chapters in books:

†TUTIN T. G. 1996. *Helleborus* L. Pp. 249-251. In: †T. G. TUTIN et al. (eds). *Flora Europaea*. 2nd ed., 1993, reprinted 1996. Vol. **1**. *Psilotaceae to Platanaceae.* Cambridge: Cambridge University Press, xlvi, 581 pp., illus. ISBN 0-521-41007-X (HB).

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