RESEARCH REGARDING THE STRUCTURE OF BIOFORMS, ECOFORMS AND GEOELEMENTS IN THE HERB LAYER IN SOME REGENERATING TURKEY OAK PHYTOCENOSES

Geambasu Teodora*

* Forest Research and Mangement Institute, Oradea Station, 70 Ştefan cel Mare Street, Oradea, Romania, e-mail: teodorageambasu@yahoo.com

Abstract

The present paper has in view to bring a reasonable contribution to the knowledge of the species complex that characterizes the life of the Turkey oak phytocenoses, when they are submitted to a disturbance – in our case, the gradual thinning of the stand, as a consequence of regeneration cutting application.To highlight the variation of the specific composition and implicitly of the herb layer structure, after these silvicultural interventions, three Turkey oak stands have been selected. One stand is with no cuttings being considered the "control" stand and the other two stands are with cuttings, one of them with opening tree-group cuttings and the other one with enlargement tree-group cuttings . A quantitative evaluation for the herb layer has been considered in these stands. As a consequence, the type of association to which the three phytocenoses belong to, that is Carpino-Quercetum cerris Klika 1938, the list of species that include 78 species/ha, the species richness, as well as the structure of these phytocenoses from the viewpoint of life forms, their phytogeographic character, of their relationship with the ecologic factors, were determined. ***It was noticed that after the stand thinning, as a consequence of the regeneration cutting application, the richness of the herb species increases very much especially after the enlargement tree-group cuttings, and the structure of these phytocenoses undergoes changes at the level of herb layer.***

Key words: Turkey oak phytocenoses, species richness, richness, bioform, geoelement, ecologic structure

INTRODUCTION

Turkey oak (*Quercus cerris* L.) is one of the seven species of the genus *Quercus* found in Romania. Although the cumulated surface forested with Turkey oak is reduced, of only 185.000 ha, the Turkey oak is spread on a larger area, because it can form not only pure stands, but it is also present in different rates in mixtures with other species of *Quercus*, with mixed species (hornbeam, linden) and even with beech. Because, silviculturally, the Turkey oak didn't present special problems, there was poor scientific research upon this species. However, the Turkey oak is interesting because in comparison with the Hungarian oak and other oaks, was not affected by massively drying, having a great drought resistance; it can be easily regenerated from seeds and sprouts and it has a rapid growth when young; it provides a pretty high wood yield in climate and soil conditions that are unfavourable for other species.

The pure and mixed Turkey oak stands present a high stability even in pronounced anthropization conditions and in “sites in which other species don’t survive.” (Chiriță, 1938)

The present paper has in view to bring a reasonable contribution to the knowledge of the species complex that characterizes the life of the Turkey oak phytocenoses, when they are submitted to a disturbance – in our case the gradual thinning of the stand as a consequence of regeneration cutting application. To highlight the variation of the specific composition and implicitly of the herb layer structure, as a consequence of these silvicultural interventions, some Turkey oak stands have been chosen from the western part of the country, that is from Bihor county.

The approach of such a research was determined by the national and international interest in the preservation of the forest ecosystem biodiversity, as a reference base for the evaluation of the effect of different cultural forest measures for its preservation.

MATERIAL AND METHOD

Research Site

The researches for the present paper were developed in the Turkey oak stands located on the 3rd order terrace of Crisul Repede River, a subdivision of the High Plain of Crisuri Rivers. Administratively, these stands belong to O.S. Oradea, U.P.V.– Alparea (O.S. = forest district, U.P. = working unit).

Research Material

The research material consisted in three Turkey oak stands, one of them being with no_regeneration cuttings, considered as “control” sample (u.a. 75B) (u.a. – working section), and two stands with opening tree-group cuttings (u.a. 83), respectively with enlargement tree-group cuttings (u.a. 76A).

All the three Turkey oak stands are placed on a plateau at an altitude of 200 m, the soil type is stagnic luvosoil. The stands are characterized by the same site type: 7.3.3.3. – hilly with Quercus-type trees with pedunculate oak Ps, podsolit, strongly pseudo-gleyzed, great edaphic and they have the same forest type: 711.1 – Normal hilly Turkey oak forest

The stand from O.S. Oradea, U.P. V – Alparea, u.a. 75 B (control stand) with a surface of 7.5 ha is characterized by: - composition: 9CE1CA – age: 75 years old, - consistency: 0.8; site class: 2nd, the stand from u.a. 83 (stand with opening tree-group cuttings)with a surface of 10.9 ha is characterized by: - composition: 10CE - age: 85 years old, - consistency:

0.6; site class: 2nd, and that from u.a. 76A (stand with enlargement and lighting tree-group cuttings) with a surface of 10.0 ha is characterized by: - composition: 10CE, - age: 85 years old, consistency: 0.4, - site class: 2nd. In the case of Turkey oak stands with cuttings, the time spent from the application of cuttings till the moment of research was of three years.

Research Method

Because the aim of the research refers to the way in which the specific composition of the herb layer evolves inside the dominant Turkey oak phytocenoses (*Quercus cerris* L.), found in different stages of its natural regeneration process, it would have been impossible for this study to be accomplished in a relatively short period of time. This is the reason why I proceeded to the research of some phytocenoses that are different from the viewpoint of the time in which the silvicultural intervention took place, but characterized by the same site conditions and belonging to the same plant association (*Carpino-Quercetum cerris,* Klika 1938).

For the identification of the association in the control stand, ten sample surfaces of 1000 mp each were placed, for which a list of species from all the layers was accomplished, being considered the richness-dominance with the help of Braun-Blanquet scale.

The sample surfaces were placed in the control Turkey oak stand at at least 50 m from its margin, avoiding the earth roads and paths within the interior of the stand. The length of these surfaces was of 100 m and the width of 10 m, the surfaces having the same orientation, being parallel one with each other.

In each chosen stand a quantitative evaluation was also made for the herb layer, this thing being possible by placing 50 rectangular inventory surfaces of 0.5 x 0.3 m in which the species (resulting the species list).and the number of individuals belonging to these species were recorded

For the placement of the inventory surfaces, a randomized sampling was adopted that consisted in the random placement of these inventory surfaces, offering thus, to each part of the stand, the chance of being selected. The size of the surface in which the inventory surfaces have been placed was the same for each stand, respectively of 5.0 ha. However, for an accurate analysis, the interference areas with the earth roads and existent paths were avoided, as well as, the areas with stubs, etc. In the stands with cuttings, the number of inventory surfaces placed in the areas with cuttings (tree-group opening) was equal with the one in the area with no cutting.. Thus, the inventory surfaces have had a non-permanent character.

For the classification of the plants in different biological forms, Raunkiaer's classification has been used, based on the way in which different vegetal species protect their regenerative parts during the unfavourable periods. (Cristea et. al., 2004).

To establish the affiliation of the component species to different categories of geoelements, a combination of two systems have been used in the present paper, that is one belonging to Savulescu (1940) and one belonging to Borza (1959), to which some other contributions of the Central-European chorologic school have been added. (Cristea et. al., 2004).

For the characterization of the phytocenoses ecological structure, the preferences of the species towards the main ecological factors have been taken into account: edaphic humidity (U), air temperature (T) and soil reaction (R), this approach method being used by the phytocenologic school from Cluj-Napoca. (Cristea et. al., 2004).

For the name of the species "Romanian Illustrated Flora" was used. (Ciocârlan, 2000).

RESULTS AND DISSCUSIONS

Results regarding the species richness

The species richness of a phytocenosis is given by the number of plant species that vegetates in the respective phytocenosis.

Among the indices of phytocenosis structure the specific density (richness) was determined, that represents the number of specific species on a certain investigated surface. This index was determined according to the surveys made in the Turkey oak stand with no cuttings by noticing that at the level of phytocenoses there are 78 species/ha out of which the tree layer is represented by three species/ha, the shrubby and seedling layer is represented by six species/ha, and the herb layer presents an increased density of 69 species/ha.

The average value of the species density in the studied Turkey oak stand is of 40.5 species/1000 square metres.

Results regarding the species abundance

In Table 1, the results of the research regarding the abundance of the specific species in the herb layer of the studied phytocenosis are presented. Besides the abundance, the bioform, geoelement as well as the preference of the respective species towards the main ecological factors – edaphic humidity (U), air temperature (T) and soil reaction (R) for each species were mentioned.

Table 1

Species abundance in the herbaceous and under-shrubby layer within the studied Turkey oak stands

Species	**Abundance** No. ind./ha			**Bioform**	**Geoelement**	**Ecologic form**		
	75B	83	76A			**U**	**T**	**R**
1.	2.	3.	4.	5.	6.	7.	8.	9.
Poa nemoralis	194666	230666	152000	H	Eua.	3	3	0
1.	2.	3.	4.	5.	6.	7.	8.	9.
Molinia caerulea	106666	225333	221333	H	Eua	4	3	0
Stellaria holostea	316000	89333	141333	H-Ch	Eua	3	3	0
Agrostis capillaris	38666	156000	222666	H	Circ	0	0	0
Carex pallescens	22666	140000	204000	H	Circ.	3,5	3	3
Carex divulsa	29333	169333	93333	H	Eua	2,5	3	0
Festuca rubra	22666	110666	124000	H	Circ	3	0	0
Fragaria vesca	73333	92000	50666	H	Eua	3	2,5	0
Carex pilosa	36000	57333	48000	H	Eua	2,5	3	3
Cerastium sylvaticum	24000	14666	82666	H	Euc	3,5	3	0
Calamagrostis epigeios	32000	34666	38666	H	Eua	2	3	0
Galium pedemontanum	61333	16000	18666	Th	Med.	2	3,5	4
Sedum telephium	66666	14666	6666	H	Eua	2	3	0
Lysimachia nummularia	34666	38666	12000	Ch	Eur	4	3	0
Polygonum convolvulus	25333	14666	26666	Th	Eua.	2,5	3	3
Clinopodium vulgare	24000	10666	30666	H	Circ.	2	3	3
Viola reichenbachiana	12000	40000	10666	H	Eua.	3	3	3.5
Conyza canadensis	1333	8000	46666	Th-TH	Adv.	2,5	0	0
Ajuga reptans	4000	22666	26666	H-Ch	Eur.	3,5	0	0
Galeopsis pubescens	12000	20000	18666	Th	Euc.	3	3	0
Lysimachia punctata	25333	10666	10666	H	Pont-Med	3,5	3,5	3
Brachypodium sylvaticum	10666	16000	17333	H	Eua.	3	3	4
Moehringia trinervia	12000	14666	9333	Th-TH	Eua.	2,5	3	3
Lapsana communis	13333	4000	9333	Th-TH	Eua.	2,5	3	3
Senecio viscosus	5333	8000	12000	TH	Eur.	2	3,5	2,5
Potentilla erecta	10666	4000	10666	H	Eua.	0	0	0
Oxalis stricta	1333	4000	17333	Th	Eur.	3,5	0	0
Vincetoxicum hirundinaria	14666	4000	4000	H	Eur.	2	4	4
Geum urbanum	2666	8000	5333	H	Eua.	3	3	4
Trifolium montanum	1333	8000	5333	H	Eua	2,5	2	4
Polygonatum multiflorum	5333	8000	1333	G	Eur	3	3	3
Hypericum perforatum	2666	4000	5333	H	Eua	3	3	0
Cytisus nigricans	5333	4000	2666	Ph	Euc	2,5	3	0
Lactuca serriola	2666	2666	6666	Th-TH	Eua.	1,5	3,5	0
Euphorbia cyparissias	4000	1333	2666	H	Eua.	2	3	4
Scrophularia nodosa	2666	2666	2666	H	Eua.	3,5	3	0
Hypericum hirsutum	1333	2666	2666	H	Eua	3	3	3
Hieracium sabaudum	2666	1333	2666	H	Eur	2,5	3,5	2,5
Astragalus glycyphyllos	2666	1333	1333	H	Eua.	3	3	4
Linaria vulgaris	4000	-	9333	H	Eua.	2	3	4

Lamium galeobdolon	8000	-	5333	H-Ch	Euc.	3	0	4
Tanacetum corymbosum	6666	-	5333	H	Eua.	2,5	2,5	3
Sonchus asper	2666	-	5333	Th	Eua.	3,5	3	4
Sedum cepaea	1333	-	2666	Th-TH	Med.	3	4	0
Pulmonaria mollis	1333	-	1333	H	Eua	2,5	3	4
Carex brizoides	-	200000	356000	H-G	Euc.	3,5	3	2
Apera spica-venti	-	110666	376000	Th	Eua.	3,5	0	2,5
Holcus lanatus	-	148000	172000	H	Eua.	3,5	3	0
Poa trivialis	-	122666	176000	H	Eua.	4	0	0
Dactylis glomerata	-	176000	90666	H	Eua.	3	0	4
Juncus tenuis	-	66666	190666	H	Adv.	3,5	3	4
Poa angustifolia	-	48000	118666	H	Eua.	2	3	0
Polygonum hydropiper	-	62666	92000	Th	Eua.	4,5	3	4
Juncus conglomeratus	-	85333	38666	H	Eua.	4,5	3	3
Festuca gigantea	-	89333	34666	H	Eua.	4	3	2,5
Juncus bufonius	-	24000	44000	Th	Cosm.	4,5	0	3
Veronica montana	-	6666	44000	Ch	Eur.	3,5	2,5	3
Veronica chamaedrys	-	6666	36000	H-Ch	Eua	3	0	0
Epilobium montanum	-	8000	24000	H	Eua	3	0	3,5
Stellaria graminea	-	4000	24000	H	Eua.	2,5	2	3
Achillea millefolium	-	8000	17333	H	Eua.	3	0	0
Polygonum aviculare	-	12000	8000	Th	Cosm.	2,5	0	3
Glechoma hederacea	-	9333	9333	H-Ch	Eua.	3,5	3	0
Prunella vulgaris	-	6666	10666	H	Circ.	3	3	0
Genista tinctoria	-	4000	9333	Ch	Eua	2,5	3	2
Campanula patula	-	4000	8000	TH	Eur.	3	2,5	3
Taraxacum officinale	-	8000	4000	H	Eua.	3	0	0
Leontodon hispidus	-	1333	8000	H	Eua.	2,5	0	0
Ranunculus acris	-	1333	6666	H	Eua.	3,5	0	0
Alliaria petiolata	-	2666	4000	Th-TH	Eua.	3	3	4
Vicia tetrasperma	-	1333	4000	Th	Eua.	3,5	3	3
Matricaria inodora	-	1333	4000	Th-TH	Eua.	0	3	3,5
Senecio sylvaticus	-	2666	2666	Th	Eur.	3	3	3
Hieracium maculatum	-	1333	2666	H	Eur.	2	3	2
Rumex obtusifolius	-	2666	1333	H	Eur.	4	0	3
Filipendula vulgaris	-	1333	1333	H	Eua.	2,5	3	0
Cirsium vulgare	-	1333	1333	TH	Eua.	3	3	0
Allium scorodoprasum	6666	-	-	G	Euc.med	2	3	4
Veronica officinalis	2666	-	-	Ch	Eua.	2	2	2
Mycelis muralis	2666	-	-	H	Eur.	3	3	0
Viola alba	2666	-	-	H	Med.-Euc.	3	4,5	4
Stachys officinalis	1333	-	-	H	Eua.	3	3	0
Melica nutans	-	64000	-	H-G	Eua.	3	0	4
Erechtites hieracifolia	-	12000	-	Th	Adv.	3	0	0
Euphorbia amygdaloides	-	10666	-	Ch	Eur.	3	3,5	4
Eupatorium cannabinum	-	2666	-	H	Eua.	4	3	0
Geranium robertianum	-	2666	-	Th	Cosm.	3,5	3	3
Lythrum hyssopifolia	-	2666	-	Th	Cosm.	4	3	0
Athyrium filix-femina	-	1333	-	H	Cosm.	4	2,5	0

Senecio vulgaris	-	1333	-	Th-TH	Eua.	3	0	0
Lactuca saligna	-	1333	-	Th-TH	Med.	1,5	4	4
Anthoxanthum odoratum	-	-	112000	H	Eua.	0	0	0
Bromus arvensis	-	-	96000	Th-TH	Eua.	2,5	3	0
Vinca minor	-	-	94666	Ch	Med..	3	3	3
Festuca pratensis	-	-	56000	H	Eua.	3,5	0	0
Milium effusum	-	-	45333	H	Circ.	3,5	3	3
Alopecurus pratensis	-	-	36000	H	Eua.	4	3	0
Lolium italicum	-	-	28000	Th	Med	2,5	4	4
Crepis biennis	-	-	16000	TH	Eur.	3	3	4
Silene italica	-	-	14666	H	Eua.	3	0	3
Plantago lanceolata	-	-	13333	H	Eua.	0	0	0
Lychnis flos cuculi	-	-	10666	H	Eua.	3,5	2,5	0
Hieracium latifolium	-	-	10666	H	Eur.	2,5	3,5	3,5
Gypsophilla muralis	-	-	9333	Th	Eua	2	3	2
Trifolium campestre	-	-	9333	Th-TH	Eur.	3	3	0
Filago germanica	-	-	6666	Th	Eua.	2	3	0
Plantago major	-	-	5333	H	Eua.	3	0	0
Centaurea nigrescens	-	-	5333	H	Euc.	3,5	3	3
Setaria pumila	-	-	5333	Th	Cosm.	2,5	4	0
Hieracium virosum	-	-	4000	H	Eua.	2,5	4	4
Leucanthemum vulgare	-	-	4000	H	Eua.	3	0	0
Potentilla argentea	-	-	4000	H	Eua.	2	4	2
Tanacetum vulgare	-	-	4000	H	Eua.	3	3	0
Verbascum blattaria	-	-	4000	H	Eua.	2,5	3,5	4
Ambrosia artemisiifolia	-	-	4000	Th	Adv.	2	0	0
Crepis foetida	-	-	4000	Th	Eua.	2	3,5	3
Galium palustre	-	-	2666	H	Circ.	5	3	0
Galium mollugo	-	-	2666	H	Eua.	3	0	3
Leontodon autumnalis	-	-	2666	H	Eua.	3	0	0
Trifolium pratense	-	-	2666	H	Eua.	3	0	0
Potentilla alba	-	-	2666	H	Eur.	2,5	3,5	3
Rumex sanguineus	-	-	2666	H	Eur.	4	3	4
Polygala vulgaris	-	-	2666	H-Ch	Eua.	3	3	3
Solanum nigrum	-	-	2666	Th	Cosm.	3	4	0
Melampyrum nemorosum	-	-	2666	Th	Eur.	3	3	3,5
Crepis pannonica	-	-	2666	TH	Pont-pan	2	2	4
Senecio germanicus	-	-	1333	H	Eua	3,5	3	3
Cichorium intybus	-	-	1333	H	Eua.	2,5	3,5	4,5
Myosotis palustris	-	-	1333	H	Eua.	5	3	0
Primula veris	-	-	1333	H	Eua.	3	2	5
Hieracium sp.	-	-	1333	H	Eur.	2,5	3,5	2,5
Torilis arvensis	-	-	1333	Th	Eua.	2,5	3,5	4
Raphanus raphanistrum	-	-	1333	Th	Med.	2,5	3	0
Aira elagantissima var. biaristata	-	-	1333	Th	Med.	2	4	0
Total no. ind./ha	1303980	2941308	4294624	*	*	*	*	*

The structure of the Turkey oak phytocenoses in the herb layer is strongly influenced by the competition for the environmental factors, that is for light that has a very strong modelling effect. As the trees are extracted from the tree layer, as a consequence of applying the cuttings corresponding to the shelterwood group system, in the herb layer, an increase in the number of species takes place (50 species in the Turkey oak stand with no cuttings, 80 species in the Turkey oak stand with opening tree-group cuttings and 120 species in the Turkey oak stand with enlargement tree-group cuttings), as well as their abundance (1 303 978 ind./ha in the Turkey oak stand with no cuttings, 2 941 308 ind/ha in the Turkey oak stand with opening tree-group cuttings and 4 294 624 ind./ha in the Turkey oak stand with enlargement tree-group cuttings).

To illustrate the way in which the abundance of the main herbaceous species evolves in the Turkey oak stands with cuttings, we took the first five herbaceous species with high abundance in the control stand.

In the case of the control Turkey oak stand, the most abundant species is Stellaria holostea with 316 000 ind./ha. This abundance decreases significantly up to 72% (89333 ind./ha) in the stand with opening tree-group cuttings, after which it increases with 58% (141 333 ind./ha) in comparison with the cutting mentioned above, in the stand with enlargement tree-group cuttings.

The next three species according to their abundance in the control stand are: Poa nemoralis with 194 666 ind./ha, Molinia coerulea with 106 666 ind./ha and Fragaria vesca with 73 333 ind. /ha, all of them being species characteristic for the forest and forest cuttings. The evolution pattern of these species consists in an increase in the abundance in the case of applying opening tree-group cuttings, with an increase of 18% for the first species, of 111% for the second species and respectively of 25% for the third species. After the application of the enlargement tree-group cuttings, the abundance of these species decreases slightly with 35% for the first species, with 2% for the second species and with 45% for the third species with respect to the opening tree-group cuttings.

The fifth place in the list of species with high abundance in the control stand is occupied by Sedum telephium that is a pioneer species for which the abundance evolution in the three stands (control stand, stand with opening tree-group cuttings, stand with enlargement tree-group cuttings) is made according to a descendent curve. The abundance of this species in the control stand was of de 66 666 ind./ha, after which in the stand with opening tree-group cuttings it decreases to 21% with respect to the control stand, and in the stand with enlargement tree-group cuttings it decreases to 10% with respect to the stand with opening tree-group cuttings.

Results regarding the specific composition of the herb layer

The establishment of the specific composition of a phytocenosis presents a significant importance that resides in the fact that each species presents some biological characteristics, some needs and tolerances with respect to the ecological factors; they also have a role to play in the edification of the phytocenosis and a certain spreading. Thus, each species belongs to a certain form of life (bioform), to a certain ecological form and to a phytogeographical form (geoelement) (Ivan, 1979).

Taking into account the species characteristics, the structure of the Turkey oak phytocenoses studied from the point of view of life forms (table 2), of their phytogeographic nature (table 3), of their relationship with the ecologic factors (temperature – table 4, humidity – table 5, soil reaction – table 6)" are established in the following tables.

Table 2

Distribution of bioforms in the studied Turkey oak phytocenoses (according to abundance)

Location	Applied cutting	Bioforms: (%)								
		Hemicryptophyte (H)	Annual therophyte (Th)	Biannual therophyte (TH)	Annual therophyte Biannual therophyte (Th-TH)	Camephyte (Ch)	Hemicryptophyte-camephyte (H-Ch)	Geophyte (G)	Hemicryptophyte-geophyte (H-G)	Camephyte -Hemicryptophyte (Ch-H)
u.a. 75B	Control stand	59	8	-	4	3	25	1	-	-
u.a. 83	Group shelterwood system – opening tree-group	76	10	-	2	2	1	-	9	-
u.a. 76A	Group shelterwood system – enlargement tree group	60	15	1	7	4	5	-	8	-

Table 3

Distribution of geoelements in the studied Turkey oak phytocenoses (according to abundance)

Location	Applied cutting	Geoelements : (%)							
		Circumpolar (Circ)	Eurasian (Eua)	European (Eur)	Central-european (Euc)	Mediterranean (Med)	Adventive (Adv)	Cosmopolitan (Cosm)	Pontic-Mediterranean (Pont.-Med)
u.a. 75B	Control stand	8	77	4	4	7	-	-	2
u.a. 83	Group shelterwood system –opening tree-group	14	70	3	8	1	3	1	-
u.a. 76A	Group shelterwood system – enlargement tree group	15	60	4	11	3	6	1	-

Table 4

Ecological structure of the studied Turkey oak phytocenoses - with respect to temperature (according to abundance)

Location	Applied cutting	Species cetegories with respect to temperature : (%)					
		Hekistotherm	Microtherm	Mesotherm	Moderate-thermophyle	Thermophyle	Thermotolerant
u.a. 75B	Control stand	-	6	86	1	-	7
u.a. 83	Group shelterwood system – opening tree-group	-	4	67	-	-	29
u.a. 76A	Group shelterwood system – enlargement tree group	-	4	61	1	-	34

Table 5

Ecological structure of the studied Turkey oak phytocenoses -with respect to humidity (according to abundance)

Location	Applied cutting	Species categories with respect to humidity: (%)					
		Xerophyte	Xeromesophyte	Mesophyte	Mesohygrophyte	Hydrophyte	Hydrotolerant
u.a. 75B	Control stand	-	27	58	11	-	4
u.a. 83	Group shelterwood system – opening tree-group	-	15	57	23	-	5
u.a. 76A	Group shelterwood system – enlargement tree group	-	18	59	15	-	8

Table 6

Ecological structure of the studied Turkey oak phytocenoses -with respect to the soil reaction (according to abundance)

Location	Applied cutting	Species categories with respect to the soil reaction : (%)					
		Very acidophile	Acidophile	Acido-neutrophile	Weak acido-neutrophile	Neutro-basophile	Amphytolerant
u.a. 75B	Control stand	-	1	14	9	-	76
u.a. 83	Group shelterwood system – opening tree-group	-	14	16	15	-	55
u.a. 76A	Group shelterwood system – enlargement tree group	-	19	15	14	-	52

As regards the dynamics of the bioform's structure in the Turkey oak stands, a large presence of hemicryptophytes is noticed both in the control stand (no cutting stand) and in those with cuttings.

From a phytogeographic point of view (geoelements), it is noticed that most of the species in the Turkey oak stands belong to the eurasian geoelement.

With respect to the temperature, the studied Turkey oak stands are characterized by the presence of the mesotherm species. The percent of the mesotherm species decreases as long as the stands are thinned. The loss of percents in the mesotherm species moves towards the thermotolerant species whose percents.

The distribution of the species according to humidity shows us that most of the specific populations identified in the vegetal floor of the studied Turkey oak stands belong to the mesophyte species. Their percent remains relatively constant even in the stands that present cuttings. The species that carry a disbalance altogether with the application of the cuttings characteristic for the group shelterwood system are the xeromesophyte species whose percent decreases with respect to the mesohygrophyte and hydrotolerant species.

In the Turkey oak phytocenoses that present cuttings, it is noticed the increase of the percent of acidophilous and acido-neutrophil species.

DISCUSSIONS

Discussions regarding the species richness

The species richness that represents an important indicator of the phytocenoses' floristic structure, was determined by the biologists I. Pop and V. Cristea (2002) from Cluj for the main associations that include Turkey oak in their composition, according to the existent phytosociological descriptions. Thus, for the Carpino-Quercetum cerris association to which the studied Turkey oak phytocenoses belong to, the total number of species identified in 62 surveys by the above-mentioned biologists is of 130, out of which 13 are species that belong to the tree layer, 10 belong to the shrubby layer and 107 species belong to the herb layer.

By comparing the number of species identified by the two biologists, for the above-mentioned association, to the number of species within the control Turkey oak forest, it is noticed that it is much higher. This thing is due to the high number of used surveys, but also due to the distribution of these surveys in more regions (nine regions).

As regards the value of the average density in the case of the control Turkey oak stand (with no cuttings) it presents almost double values (40.5 species/1000 square metres) with respect to those determined by I. Biris for beech forests (Biriş, 2001). He stated in his PhD thesis that the beech forests is one of the poorest in species, the average value of density in the studied ecosystems being of 20.5 species/1000 square metres. On the other hand, in the *Quercus*-genus stands, studied by M. Petrescu in Dobrogea, the average value of this indicator is of 59.3 species/1000 square metres (Petrescu 2004), thus, a superior value to that determined in the studied Turkey oak.

Discussions regarding the species abundance

The gradual extraction of the trees from the studied Turkey oak phytocenoses determined a perturbation in the ecologic community, fact that led to changes in the richness and abundance of the species in the herb layer.

The higher the intensity of cuttings, the more changes at the level of the biotope as regards the light and rainfall quantity that reach the surface of the soil. The more diversified the biotope conditions, the higher the number of populations, and implicitly the number of individuals belonging to these populations (Thienemann, 1939, in Botnariuc et Vadineanu, 1982). Thus, an increase in the number of populations and in their abundance takes place in the Turkey oak phytocenoses while the stands are thinned.

Such an evolution pattern of the diversity was described in the Mediterranean area where the diversity of the flood plain forest presents an increasing tendency during succession (Montalvo, 1993, in Petrescu, 2004).

Studying the way in which the main herbaceous species in the Turkey oak phytocenoses under study evolves, it is noticed that their abundance in some cases decreases in the case of enlargement tree-group cuttings, this fact being due to the fact that a great part of the tree-groups are occupied by seedling (but also by shrubby species), fact that prevents the development of the herb layer. As the seedling will develop horizontally, occupying extended territories also vertically, both the richness of herb species and their abundance and their abundance will be reduced significantly as a consequence of the gradual rebound to the biotope conditions before cuttings.

The decrease of the population number, while successional maturation, was also signalled in some oak forests from Costa Rica (Kappelle, 1995, in Petrescu, 2004).

Discussions regarding the specific composition of the herb layer

I. Pop and V. Cristea elaborated a synthesis of the bioform, phytogeographic elements and ecologic structure for the main associations of Turkey oak from our country. For the association *Carpino-Quercetum cerris* (to which the studied Turkey oak phytocenoses belong to), the authors reach to the conclusion that the herbaceous layer is dominated by hemicryptophyte (50.8%), followed by geophyte (13.8%) and therophyte (7.7%).

The predominance of the hemicryptophyte is absolute in all the studied Turkey oak forests, their presence in a high percent indicating a climate with a hydric deficit and a high richness of the dominated herb formations of *Poa* genus perennial species of. As the stands are thinned, an increase of the therophyte percent takes place being determined by the increase of the annual species penetration, with a great dissemination capacity (pioneering species), especially in the stands with cuttings, their increasing percent also suggesting a high degree of vegetation's anthropization.

In the case of the geoelements, the same authors highlights that the euroasian species (40% and European species (27.7%) dominate in the above-mentioned association, in a similar manner to all the other silvicultural deciduous forest in Romania. Altogether with these geoelements, the plants with Central European spreading area (11.6%) are distinguished numerically, while the cosmopolite species (1.5) and those circumpolar (3.0) are less in number and they don't have a special significance.

As regards the distribution and share of the main ecologic categories (humidity – U, temperature – T and soil chemical reaction – R), by summing up the information of the two authors, it is noticed that in the structure of the *Carpino-Quercetum cerris* association dominates the species (53.9%), xeromesophyte (45.5%), micromesotherm (71.6%), moderately thermophyle (11.9%), acido-neutrophil (40.3%), poorly acido-neutrophil (30.5%).

CONCLUSIONS

The research undergone in the Turkey oak phytocenoses led to the identification of a great number of species. Even in the conditions in which no endemic species was identified and the number of rare species - *Sedum cepaea, Sedum telephium, Hieracium maculatum* (Ciocârlan, V., 2000) is reduced, the studied Turkey oak stands preserve a great diversity of plant species.

After the thinning of the Turkey oak stands, as a consequence of regeneration cuttings, the species richness of the herb layer increases very much after the opening tree-group cutting, but especially after the enlargement tree-group cutting.

Some herb types evolve in the direction of amplifying the number of individuals altogether with the application of regeneration cuttings and other reduce their number as a consequence of the biotope changes that take place in the stands with cuttings.

The research results undergone for the emphasis of the specific composition variation of the herb layer for the studied Turkey oak phytocenoses showed an increase of the hemicryptophyte and therophyte percent in the stands with cuttings for bioforms, an increase of the circumpolar, adventive and cosmopolite element percent for geoelements, as well as, a decrease of the Eurasian ones in the stands with cuttings. A decrease of the mesotherm and an increase of the thermotolerant ones are noticed for ecoelements, a decrease of the xeromesophytes and an increase of the hydrotolerant ones, an increase of the acidophilous and acido-neutrophile are noticed in the stands with cuttings.

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