

Lithophytic groups and forest vegetation in the “Mitropolit Metodi Kusev” forest park

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Abstract

Considered as a model of the park and garden art for many years, the “Mitropolit Metodi Kusev” forest park can today successfully serve as a pattern of biologic diversity. Together with the varied grass vegetation, local wood and frutescent species develop on the Park territory on one hand, and similar introduced species are cultivated on the other.

The climatic peculiarities of the region and the process of erosion are the cause for the zonal distribution of vegetable life.

In the sites with an intensive anthropogenic pressure the steppe species dominate and the slopes all over the Park, outcropped by erosion, are being populated by lithophytic groups, mostly of Mediterranean origin.

Keywords: association, community, floristic element, lithophytic groups.

Introduction:

The changes that occur in the anthropogenically burdened regions are being watched with bigger and bigger concern in the recent years.

Created over the remnants of some stone-pits more than one hundred years ago, the “Mitropolit Metodi Kusev” forest park filled people with admiration for its wide variety of exotic wood species years before. Quite few of them have survived to this day. To make up for them, successfully develop local wood and frutescent vegetable life, which together with the grass species, having invaded from the neighboring territories, build up unparalleled variety of steady plant communities. Their distribution follows the common objective laws that govern the vegetable cover of Bulgaria.

Materials and methods

The transect method is used for the composition determination of the of grass species; the park territory was arbitrary divided into four sections, with 5 to 6 control sites (50x50 cm) in each. The composition of species is described for every control

site, and the edicator and the number of the other species, located within the boundaries of the control site are counted species after species. The samples are measured species after species in fresh and in dry condition by the SPO 52 electronic balance, and on this basis the interrelation **cereals – legumes – various grass species** is determined.

Determination of the grass associations is in conformity with Gantchev (1958, 1965); Yordanov (1936); Kozhuharov (1979); Stoyanov (1951), and of the frutescent associations is in congruence with Bondev (1969, 1991) and Apostolov (1997). The following abbreviations are used for the floristic elements:

- Alpmed – Alpine-Mediterranean;
- Apbal – Apennine-Balkan;
- Bal- Balkan;
- Boreal- borealic;
- Euro-as – Euro Asian;
- Euro-OT – Euro Asian-Oriental-Turanian;
- Eurosib – Euro – Siberian;
- Euromed – Euro –Mediterranean;
- Eurosubmed – Euro-sub-Mediterranean;
- Cos- Cosmopolitan;
- Med – Mediterranean;
- Pont – Pontic;
- Pontomed – Pontic-Mediterranean;
- Subboreal – sub borealic;
- Submed – sub Mediterranean;
- Smed-As – Southern-Mediterranean-Asian.

For determination of the floristic elements the Conspectus of higher flora (Asyov and colleagues, 2002) is used.

Results and deductions:

Eighteen out of the 27 examined control sites are with cereals as a dominant and belong to one or another type of the grass formations. In the remaining 9 control sites the various grass species prevail. Their distribution is as follows (**Table 1**):

Table 1. Lithophytic formations on the terrain of the “Mitropolit Metodi Kusev” forest park

Site №1	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Cereals: Dichantium ischemum (L.) Roberty Cynodon dactylon (L.) Pers.	2 5	SMed-As Cos	1,8 1,5	1,3 1,1
Legumes: Medicago minima (L.) Bart.	7	Euro-as	3,5	0,8
Various grass species: Potentilla erecta (L.) Rauschel Centaurea cyanus L. Thlaspi praecox Wulf. Rumex acetosella L. Salvia pratensis L.	9 2 5 1 2	Subboreal Euromed Submed Eurosubmed Euromed	7,2 1,4 7,0 2,7 5,0	4,5 0,8 5,4 1,9 1,6
Site №2	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Cereals: Hordeum murinum L.	7	Boreal	2,1	1,7
Various grass species: Malva sylvestris L. Echium italicum L. Linum hirsutum L. Poligala monspeliaca L.	4 2 18 15	Cos Submed Submed Med	62,8 31,4 10,8 9,0	19,4 9,7 7,2 4,5
Site №3	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Cereals: Aegilops triuncialis L. Aegilops cylindrica Host Cynodon dactylon L. Dasypyrum villosum (L.) Cand	5 3 5 7	Euroas Euroas Cos Submed	3,1 1,7 1,5 4,2	2,7 1,2 1,2 2,1
Various grass species: Plantago lanceolata L. Orlaja grandiflora (L.) Hoffm Linum bienne Miller. Salvia pratensis L. Sangisorba officinalis L.	17 8 5 4 3	Cos Apbal Med Euromed Subbor	6,1 4,8 3,1 10,0 3,3	2,8 2,4 2,3 1,7 1,7
Site № 4	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Cereals:				

Melica ciliata L.	10	Eurosib med	6,7	5,5
Phleum pratense L.	2	Eurosibmed	1,9	1,8
Various grass species:				
Orlaja grandiflora(L.) Hoffm.	47	Apbal	30,3	15,6
Ferulago sylvatica(Bess.)Reichenb	3	Submed	3,1	2,3
Geranium molle L.	5	Euromed	12,0	6,0
Site №5	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Cereals:	38			
Festuca pseudovina L.		Submed	3,7	2,3
Legumes:				
Onobrychis alba(Waldst. Et Kit.) Desv.	2	Submed	2,9	0,9
Various grass species:				
Linum usitatissimum L.	68	Pontomed	27,1	13,8
Sanguisorba officinalis L.	9	Subbor	6,3	3,4
Jurinea mollis(L.)Rchb.	3	Pontomed	1,9	0,4
Hypericum perforatum L.	4	Bal	3,3	1,3
Plantago lanceolata L.	1	Kos	1,6	0,5
Asperula tenella Heuffel ex Degen	1	Submed	12,1	6,4
Site №6	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Cereals:				
Agropirum repens (L.) P.B.	3	Boreal	8,2	5,0
Legumes:				
Onobrychis alba(Waldst. Et Kit.) Desv.	1	Submed	0,2	0,1
Various grass species:				
Siderites montana L.	21	Submed	15,0	10,7
Linum tenuifolium L.	10	Pontomed	5,9	2,8
Xeranthemum annuum L.	19	Submed	23,3	13,2
Linaria vulgaris Mill.	1	Eurosib	10,2	4,1
Convolvulis cantabrica L.	12	Pont	7,7	3,7
Anthemis cotula L.	3	Eurosib	3,4	1,4
Jurinea mollis(L.) Rchb.	2	Pontomed	1,0	0,5
Stachys recta L.	2	Euromed	1,6	0,9
Helianthemum nummularium(L.)Miller	1	Alp-Med	0,2	0,1
Site №7	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Various grass species:				
Asphodeline lutea(L.)Reichenb.	8	Pontomed	105,8	32,4
Allium rotundum L.	3	Euro-OT	2,2	1,1
Orlaja grandiflora(L.)Hoffm.	3	Apbal	10,9	6,3
Teucrium chamaedrys L.	2	Pontomed	0,2	0,1

Site №8	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Cereals: Chrysopogon gryllus(L.)Trin. Melica ciliata L.	3 1	Pontomed Eurosubmed	12,1 0,2	6,9 0,1
Various grass species: Orlaja grandiflora(L.)Hoffm. Teucrium chamaedrys L. Bituminaria bituminosa(L.)Stirt. Linum usitatissimum L. Dianthus giganteus D'Urv. Stachys recta L.	8 49 3 47 2 1	Apbal Pontomed Pontomed Pontomed Submed Euromed	3,6 25,6 1,7 58,8 3,0 1,6	1,7 12,8 0,4 34,6 1,9 0,8
Site №9	Number	Floristic element	Weight in fresh condition [gr.]	Weight in dry condition [gr.]
Various grass species: Orlaja grandiflora(L.)Hoffm Linum usitatissimum L. Poligala monspeliaca L. Sanguisorba officinalis L.	42 2 2 42	Apbal Pontomed Med Subbor	41,4 1,3 1,5 63,9	20,1 0,8 0,5 30,4

It becomes obvious from the analysis of the obtained results that the various grass species predominate in the nine examined control sites.

The presence of cereals and legumes is insignificant.

The communities of the various grass species are situated on the high-altitude open parts of the both hills of the Park, at sloping terrain with almost outcropped basic rock and not deep soil layer.

Their distribution is zonal, on patches, alternating residual wood and frutescent vegetation.

In the plant communities, located on the territory of the forest park, the grass species of Mediterranean origin predominate: sub-Mediterranean, Pontic Mediterranean, Euro-Mediterranean etc.

Distribution of the plant species in accordance with the floristic elements is as follows:

Sub-Mediterranean- Asian, Euro -Oriental-Turanian, Balkan, Alpine Mediterranean and Pontic – one species each;

By two species are represented the groups of the Borealic and Euro-Siberian floristic elements;

By three species are represented – the Euro-Asian and Mediterranean floristic elements;

By four species are represented – the sub-Borealic, the Apennine-Balkan and the Euro – sub-Mediterranean floristic elementsl.

Four species are referred to the group of the Cosmopolitans, and to the Euro Mediterranean floristic element – six species.

Most of the species belong to the group of the sub-Mediterranean floristic element: 12 species, and to the Pontic-Mediterranean floristic element – 11 species.

The residual wood vegetable life is represented by the communities of *Carpinus orientalis* Mill.; *Quercus pubescens* Willd., *Q. cerris* L. and *Fraxinus oxycarpa* Willd.

The trees are low-stemmed and offshoots.

In the wood layer excepting the predominant species, *Ulmus minor* Mill., *Amygdalus communis* L., *Juglans regia* L., *Pyrus pyrastrer* Buzgst. are available.

In the lower-altitude sites the deciduous vegetation is mixed with artificial plantations of *Pinus sylvestris*, *Pinus nigra*, *Quercus* and *Celtis Australis*.

The mixed wood plantations gradually change to frutescent vegetable life of the species *Paliurus spina-christi* Mill., *Cotinus coggygria* Scop., *Jasminum fruticans* L. in the open localities. The frutescent vegetation settles down in zones, on groups.

The grass layer, especially in the coniferous plantations, is surprisingly poor-*Brachypodium silvaticum*(Huds.) Beauv., *Geum urbanum* L., *Arabis turrata* L. , *Fragaria vesca* L..

From the clambering lianas often *Clematis vitalba* L., *Tamus communis* L., *Hedera helix* L., *Thalictrum aquilegifolium* L. can be found.

Inferences:

Analyzing the results from the present article and those from the article **“Grass associations with cereals as their dominant in the “Mitropolit Metodi Koussev” forest park”**, can clearly be followed the presumed way of development of the plant cover on the territory of the forest park.

The forest park territory is hilly, and is in the immediate vicinity of the flanks of the Sarnena Sredna Gora mountain.

Typical root vegetation in it have been the oak forests. After the invasion of Machmud pasha they have been cleared, including those on the Ayazmoto hills.

In the course of more than one hundred years, afforestation undertakings with different intensity have been implemented in various parts of the Park.

Forestation activity has been more energetic in the spots with stronger anthropogenic pressure – round the alleys and the recesses for recreation and sports.

In this way in the lower-altitude portions of the Park, pure and mixed forest plantations of coniferous and deciduous trees develop, some of them exotic. In the higher-altitude sections of the Park, however, the influence of the anthropogenic factor is weaker. The climatic and soil agents are the ones with the strongest effect that determine the pattern of the vegetable cover.

The forest ranges are situated in zones – there are patches, free of wood vegetable life among them. At present, tracks of animals and of grazing can be observed on these localities.

Zoogenic factor has increased the process of erosion, which has reflected on the plant cover – frutescent communities of *Carpinus orientalis*, sumac (*Cotinus Cogygia*), thorny bush (*Paliurus spina christii*), and *Quercus cerris* have settled over the unoccupied areas. The bushes are low and scabbed.

Simultaneously with that process, the steppefying of these parts of the Park with *Andropogon gryllus* (L). Trin. has continued, and in the lower-altitude parts of the Park, *Poa bulbosa* is added. In the sheltered, preserved from the erosion places of the Park, the *Andropogon gryllus* (L). Trin. is the main edificator of the grass communities.

In the sloppy terrain, typical for the Park, the frutescent communities change with grass cenosis. Under the impact of pasture and the climatic conditions, the surface erosion intensifies, giving as a result an outcrop in different in size parts of the Park and bare patches among the thinning out grass communities.

The loose soil and the rocks are a favourable environment for development of lithophytic vegetation – representatives of the *Helianthemum*, *Plantago*, *Anthemis*, *Salvia* genera, etc. Most of them are terrophytes (in conformity with Raunkiaer). Towards the middle of May terrophytes die – i.e. the communities they form are ephemeral. They clear space for the lithophytic groups of the Mediterranean species.

In this way exogenic change of the vegetable cover, achieved in three phases is observed:

Firstly: steppefying of the plant cover with the *Andropogon gryllus* (L). Trin associations. In some associations other steppe elements are present, such as *Stipa joanis* Celac., *Melica ciliata* L., *Bromus tectorum* L. etc.

Secondly: populating the Park territory with terrophytes and formation of ephemeral groups.

Thirdly: complete erosion of the soil and development of lithophytic groups, mostly of the Mediterranean species.

The main driving force during the first stages are human activity and pasture, and the climatic factors, erosion in particular during the last ones.

The determination of common objective laws in the development of the vegetable life, and of the factors exerting negative pressure on it, will help for the correct usage of the biological resources in the region, and for preservation of the biodiversity by initiating severe measures for defense of the plant species.

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