

Grass associations with cereals as their dominant in the “Mitropolit Metodi Koussev” forest park

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Abstract

The idea for the forest shelter belts round the towns arises in the 30s of the last century. The impact of the forest parks on the environment and man is bidirectional – the specific climate and relief determine the pattern of the vegetable cover in a given region on one hand, and the plant cover itself alters the microclimate, often in positive direction – on the other.

Sixteen grass associations, referring to 4 types of formations are described by means of the transect method and through assigning control sites on the forest park territory:

- mesophytic formations of *Agropirum repens* (L.) P.B., represented by three associations;

-essential presence of steppe formations of *Festuca pseudovina* Hack. and *Andropogon gryllus*(L.) Trin., represented by five associations;

-domination of the ephemeral and ephemeroïdal formations of *Poa bulbosa* L. and *Dasypyrum villosum*(L.) Cand.

As a result of the severe disturbance of the integrity of the vegetable cover, especially in the higher-altitude parts of the countryside, there is zonal distribution of the grass vegetation.

The research results support the general trend of steppefying of the open sloping lands with *Andropogon gryllus*(L.) Trin., ephemerals and ephemeroïdals, typical for the hilly parts of the Stara Zagora field (Gantcev, 1965).

Key words: formations, association, dominant, ephemeral, ephemeroïdals

Introduction

The “Mtropolit Metodi Koussev” forest park is situated over total area of 3500 decares in the northern part of Stara Zagora , on two hills, flanks of Sredna Gora mountain – the “Ayazmoto” hill, with area of 600 decars and the “Kazlera” hill behind it, with area of 2900 decares.

The forest-vegetable region in which the park is located is a combination of flat country and undulating terrain. The basic rocks are marls, limestone with tuffs and tuffits with marl shales. The type of the soil is humus-carbonate, with a medium depth to shallow; the basic rock is often outcropped.

The altitude varies in the range from 270 to 430 meters, the exposure is southern, south-eastern, with some south-western components.

With respect to the climate the region comes in the moderate-continental climatic zone or more specifically in the Southern-Bulgarian climatic sub-zone (Bondev, 1991).

The average annual temperature during the period of research was 11,8°C. The mean quantity of precipitation per year is 482,6 mm.

By this time the grass vegetation has never been subject to investigation. The grass species have gradually invaded the park territory, crossing its boundaries and taking all vacant niches. As a result, steady associations of grass species are formed, repeating the general objective laws governing the distribution of vegetation in the country (Bondev , 1969; Kozhuharov, 1979).

Materials and methods

The research work was conducted in the period from April to September 2002. The transect method was used for the determination of the grass species available and the type of associations they belong; the park territory was arbitrary divided into four sections, with 5 to 6 control sites (50x50 cm) in each – 25 in all. In each site all available species are described, and the quantity of every particular species is determined. The stature of the edicator is measured, as well as the weight of every species in fresh and in dry condition (electronic balance SPO 52 is used), and afterwards the interrelation **cereals – legumes – various grass species** for every association is calculated.

The figures show graphically the proportion of these three groups in the different formations in percentage.

The determination of the grass associations is accomplished in conformity with the works of Gantchev (1958, 1965), Yordanov (1936); Kozhuharov (1979); Stoyanov (1951).

Results and debate

In 16 of the observed sites the plant composition could be referred to one or another formation in compliance with the prevailing species.

As an example, from the mesophytic grass formations, typical for planes and depressions, 3 associations from the *Agropirum repens* (L.) P.B. formation could be found in the Park territory. They grow in the elevated open parts of the park, which lack tree vegetation (Table 1).

Table 1 – Vegetable composition of the *Agropireta repentes* formation

Composition of species of association 1	Stature of the edificator [cm]	Number	Composition of species of association 2	Stature of the edificator [cm]	Number	Composition of species of association 3	Stature of the edificator [cm]	Number
Cereals: <i>Agropirum repens</i> (L.) P.B	62	42	Cereals: <i>Agropirum repens</i> (L.) P.B	64	78	Cereals: <i>Agropirum repens</i> (L.) P.B	58	115
<i>Bromus sterilis</i> L.		7	<i>Bromus tectorum</i> L.		25	<i>Dasypyrum villosum</i> (L.) Cand.		1
<i>Lolium perenne</i> L.		4	<i>Aegilops cylindrica</i> Host.		4	<i>Poa bulbosa</i> L.		7
Legumes: <i>Coronilla varia</i> L.		10	<i>Poa bulbosa</i> L.		4			
<i>Vicia sativa</i> L. <i>Medicago minima</i> (L.) Desr.		2 7	<i>Dasypyrum villosum</i> (L.) Cand.		4			
			<i>Poa silvicola</i> Guss.		3			
Various grass species: <i>Salvia pratensis</i> L.		2	Various grass species: <i>Teucrium polium</i> L.		10	Various grass species: <i>Achillea clypeolata</i> Sm.		10
<i>Orlaja grandiflora</i> (L.) Hoffmn.		2	<i>Plantago lanceolata</i> L.		4	<i>Orlaja grandiflora</i> (L.) Hoffmn.		1

The edificator of the formation is with big density, but the constituted associations are deficient with respect to the species – various grass species mostly. One of the associations is of the type *Agropirum repens* (L.) P.B - *Medicago minima* (L.) Desr., and the other two are of the type *Agropirum repens* (L.) P.B - various grass species.

The limy terrain and the dry climate are a premise for the wider distribution of the steppe species *Festuca pseudovina* Hack. and *Andropogon gryllus* (L.) Trin. The associations in which they are the prevalent species are situated in the western part of the Park, on open terrains.

Formations of the type *Festuceta pseudovinae* are found in four associations (**Table 2 and Table 3**):

Table 2 – Vegetable composition of the *Festuceta pseudovinae* formation

Composition of species of association 1	Stature of the edificator [cm]	Number	Composition of species of association 2	Stature of the edificator [cm]	Number
<i>Festuca pseudovina</i> Hack	52	48	<i>Festuca pseudovina</i> Hack	55,3	45
<i>Poa bulbosa</i> L.		7	<i>Poa bulbosa</i> L.		4
			<i>Phleum pratense</i> L.		18
			<i>Melica ciliata</i> L.		7
Legumes: <i>Coronilla varia</i> L. Various grass species: <i>Scandix pecten-</i> <i>veneris</i> L.		3 3	Various grass species: <i>Achillea clypeolata</i> Sm.		3
<i>Marrubium pergrinum</i> L.		15	<i>Orlaja grandiflora</i> (L.) Hoffmn.		38
<i>Salvia pratensis</i> L.		7	<i>Helianthemum nummularium</i> (L.) Miller.		4
<i>Convolvulus cantabrica</i> L.		5	<i>Centaurea cyanus</i> L.		3
<i>Erodium cicutarium</i> (L.) L’Her.		4			

Table 3. Vegetable composition of the Festuceta pseudovinae formation

Composition of species of association 3	Stature of the edificator [cm]	Number	Composition of species of association 4	Stature of the edificator [cm]	Number
Cereals: Festuca pseudovina Hack	47	153	Cereals: Festuca pseudovina Hack	58	52
Lolium perenne L.		1	Dactylis glomerata L.		1
Dasypyrum villosum(L.) Cand.		2	Lolium perenne L.		7
Dactylis glomerata L.		11	Agropirum repens (L.) P.B		3
Bromus tectorum L.		1	Poa pratensis L.		3
Legumes: Vicia sativa L.		2	Legumes: Trifolium angustifolium L.		3
Medicago minima (L.) Barta.		45	Coronilla varia L.		2
Onobrychis alba (W et K.) Desv.		4			
Various grass species: Teucrium polium L.		8	Various grass species: Orlaja grandiflora (L.) Hoffmn.		21
Sanguisorba off. L.		7	Euphorbia cyparissias L.		1
Galium odoratum (L.) Scop.		1	Stachys germanica L.		1
			Filipendula vulgaris Moench.		1

The communities of *Festuca pseudovina* Hack. occupy slightly sloping, limy terrains and in their composition the various grass species are the dominant. These various grass species are represented by species of small importance or by weedy ones. Three out of the four associations are of the type *Festuca pseudovina* – from the various grass species, and in one association only essential part takes *Medicago minima* (L.) Barta.

In the areas occupied by this formation, frutescent vegetation from the types *Cotinus coggygia* Scop., *Syringa vulgaris* L. , *Paliurus spina-christii* Mill., *Colutea arborescens* L., *Cornus mas* L. and *Genista depressa* M.B. are found.

The association can be used for production of hay and for pasture, but the comparatively big number of various grass species makes it of small value with respect to the agriculture.

For the territory under investigation, the association of the type *Andropogon gryllus* – *Poa bulbosa* is the one that is specified from the group of formations, typical for the secondary mesotermic steppes with *Andropogon gryllus*(L.) Trin. as an edificator. (**Table 4**).

The composition of species of the association is relatively poor. *Poa bulbosa* develops early in spring as an ephemeral and dominates till the beginning of the summer. During the summer months it is replaced by the *Andropogon gryllus* (L.) Trin.

Table 4. Vegetable composition of the *Andropogoneta grylli* formation

Composition of species	Stature of the edificator [cm]	Number
Cereals: <i>Andropogon gryllus</i> (L.) Trin.	1,20	15
<i>Poa bulbosa</i> L.		14
<i>Festuca pseudovina</i> Hack		1
<i>Phleum pratense</i> L.		1
Legumes: <i>Trifolium angustifolium</i> L.		5
Various grass species: <i>Orlaja grandiflora</i> (L.) Hoffmn.		5
<i>Teucrium polium</i> L.		2
<i>Convolvulus cantabrica</i> L.		8
<i>Alyssum desertorum</i> Stapf.		1

The slight difference between winter and summer precipitation is the reason for the development of terrophytic and more specifically of ephemeric vegetation. There is a permanent presence of the communities from the *Dasypyreta villosae* formation on the terrain.

Two out of the three associations specified on the site are of the *Dasypyrum villosum* (L.) Cand.- *Aegilops triuncialis* L. type. (Table 5).

Table 5. Vegetable composition of the *Dasypyreta villosae* formation

Composi- tion of spe- cies of as- sociation 1	Stature of the edifica- tor (cm)	Number	Composi- tion of spe- cies of asso- ciation 2	Stature of the edifica- tor (cm)	Number	Composi- tion of spe- cies of asso- ciation 3	Stature of the edifica- tor (cm)	Number
<i>Dasypyrum vil- losum</i> (L.) Cand	80	89	<i>Dasypyrum villosum</i> (L.) Cand	70	163	<i>Dasypyrum villosum</i> (L.) Cand	75	117
<i>Aegilops triuncialis</i> L.		24	<i>Aegilops triuncialis</i> L.		54	<i>Agropirum repens</i> (L.) P.B.		6
<i>Cynodon dactylon</i> (L.)Pers.		2	<i>Aegilops cylindrica</i> Host		13			
<i>Hordeum murinum</i> L.		4	<i>Lolium perenne</i> L.		4			
Legumes: <i>Medicago minima</i> (L.) Bart.		19						
Various grass spe- cies: <i>Fragaria vesca</i> L.		9	Various grass spe- cies: <i>Eryngium campestre</i> L. <i>Potentilla erecta</i> (L.) Rauschel.		2 1	Various grass spe- cies: <i>Orlaja grandiflora</i> (L.) Hoffmn. <i>Eryngium campestre</i> L.		3 1
						<i>Scrophularia canina</i> L.		1

The communities of *Dasypyrum villosum* distinguish themselves with big density of the plant cover, which doesn't allow development of a layer of legumes and various grass species.

The proximity to a densely populated locality and the never-ending stream of visitors on the Park territory are natural bases for the development of ephemeroïdal formations of the type *Poaeta bulbosae*.

In their development the communities of *Poa bulbosa* L.var. *vivipara* reach two times their climax. Spring-time associations are predominantly studied in the re-

search work, when towards the end of the spring *Poa bulbosa* is gradually replaced by *Festuca pseudovina*. In autumn the composition of the various grass species changes essentially.

The associations of *Poa bulbosa* L. can be found more frequently in the low-altitude parts of the Park and along the pathways and the roundabouts in the elevated parts.

Two out of the five examined associations of *Poa bulbosa* L. are of the *Poa bulbosa* - *Festuca pseudovina* type, while in the remaining three associations wide diversity of cereals, legumes and various grass species is registered (Table 6 and Table 7).

Table 6. Vegetable composition of the *Poa bulbosa* formation

Coposition of species of association 1	Stat-ure of the edific. [cm]	Number	Compostion of species of association 2	Stat-ure of the edific. [cm]	Number	Coposition of species of association 3	Stat-ure of the edific. [cm]	Number
<i>Poa bulbosa</i> L	28,2	24	<i>Poa bulbosa</i> L	25,3	29	<i>Poa bulbosa</i> L	30,6	21
<i>Festuca pseudovina</i> Hack		12	<i>Festuca pseudovina</i> Hack		28	<i>Phleum pratense</i> L.		2
<i>Bromus sterilis</i> L.		2	<i>Stipa joannis</i> Celac.		9	<i>Festuca pseudovina</i> Hack		9
			<i>Phleum pratense</i> L.		24	<i>Aegilops triuncialis</i> L.		2
			<i>Dactylis glomerata</i> L.		6	<i>Setaria verticillata</i> (L.) Beauv.		1
			<i>Melica ciliata</i> L.		4			
Various grass species: <i>Potentilla erecta</i> (L.)		1	Legumes: <i>Medicago minima</i> (L.) Barta.		8	Various grass species: <i>Centaurea napulifera</i> Roch.		2
<i>Plantago lanceolata</i> L.		2	<i>Trifolium angustifolium</i> L		3	<i>Sanguisorba</i> off. L.		2
<i>Convolvulus cantabrica</i> L.		9	<i>Trifolium hirtum</i> All.		5	<i>Erodium cicutarium</i> (L.) L, Her		1
<i>Linum usitatissimum</i> L.		7	Various grass species: <i>Thymus longidentatus</i> (Deg. Et Urum.) Ronn.		24	<i>Fragaria vesca</i> L.		1
<i>Centaurea napulifera</i> Roch.		1	<i>Helianthemum aegypticum</i> (L.)		7			

Coposition of species of association 1	Stat-ure of the edif. [cm]	Number	Compostion of species of association 2	Stat-ure of the edf. [cm]	Number	Coposition of species of association 3	Stat-ure of the edif. [cm]	Number
			Mill.					
			Potentilla erecta (L.) Rauschel.		3			
			Fragaria vesca L.		2			
			Orlaja grandiflora (L.) Hoffmn.		1			

Table 7. Vegetable composition of the Poaeta bulbosae formation

Composition of species of association 4	Stature of the edificator (cm)	Number	Composition of species of association 5	Stature of the edificator (cm)	Number
Poa bulbosa L	31	17	Poa bulbosa L	30	37
Aegilops triuncialis L.		8	Aegilops triuncialis L.		10
Aegilops cylindrica Host.		5			
Festuca pseudovina Hack		9			
Lolium perenne L.		5			
Legumes: Trifolium angustifolium L.		15	Legumes: Medicago minima (L.) Barta.		3
Onobrychis alba (W et K.) Desv.		1	Coronilla varia L.		8
Various grass species: Orlaja grandiflora (L.) Hoffmn.		13	Various grass species: Thymus longidentatus (Deg. Et Urum.) Ronn.		3
Thymus longidentatus (Deg. Et Urum.) Ronn.		4	Xeranthemum annuum L.		2
Filipendula vulgaris Moench.		13	Helianthemum nummularium(L.) Miller.		1

In the remaining nine control sites the various grass species predominate, forming lithophytic groups over the denuded of forests slopes, in the higher-altitude parts of the Park, where the erosion has taken complete possession.

The interrelation **cereals: legumes: various grass species** for the separate formations is as follows:

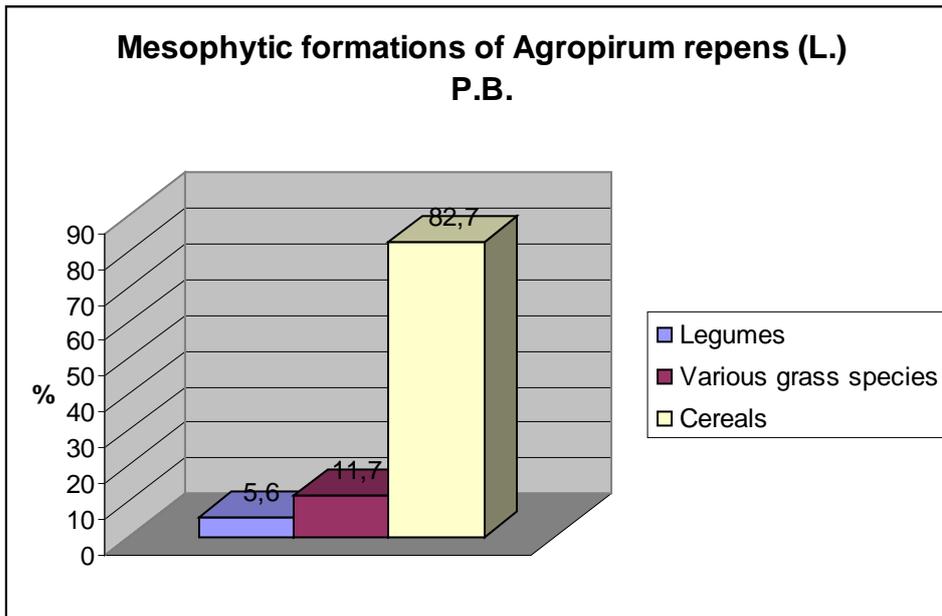


Fig. 1

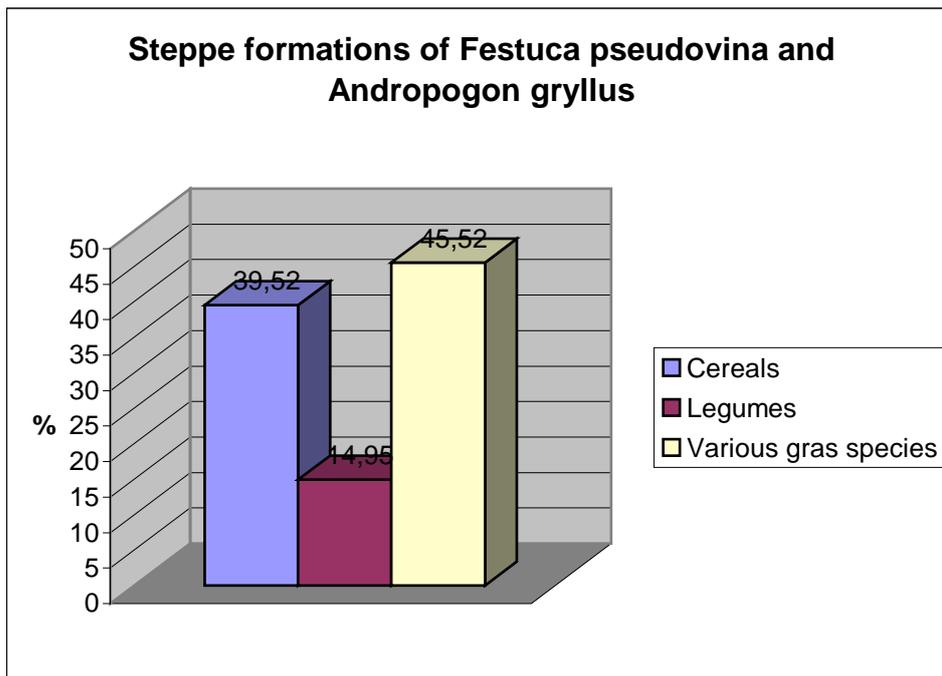


Fig. 2

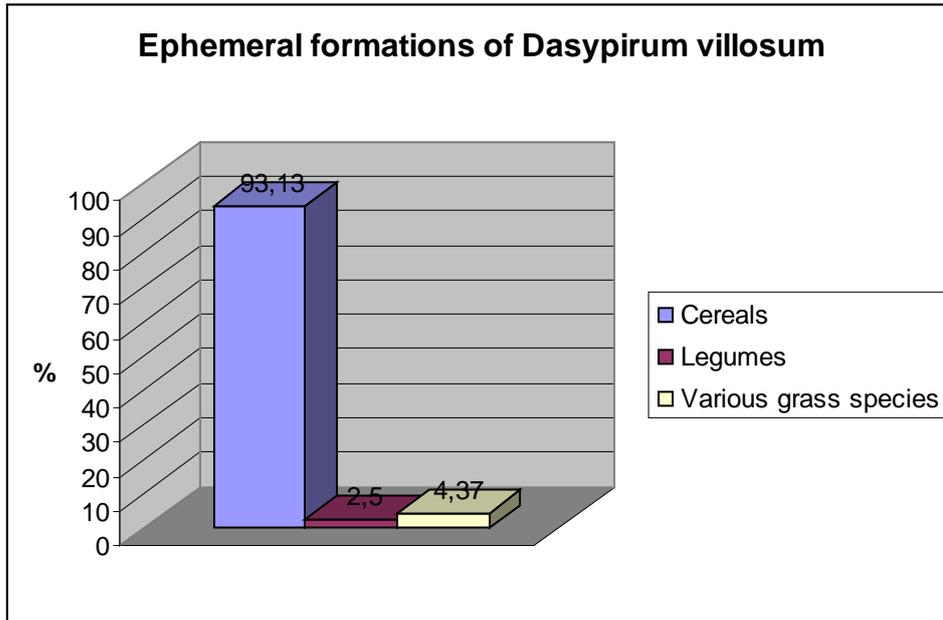


Fig. 3

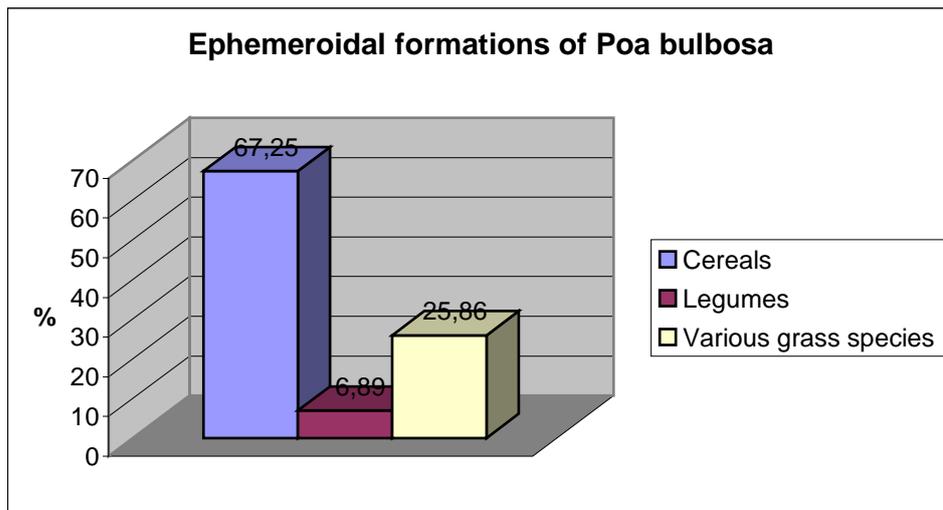


Fig. 4

Some objective laws become visible from the diagrams:

-in 18 of the analyzed formations cereals dominate, and in 8 of them ephemeral and ephemeroïdal species are the dominant;

-at the mesophytic formations with *Agroporum repens* as a basic edificator, the cereals take significant part of the grass cover, with 78% of the plant cover being a dominant;

-at the steppe formations the dominant hardly takes $\frac{1}{4}$ of the vegetable cover .

In the grass cover the various grass species and the cereals predominate;

-almost the same trend is observed at the ephemeroïdal associations of *Poa bulbosa*. The dominant is with low density and allows development of other cereals;

-the ephemeral formations of *Dasypyrum villosum* make dense plant cover and are with poor composition of species. The availability of associations of the last two types is a proof for strong anthropogenic pressure in the region (Stoyanov, 1951).

Inferences:

There is a zonal distribution of the vegetation on the two hills of the Forest park "Mitropolit Metodi Kusev";

The introduced and local wood species alternate with open parts of grass vegetation in the low-altitude portions of the Park Ephemeral and ephemeroïdal associations of *Dasypyrum villosum* and *Poa bulbosa* are prevailing there;

In the higher-altitude open parts of the Park the groups of the *Andropogon gryllus* are situated. They develop in tuffs on the outcropped, with a thin soil layer and visible basic rock terrains, and allow availability of various grass species;

The communities of the *Festuca pseudovina* are spread all over the Park;

The atmospheric conditions and the orographic peculiarities are natural bases for the significant presence of a steppe element - *Stipa joanis* Celac., *Melica ciliata* L., *Festuca pseudovina* Hack., *Bromus tectorum* L.;

The ephemeral and ephemeroïdal formations take a big share (50%) of the vegetable cover. The plant species that build them up are terrophytes, finishing their life cycle in the end of May. They clear space for the development of lithophytic vegetation – various grass species, primarily of Mediterranean origin;

The steppefying of the plant cover and the invasion of Mediterranean vegetable life are common objective laws, typical for the plant communities of the Gornotrkijski phytogeographic district.

References:

- Bondev, I. 1969. Edificators and dominants of the vegetable cover of Bulgaria – B: II-nd National botany conference, p. 199-212.
- Gantchev, I., Vulev, S., Yordanov, D. and colleagues 1964. Vegetation of the meadows and pastures in Bulgaria, Issue of Bulgarian Academy of Science, p. 258.

- Gantcev, I. 1965. Residual forests in the Stara Zagora field and on its peripheral hills (formation, successions, and floristic analysis). Proceedings of the Botany Institute, Bulgarian Academy of Science, Sofia., vol. XIV, 19-87.
- Gantcev, I. 1965. Residual forests in the Stara Zagora field and on its peripheral hills (formation, successions, and floristic analysis). Part II, Proceedings of the Botany Institute, Bulgarian Academy of Science, Sofia., vol. XV, 5-89.
- Yordanov, D. 1936. Upon the distribution of the steppe vegetation in Bulgaria. Symposium of Bulgarian Academy of Science, Sofia, № 32, 6-23
- Kozhuharov, S. 1979. The Bioresources of Bulgaria. Public education. p. 182
- Stoyanov, N., Ahtarov, B. 1951. Ephemeroïdal vegetable communities in our southern regions. Proceedings of the Botany Institute, Bulgarian Academy of Science, Sofia., vol. II, p. 49-79
- The Flora of Bulgaria, vol. 1-9, Sofia, BAS.
- Rikli, d-r M. Das Pflanzenkleid der Mittelmeerländer. Berm.1946.Bd.I – 436, Bd.II – 437 –1093.