

ECOLOGY OF TURKEY OAK AND SESSILE OAK MIXED FORESTS FROM THE MESEȘ MOUNTAINS

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Abstract

Turkey oak and Sessile oak mixed forests colonize the slopes of the Meseș Mountains, having a predominant southern exposure, a slope 25-30⁰, at an altitude ranging between 520-670 m. They grow on a substratum consisting of marl, sandstone, volcanic tuffs covered by skeletal, surface and partially medium to deep soils which are poor in mineral salts and categorised as districambosol, clayey-loamy, weakly-acid neutrophilic soils. A number of five phytocenological surveys were performed and the inventory species were computed in an association table by specifying the type of the bioform, floristic elements, and by mentioning the values for the ecological indices: humidity, temperature, chemical reaction of the soil. The Quercetum petraeae-cerris floricultural inventory includes 54 species, of which five species are characteristic to Quercion petraeae, nine species belonging to the Frasinio orni-Cotinetalia order and nine species are characteristic for the Quercetia pubescenti-petraeae class. The phytocoenoses spectrum of the Turkey oak and Sessile oak forests is dominated by hemicryptophytes (55.55 %), followed by phanerophytes (24.07 %), and geophytes (11.11 %). The spectrum of phytogeographical elements reveals the predominance of European species (29.63 %), followed by Eurasian (27.77 %), Central European (22.22 %) and Southern European (7.40 %) ones. The diagram of the ecological indices with reference to the humidity, temperature, chemical reaction of the soil shows that the Turkey oak and Sessile oak forests colonize of the Meseș Mountains have a mesophilic (38.88 %), towards a xeromesophilic nature (37.03 %), and a mesothermal (66.66 %) character, while encompassing a acid-neutrophilic (44.44 %) to weak acid-neutrophilic (22.22 %) feature.

Key words: phytocoenoses, Turkey oak and Sessile oak, bioforms, geoelements

INTRODUCTION

Turkey oak and Sessile oak mixed forests of the Meseș Mountains are spread on sunny mountain slopes at an altitude ranging between 520-670 m enjoying a predominant southern exposure, a slope 25-30⁰, on rocks of marble, sandstones, and volcanic tuffs. The soils on which these forests grow are partly skeletal, districambosol, clayey-loamy, neutrophilic-acid, oligobasic, poor in humus and mineral substances.

Turkey oak and Sessile oak mixed stand surveyed is termophil, xerophilous, and specific to the forest steppe of the Northwest Plain of Romania from where it migrated during phyto-historical times towards the Meseș Mountains, forming forest stand islands on the hills and southern slopes.

Research works on Turkey oak (*Quercus cerris*) and Sessile oak (*Quercus petraea*) mixed stands in the Meseş Mountains have not been made before except for Balász Ferenc (1941) who, together with Professor R. Soó, performed four hikes, totalling 13 days of observations, when they have compiled a list of species encountered, including a forest stand of *Quercetum cerris* (sub-spontaneous) above the settlement of Treznea.

Regarding the neighbouring territories, research on the Turkey oak and Sessile oak mixed forests was carried out by Marian (2008) at Culmea Codrului peak, Karácsony (2011) in the Tășnad Hills, Coldea (1972) in the Plopiș Mountains, Burescu and Doniță (2003) in Pădurea Craiului Mountains, Chifu T. Irimia, I., Zamfirescu, O. (2014) in Moldova, and Sanda et al. (2007-2008).

MATERIAL AND METHOD

The research area surveyed consists of the following forest compartments (u.a): Ua 10A, Ua 28B, Ua 29A, Ua 29B within the Management Unit (U.P.) IV, Greabăn, Almaș Forest District, and Ua 45, Management Unit VI Treznea, Zalău Forest District. The research material consists of the natural forest-ecosystems of the Balkan-Pannonian mixed forests of Sessile oak (*Quercus petraea*), Turkey oak (*Quercus cerris*), European beech (*Fagus sylvatica*) and *Melettis melssophyllum*, which is natural habitat of community interest Natura 2000:91MO, code R4132 (Doniță et al., 2005).

For the forest stands surveyed the floral inventory was carried out, and the identified species were recorded in the association table with the ranking of the abundance-dominance after the Braun-Blanquet scale (1964). The phytocoenoses of the association *Quercetum petraeae-cerris* were analyzed and characterized phytocenologically, ecologically and cytogenetically based on histograms of bioform distribution, phytogeographical elements distribution, gene karytype distribution, and on the basis of ecoforms distribution diagram (ecological indices).

The classification of species by categories of bioforms was made after the Raunkiaer system (1937), improved by J. Braun-Blanquet (1964). The classification of plants in categories of phytogeographical elements (geoelements) was made after the classification of Meusel et Jäger (1992).

The analysis of the composition of Turkey oak and Sessile oak mixed stands in terms of ecological categories (ecological indices) with reference to humidity (H), temperature (T), chemical reaction of the soil (R) was made after the works of Csürös et al. (1967), Beldie, Chiriță (1967), Sanda et al. (1983, 2003), and Ellenberg (1979) who adopted the ecological indices values of Central Europe to pedo-climatic conditions of Romania.

RESULTS AND DISCUSSION

The floristic inventory of Turkey oak and Sessile oak mixed forests (see Table 1 below) the association *Quercetum petraeae-cerris* includes 54 species aged 80-100 years, which entails a high biodiversity of Turkey oak and Sessile oak mixed forests ecosystems of which seven species are characteristic for *Quercion petraeae*, nine species belong to *Fraxino orni-Cotinetalia*, and nine species are characteristic for the order *Quercetea pubescenti-petraeae* orders.

Place and date of surveying: Forest compartment (Ua) 28B, Management unit (U.P.) IV, Greabăn, Almaş Forest District (O.S), 24.08.2018; Forest compartment (Ua) 29 A, Management unit (U.P.) IV, Greabăn, Almaş Forest District (O.S), 24.08.2018; Forest compartment (Ua) 29 B Management unit (U.P.) IV, Greabăn, Almaş Forest District (O.S), 24.08.2018; Forest compartment (Ua) 10 A, Management unit (U.P.) IV, Greabăn, Almaş Forest District (O.S), 06.09.2018: Forest compartment (Ua) 45, Management unit (U.P.) VI, Treznea, Zalău Forest District (O.S), 19.04.2013.

Table 1

Floristic inventory of Turkey oak and Sessile oak mixed forests

Bio.	Phyt. EL	UTR	2n	Survey no.	1	2	3	4	5	K	ADm		
				Forest compartment	28 B	29 A	29 B	10 A	45				
				Altitude (m)	680	620	670	550	420				
				Exposition	S	SV	S	NV	NE				
				Slope (°)	25	30	23	20	30				
				Tree height (m)	24	22	22	16	26				
				Tree diameter (cm)	34	32	30	20	50				
				Crown density	0.7	0.8	0.7	0.8	0.8				
				Herb layer coverage (%)	50	70	70-80	70	70				
				Surface (ha)	11.21	17.75	4.65	25	21				
MPh	E	2.5	3	0	D	<i>As. Quercus petraea</i>	4	4	4	3	V	57.5	
MPh	M	2	3.5	3	D	<i>As. Quercus cerris</i>	2	2	1	2	V	12.5	
Quercion petraeae													
H	Eua	3	3	0	P	<i>Trifolium medium</i>	+	+	•	+	+	IV	0.4
H	E (C)	2.5	3	3	D	<i>Vicia casubica</i>	+	+	+	•	•	III	0.3
H	Eua	2	3	4	D	<i>Verbascum nigrum</i>	•	+	•	+	•	II	2.2
G	M	3	3.5	4	P	<i>Taumus comunis</i>	•	+	•	+	+	III	0.3
mPh	P-M	2	3.5	4	D,P	<i>Cornus mas</i>	•	•	+	+	+	III	0.3
H	E	2,5	3	4	D	<i>Trifolium alpestre</i>	+	•	•	•	•	I	0.1
H	Ec-M	2.5	3.5	5	D	<i>Calamintha menthifolia</i>	•	•	•	+	•	I	0.1
Fraxino orni-Cotinetalia													
H	Cp	3	3	0	P	<i>Poa nemoralis</i>	2	1	1	1	+	IV	6.6
Th	Eua	2.5	2.5	3	P	<i>Tanacetum corymbosum</i>	+	+	+	+	•	IV	0.4
H	E	2.5	3	5	CN	<i>Melittis melissophyllum</i>	+	+	+	+	+	V	0.5
H	Eua	3	2.5	0	D	<i>Fragaria viridis</i>	•	+	+	+	+	IV	0.4
H	Eua	3	3	0	D	<i>Stachys officinalis</i>	•	+	+	+	•	III	0.3
nPh	Ec	2.5	3.5	2	P	<i>Cytisus nigricans</i>	•	+	+	•	•	II	0.2
nPh	E	2	3	3	P	<i>Rosa canina</i>	•	•	+	+	•	II	0.2
H	E	1.5	3	3.5	P	<i>Hieracium bauninii</i>	•	+	•	•	+	II	0.2
G	Ec	3	3	3	P	<i>Symphytum tuberosum</i>	•	+	•	•	•	I	0.1
Quercetea pubescenti-petraeae													
Ch	E	2.5	3	3	P	<i>Genista tinctoria (G. ovata)</i>	+	+	+	+	+	V	0.5
Th-H	B-Pan	1.5	4	4.5	P	<i>Digitalis lanata</i>	+	+	+	+	•	IV	0.4
H	Eua	3	3	0	D	<i>Campanula persicifolia</i>	+	+	+	+	•	IV	0.4
H	Ec	2.5	3	3	D	<i>Lathyrus niger</i>	+	+	+	+	•	IV	0.4

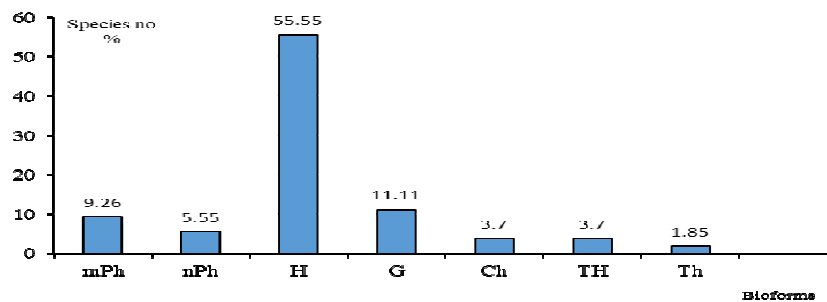
H	Ec-M	2.5	3	4	D	<i>Melica uniflora</i>	1	+	+	+	•	III	0.3
H	Cp	2.5	3	3	D	<i>Clinopodium vulgare</i>	+	•	+	+	•	III	0.3
TH-H	M	3	0	3	D	<i>Silene italica</i>	+	•	+	+	+	IV	0.4
H	E (M)	2	4	4	D	<i>Vincetoxicum hirundinaria</i>	+	•	•	+	•	II	0.2
H	Alp-Carp-B	2.5	3	4	P	<i>Achillea distans</i>	+	•	•	+	•	II	0.2
Quercus-Fagetea													
MPh	E	3	3	0	D	<i>Fagus sylvatica</i>	+	2	1	1	2	V	9.1
H	Ec	2.5	2.5	2	D	<i>Luzula luzuloides</i>	1	2	3	3	•	IV	19.5
G	Ec	2.5	3	3	P	<i>Carex pilosa</i>	2	1	2	2	+	IV	11.6
G-H	E-M	4	2	3	D	<i>Festuca drymeja</i>	1	3	2	1	•	IV	13
G	Ec	2.5	3	3	P	<i>Galium schultesii</i>	+	+	1	+	•	IV	1.3
mPh	E-Balc	3	3	4.5	D	<i>Corylus avellana</i>	+	+	+	+	+	IV	0.5
H	Ec	2.5	3	3	D	<i>Dactylis polygama</i>	+	+	+	+	•	IV	0.4
H	E	2	3	2	D,P	<i>Hieracium sabaudum</i>	+	•	+	+	•	III	0.3
H	Eua	3	3	3	D	<i>Stellaria holostea</i>	+	+	•	+	•	III	0.3
mPh	Eua	2.5	3.5	3	D	<i>Crataegus monogyna</i>	+	•	+	+	•	III	0.3
H	Ec	3	2.5	3.5	D	<i>Aposeris foetida</i>	+	+	+	•	+	IV	0.4
MPh	E	3	3	3	P	<i>Carpinus betulus</i>	+	•	+	2	2	IV	9
H	Eua (C)	2	3	2	P	<i>Calamagrostis arundinacea</i>	+	•	•	+	•	II	0.2
nPh	E	3	2.5	2	P	<i>Rubus hirtus</i>	•	+	•	•	•	II	0.2
MPh	Ec-M	3	3	3	D,P	<i>Prunus avium</i>	+	•	•	•	+	II	0.2
H	Eua	3	3	3	D	<i>Lathyrus vernus</i>	+	•	•	•	•	I	0.1
G	Eua-M	3	3	0	P	<i>Galium odoratum</i>	+	•	•	•	+	II	0.2
mPh	Eua	3.5	3	3	D	<i>Daphne mezereum</i>	•	+	•	•	•	I	0.1
H	Cp	2.5	3	0	D,P	<i>Hieracium umbellatum</i>	+	•	•	•	•	I	0.1
H-Ch	Ec	3	0	4	P	<i>Lamium galeobdolon</i>	•	+	•	•	+	II	0.2
Ch	Eua	2	2	2	D,P	<i>Veronica officinalis</i>	•	+	•	•	•	I	0.1
H	E	3.5	3	3	D	<i>Pulmonaria officinalis</i>	•	+	•	•	+	II	0.2
H	M	3	3	4	P	<i>Geum urbanum</i>	•	+	•	•	•	I	0.1
Variae syntaxa													
H	Cp	2.5	2	3	D	<i>Solidago virgaurea</i>	+	+	+	+	•	IV	0.4
mPh	E (n)	3	3	3	P	<i>Sambucus nigra</i>	+	+	•	•	+	III	0.3
H	Eua	2.5	3	4	D	<i>Campanula glomerata</i>	+	•	•	•	•	I	0.1
H	Eua	3	3	0	P	<i>Hypericum perforatum</i>	•	•	•	+	•	I	0.1

The tree layer consists of *Quercus petraea* (ADm = 57.5%), (K max. = V), *Quercus cerris* (ADm = 9 %), (K max = V) in the codominance ratio, accompanied by *Fagus sylvatica*, *Carpinus Betullus*, *Prunus avium*. The crowning of the trees is 0.7-0.8, the trunk diameters ranges between 30-50 cm and the heights thereof reach 16-24 m.

The layer of less developed shrubs consists of specimens of *Corylus avellana*, *Crataegus monogyna*, *Sambucus nigra*, *Daphne mezereum*, *Rosa canina*. The herb layer with a 70% overall coverage is subordinated to the alliance **Quercion petraeae**: *Trifolium medium*, *Tamus communis*, *Verbascum nigrum*, order **Fraxino orni-Cotinetalia**: *Poa nemoralis*, *Melittis melissophyllum*, *Tanacetum corymbosum*, *Fragaria viridis*, *Stachys officinalis*, *Cytisus nigricans* and class **Quercetea pubescenti-petraeae**: *Genista tinctoria* ssp. *ovata*, *Digitalis lanata*, *Campanula persicifolia*, *Lathyrus niger*, *Clinopodium vulgare*, *Silene italica*. Several transgressive species belonging to the class **Quercus-Fagetea**: *Fagus sylvatica*, *Luzula luzuloides*, *Carex pilosa*, *Festuca drymeja*, *Galium schultesii*, *Dactylis polygama*, *Stellaria holostea*, *Aposeris foetida*, *Hieracium sabaudum* entered this association.

The presence in the floral composition of a large number of species characteristic to the classes *Quercus pubescenti-petraeae* and *Quercus-Fagetea* shows the thermophilic and xeromesophilic nature of the association.

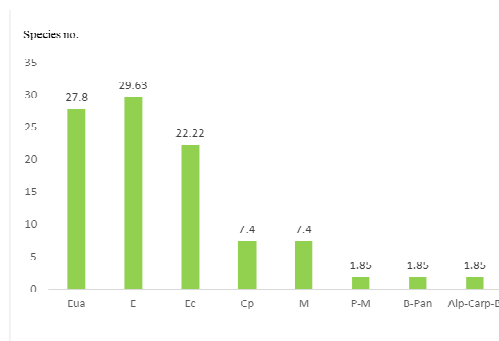
The analysis of phytocoenoses of the association *Quercetum petraeae-cerris* shows that hemicryptophytes (55.5 %) predominate in the spectrum of bioforms (55.5 %), followed by phanerophytes i.e. 24.07 % (Mph = 9.26%, mPh = 9.26 %, nPh = 5.55 %), geophytes (11.11 %), as the most environmentally friendly ecological forms to a temperate-continental climate habitat.



Legend: Ph= phanerophytes; MPh= megaphanerophytes; mPh= mesophanerophytes; H= hemicryptophytes; G= geophytes; T= therophytes; TH= biennial therophytes; Th= annual therophytes.

Fig 1 Analysis of phytocoenoses of the association *Quercetum petraeae-cerris*

In the spectrum of the phytogeographical elements (Fig 2), the prevalent species are the European (29.63 %), followed by the Eurasian (27.77 %), the Central European (22.2 %) and the circumpolar ones (7.40 %).

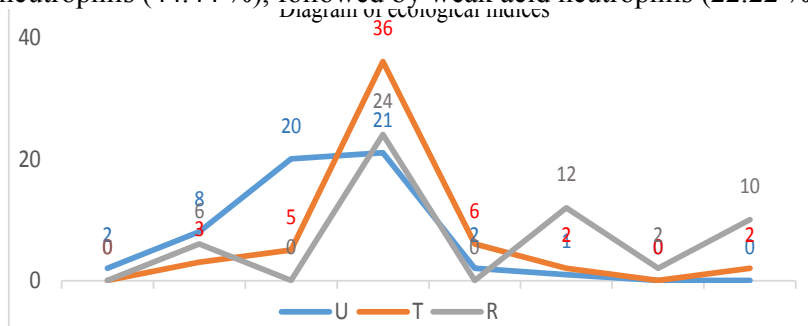


Legend: Eua = Eurasian; E= European; Ec = Central European; Cp= circumpolar; M = Mediterranean; P-M = Pontic Mediterranean; B-Pan = Balkan-Pontic; Alp-Carp-B = Alpine-Carpathian-Balkan.

Fig. 2 Spectrum of Phytogeographical elements

Southern species: Mediterranean (7.40 %), Pontic (1.85 %), Balkan (1.85 %) totals 11.10% as an expression of their cantonation in gentle microclimate environment, which is similar to that of the shores of the Mediterranean Sea.

The diagram of the ecological indices (see Chart no. 3 below) shows that the phytocoenoses of the association *Quercetum petraeae-cerris* have a xeromesophilic (51.84 %), to slightly mesophilic (42.58 %) behaviour, and a mesothermal (77.77 %) behaviour in terms of temperature. Soil chemical reaction (see Chart no. 3 below) favours the development of acid neutrophils (44.44 %), followed by weak acid neutrophils (22.22 %).



Legend: **H= humidity** ; H1.5= xerophiles; H2-2.5 =xeromesophiles ; H3-3.5 = mesophiles; H4-4.5= mesohygrophiles; H5 = hygrophiles. T2-2.5= microthermal species; T3-3.5 = mesothermal species; T4= mesothermal species; T0= eurythermal species. R2= acidophyles; R3= acido-neutrophils; R4= weak acid-neutrophils; R5= neutro-basophils; R0= euryionic species.

Fig. 3 Diagram of ecological indices

The distribution of genetic categories by karytype (see the Chart no. 4 below) reveals the dominance of the diploid species (50 %) which have the gene stock required for evolution, followed by polyploids (38.88 %), which possess valuable genes that benefit them in colonizing the land and adapting to the environmental conditions of the habitat.

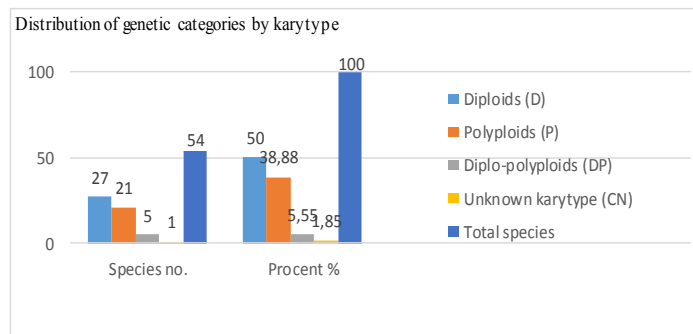


Fig. 4 Diagram of genetic categories by karytype

ECONOMIC RELEVANCE

Turkey oak and Sessile oak mixed forests are included in a natural forest ecosystem of community interest which requires preservation: Habitat 91 MO, code R4132-, Pannonian-Balkan Sessile oak (*Quercus petraea*) and Turkey oak (*Quercus cerris*), European beech (*Fagus sylvatica*) with *Melittis melissophyllum* entailing a high conservative value.

Turkey oak and Sessile oak forest stand has important role in controlling soil erosion, hydrographic basin protection and geographical climate regulation.

Although important for the wood industry, cutting should be avoided in the case of these forests because it could affect the already fragile balance of the ecosystem located within a very important habitat.

CONCLUSIONS

1. A total of 54 species were identified in a naturally endangered ecosystem of community interest, which means a relatively rich biodiversity.
2. The analysis of the bioforms reveals the dominance of the hemicryptophytes (55.5 %) as an expression of a temperate continental climate in the Meseş Mountains, accompanied by phanerophytes (24.07 %) which instils the physiognomy of the Turkey oak and Sessile oak mixed forest ecosystem.
3. As regards the genetic centre of origin and the current geographic area, the European species (29.63 %), followed by the Eurasian ones (27.77 %) and the Central European ones (22.22 %) are dominant. A lower numerical share is held by thermophilic species of Mediterranean origin reaching 11.10 %.
4. The ecological factors (humidity, temperature, chemical reaction of the soil) entail a xeromezophilic (51.84 %), mesothermal (77.7 %), acid-neutrophilic (44.44 %) to weak-acid neutrophilic (22.22 %) nature to these forests.
5. Cytogenetic analysis by karyotype reveals the dominance of diploid species (50 %), followed by polyploids (38.88 %).

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