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Phytosociological research on maquis and steppe vegetation of Başkonuş Mountain (Kahramanmaraş – Turkey)

ÖMER VAROL

Muğla Üniversity Science and Arts, Faculty Department of Biology, 4800 Muğla, Turkey, e-mail: ofvarol61@hotmail.com

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ABSTRACT: The maquis and steppe vegetation of Başkonuş Mountain which is a national park in east-Mediterranean region (Kahramanmaraş) was investigated between 1998 and 1999. From the phytogeographical point of view, study area is close to the transitional area which is between the Mediterranean and Irano-Turanian phytogeographic regions, and it is on the Anatolian diagonal. The vegetation of the study area was analyzed according to the BRAUN-BLANQUET method, and the plant associations were classified by considering characteristic species. The names of the two new associations are given: *Centaureo cheirolophae - Arbutetum unedonis* (*Quercetea ilicis*) and *Scutellario santolinoidis - Astragaletum angustifolii* (*Astragalo-Brometea*).

KEYWORDS: Mediterranean, Kahramanmaraş, phytosociology, syntaxonomy, Turkey, vegetation.

Introduction

Başkonuş Mountain, selected as the study area, is located on east-Mediterranean region (east-Taurus). Phytogeographically, it falls between the Mediterranean and Irano-Turanian floristic regions. The region has been choosen as a field because of the following: a) the study area is a national park, b) neither is there are a floristic nor a phytosociological studies in this area, c) this region is close to the transitional area which is between the Mediterranean

and Irano-Turanian phytogeographic regions, and it is on the Anatolian Diagonal (DAVIS et al. 1971).

Materials and methods

The vegetational studies have been carried out according to the BRAUN-BLANQUET's method (BRAUN-BLANQUET 1932). In this study, the climatic data of Kahramanmaraş Meteorological station were used for obtaining detailed climatic knowledge (DMİ 1974, 1984). The prevailing climate in the area is less rainy and winter mild variants of the Mediterranean climate (AKMAN 1982). Rainfall is least in Summer, the precipitation regime is therefore, "Winter-Spring-Autumn-Summer". The climatic data are given in table 1a and 1b.

For the determination of the plant associations, the sample plots have been taken from each plant formation, in sufficient number and in suitable size. Thus, the floristic compositions of the associations, dominancy and constancy of the species have been determined. In total, 20 sample plots were taken, and 2 plant associations were distinguished by the analyses of these plots. In order to compare associations, we used SÖRENSEN's (1948) index of similarity. Some soil samples were taken from various sample plots representing the different plant associations. These soil samples were analyzed by the Soil and Fertilizer Research Institute. The results of the soil analyses are shown in table 2 in order to give comparative details about the soils where the plant associations have developed. The distributions of the associations in the investigation area, and their brief ecologies are given under the title of vegetation. Before, there is no a phytosociological study in the area. However, there are some studies carried out by the other researches in the other areas which are near to our study area. Those are the studies of AKMAN (1973) and QUÉZEL (1973) on Amanus Mountains; of YURDAKULOL (1981) in Pos forests, of DUMAN (1995) in Engizek Mountain and of VAROL and TATLI (2001) in Çimen Mountain. The vegetation of the study area is evaluated by considering all the studies which were carried out in this floristic region, as follows: USLU (1977), KETONOĞLU et al. (1992), KILINÇ et al. (1992) and ÖZEN et KILINÇ (1995).

Brief description of the area

Başkonuş Mountain (national park), the study area selected, is located in the south-western part of Kahramanmaraş. It is in square C6 according to the grid system of DAVIS (1965). It is surrounded by the Sır dam and Ceyhan river in the south, Andırın district in the west, and Kahramanmaraş city in the south-east. The highest point of research area is Başkonuş hill (1775 m) (Fig. 1). This region is a national park and it is used to as generation field of *Cervus elaphus* (red deer).

Tab. 1a. The avarage and extreme climatic values of K.Maraş in the period from 1931 to 1995.

Meteorological elements	Observation periods (years)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Mean temperature (°C)	64	4.3	6.1	10.4	14.9	19.9	24.7	27.8	27.8	24.8	19.0	12.0	6.5	16.5
Max. mean temperature (°C)	64	9.2	10.5	15.3	20.8	26.4	32.0	35.3	35.9	32.0	26.6	18.7	10.9	22.8
Min. mean. temperature (°C)	64	1.2	2.4	5.2	9.1	13.4	18.0	20.6	20.4	17.5	12.1	7.1	3.9	10.8
Total rainfall (mm)	64	133.1	110.1	90.4	68.7	35.0	7.0	0.9	1.2	4.8	31.7	60.1	119.4	662.2
Mean rel. humidity (%)	13	72	73	64	57	56	48	49	48	45	52	62	74	58

Tab. 1b. Seasonal distribution of rainfall in K. Maraş (observation period 64 years).

Season	mm	%
Spring	194.1	29.4
Summer	9.1	1.3
Autumm	96.6	14.5
Winter	362.7	54.7
Annual	662.2	100

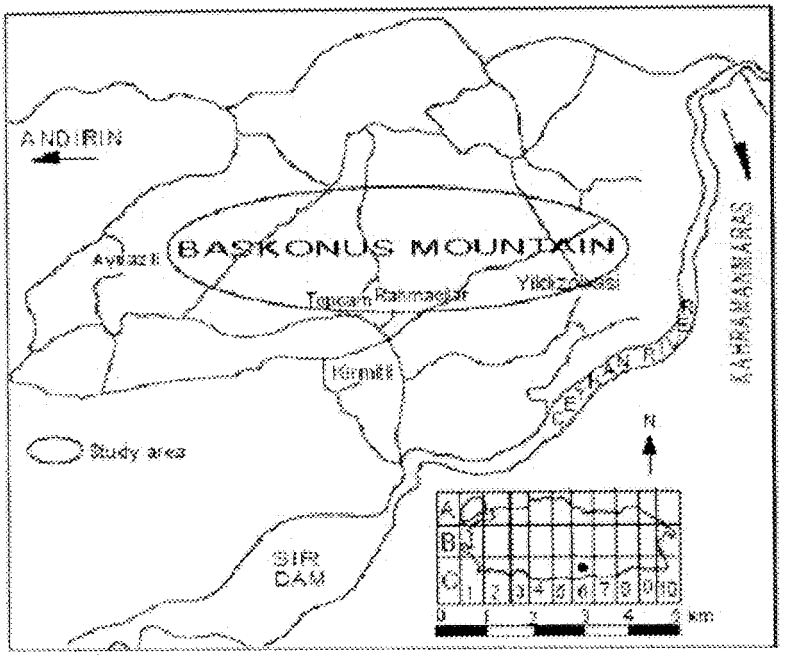

Figure 1. Location of the studied area.

Vegetation

The maqıus and steppe vegetation of Başkonuş Mountain belongs to both Eu-Mediterranean belt and Supra-Mediterranean belt. The highest point of this area is Başkonuş hill (1775 m).

Associations

Study area is close to the transitional area which is between the Mediterranean and Irano-Turanian phytogeographic regions, and it is on the Anatolian Diagonal (DAVIS et al. 1971). In the research area forest vegetation has degraded, and maquis and steppe vegetation replaced it.

A. Maquis

***Centaureo cheirolophae-Arbutetum unedonis* VAROL ass. nova hoc loco (Tab. 3)**

This association in the study area has most widespread around Yıldızobası (Bočkluca) village. The soils of the association have a slightly acidic character in 0-3 and 3-30 cm depth. Organic material quantity in the soil, which is clayey-loamy, is quite rich in horizon A. The association consists of 2 vertical layers: (a) shrub layer - coverage 80-90%, heigth 2-2.5 m; (b) herb layer - coverage 10-20%, heigth 60-80 cm.

Characteristic species of this association are *Arbutus unedo*, *Centaurea cheirolopha*, *Allium bassitense*, *Trifolium lappacaeum*, *Trifolium lucanicum*. Characteristic species of classes *Quercetea ilicis* and *Quercetea pubescentis* are found in this association. But, characteristic species of *Quercetea (etalia) ilicis* and *Quercion ilicis* in this association are mostly existed. Therefore, this association should be considered in the alliance *Quercion ilicis* and *Quercetalia ilicis* order which belongs to the *Quercetea ilicis* class.

This association of *Centaureo cheirolophae-Arbutetum unedonis* is described by 10 relevés which were taken from Yıldızobası (Bokluca) on the 14th of June 1998.

Holotype: tab. 3, rel. 2.

B. Steppe

***Scutellario santolinoidis - Astragaletum angustifolii* ass. nova hoc loco (Tab. 4)**

This association exists in the below of Başkonuş fire tower and develops as a secondary association after the destruction of *Abies cilicica* forest. The soils of the association are clayey-loamy in texture, and have basic character (pH 7.4), organic matter is 4.0%. This association has one layer total coverage is 80-90% and height is 20 cm. All of the characteristic species of this association are Irano-Turanian element. Among of these, *Astragalus plumosus* var. *plumosus* and *Scutellaria orientalis* ssp. *santolinoides* are endemic. This association is not well represented at the level of alliance and order. But, the association is included in the class *Astragalo-Brometea*. All relevés were taken from below of Başkonuş fire tower on 25th June 1998.

Holotype: tab. 4, rel. 11.

Conclusion and comments

The associations described here have been considered within the syntaxonomy as follows:

Quercetea ilicis BR.-BL. ex A. & O. BOLÖS 1950
Quercetalia ilicis BR.-BL. ex MOLINIER 1934
Quercion ilicis BR.-BL.ex MOLINIER 1934
Centaureo cheirolophae-Arbutetum unedonis VAROL 2003
Astragalo-Brometea QUÉZEL 1973
Scutellario santolinoidis-Astragaletum angustifolii VAROL 2003

In the study area, 2 plant associations belonging to maquis and steppe vegetation types have been determined. These associations are classified and named according to the code of phytosociological nomenclature (WEBER et al. 2000). The structure and brief ecologies of the associations are mentioned in the vegetation title. This research area covers associations which take place in Eu-Mediterranean belt and Supra-Mediterranean belt. Characteristic vegetation type of Eu-Mediterranean belt is maquis. But, maquis vegetation develops generally after from degraded forests which are *Pinus brutia* forest. In the same way,

Centaureo cheirolophae-Arbutetum unedonis association in the our study area develops after the from degraded *Pinus brutia* forests. *Arbutus unedo* L. communities, which are the unique representative of maquis vegetation in the region, have been stutied quite thoroughly in Turkey by many investigators (KETENOĞLU et al. 1983, KILINÇ et al. 1992, ÖZEN et KILINÇ 1995, USLU 1977). The similarity ratio is 17-25% between the associations of the research area defined by us and those of other areas defined by others (Tab. 5). In the *Scutellario santolinoidis-Astragaletum angustifolii* association is found characteristic species of *Qercetea(etelia)-pubescentis* class and order. This result shows us that this association has developed as a secondary association after the destruction of forest vegetation. The association is not represented at the level of alliance and order. This result may be due to close to the transitional area which is between the Mediterranean and Irano-Turanian phytogeographic regions of our study area. However, this association is included in the class *Astragalo-Brometea*. After the vegetation structure of the high Mountain steppe areas in the east and south-east of Anatolia is determined, new alliances and orders can be formed.

As a result, there is a heavy continuous degradation on red pine forest in the area. Day by day, maquis vegetation increases in area. To prevent this destructive effect, the inhabitants should wake up, and the destroyed areas should be afforested again with *Pinus brutia*.

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Tab. 2 - 5 on the pages 84-88.

Tab. 2. Soil analysis of associations.

	Quadrat No.	Soil depth (cm)	Saturation (%)	Total Salt (%)	Ph in Saturated Soil	$CaCO_3$ (%)	Organic Matter (%)	Phoshourus P_2O_5 (%)	Sand (%)	Silt (%)	Clay (%)	Texture
Centaureo cheirolophae - Arbutetum unedonis	2	0-3	55	0.04	6.9	0	5.3	19.3	32.7	33.4	33.7	CL
		3-30	49	0.04	6.5	0	2.6	17.9	21.8	16.8	61.3	L
Scutellariosantolinoidis - Astragaletum angustifolii	11	0-30	61	0.04	7.4	1.1	4	18.5	30.5	34.5	34.9	CL

C: Clayey, L: Loamy, S: Sandy

Tab. 3. *Centaureo cheirolophae-Arbutetum unedonis* VAROL ass. nova, type: rel. 2.

Number of relevé	1	2	3	4	5	6	7	8	9	10	C
Size of relevé (m^2)x10	40	40	40	40	40	40	40	40	40	40	
Altitude (m)x10	67	69	70	72	68	70	73	75	75	70	
Exposure	NW	NW	NE	NE	NE	N	NE	N	NW	NW	
Inclination (°)	15	15	15	15	15	20	20	15	20	20	
Coverage of shrubs (%)	80	80	90	90	80	90	80	80	80	80	
Height of shrubs (m)	2	2.5	2.5	2	2	2	2	2.5	2.5	2.5	
Coverage of herbs (%)	20	20	100	10	20	10	20	20	20	20	
Height of herbs (cm)	60	70	70	70	70	70	70	80	70	70	
Characteristic species of association											
Arbutus unedo	22	22	33	33	22	33	22	22	22	22	V
Centaurea cheirolopha	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
Allium bassitense	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	IV
Trifolium lappaceum	+2	+1	+1	+1	.	+1	+1	+1	.	+1	IV

Number of relevé	1	2	3	4	5	6	7	8	9	10	C
Trifolium lucanicum	+1	+1	+1	+2	+1	.	.	+1	+1	.	IV
Characteristic species of *Quercion ilicis*											
Jasminum fruticans	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
Quecus coccifera	22	22	22	22	+2	+2	+2	.	+2	+2	V
Pistacia terebinthus subsp. *palaestina*	12	+2	+2	22	+2	.	+2	+2	+2	+2	V
Characteristic species of *Qercetealia ilicis*											
Ruscus aculeatus var. *angustifolius*	+1	+1	+1	.	+2	+2	+2	+1	+1	+1	V
Phyllerea latifolia	.	+2	+2	+2	.	+2	.	+2	.	+2	III
Erngium falcatum	.	+1	.	.	+1	.	.	+1	.	.	II
Cercis siliquastrum subsp. *siliquastrum*	+2	.	.	.	.	.	+2	.	+2	.	II
Characteristic species of *Quecetea ilicis*											
Juniperus oxycedrus subsp. *oxycedrus*	22	22	22	22	22	22	22	22	22	22	V
Geranium purpureum	+1	+1	+1	.	+1	+1	+1	+1	+1	.	IV
Olea auropaea	.	+2	.	+2	.	.	.	.	.	.	I
Characteristic species of *Querco-Cedretalia libani*											
Quercus cerris	+2	+2	22	.	22	22	+2	22	.	+2	IV
Veronica pectinata subsp. *glandulosa*	+1	+1	+1	+1	+1	.	+1	+1	+1	.	IV
Cerstium brachypetalum	.	.	.	+1	+1	.	.	+1	.	.	IV
Quercus infectoria subsp. *boissieri*	.	.	.	.	.	.	+2	+2	.	.	I
Milium vernale subsp. *vernale*	12	.	.	.	.	+2	.	.	.	.	I
Trifolium speciosum	.	.	.	+1	.	.	.	.	.	.	I
Dorocynium graecum	.	.	.	.	+1	.	.	.	.	.	I
Characteristic species of *Quercetea pubescentis*											
Sytrax officinalis	22	22	22	+2	22	22	22	22	22	22	V
Cotinus coggyria	22	.	+2	+2	+2	22	22	22	+2	+2	V
Silene italica	.	.	+1	.	.	+2	+2	+1	.	.	II
Geum urbanum	+1	+1	.	.	+1	.	.	.	+1	.	II

Number of relevé	1	2	3	4	5	6	7	8	9	10	C
Lapsana communis	.	.	+1	+1	.	.	.	.	.	.	I
Crepis reuterana subsp. *reuterana*	+1	.	.	.	.	.	.	+1	.	.	I
Colutea cilicica	.	.	.	.	.	+2	12	.	.	.	I
Clinopodium vulgare subsp. *arundanum*	.	+1	+1	.	.	.	.	.	.	.	I
Companions											
Torilis japonica	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
Arenaria serpyllifolia	+1	+1	+2	+1	+1	+1	+1	+1	+1	+1	V
Stipa bromoides	12	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
Eremopoa songarica	+2	+1	+2	+1	+1	+1	+1	.	+1	+1	V
Cynosurus echinatus	+1	+1	+2	+2	+1	+1	.	+1	.	+1	IV
Ziziphora capitata	+1	+1	+1	+1	.	+1	.	+1	+1	.	IV
Bromus sterilis	.	+2	.	+2	+2	+2	+2	+2	+2	.	IV
Crucianella macrostachya	+1	+1	.	+1	+1	+1	+1	+1	.	.	IV
Trifolium arvense	+1	+1	+2	+2	.	.	.	+1	+1	.	III
Hypericum lydium	+1	+1	.	.	.	+1	+1	+1	.	.	III
Phleum exaratum subsp. *exaratum*	.	.	.	+2	+1	+1	+1	+1	.	+1	III
Dactylis glomerata subsp. *hispanica*	+1	+2	.	.	.	.	+2	+2	.	.	II
Sanguisorba minor subsp. *minor*	+1	+1	.	.	+1	+1	.	.	.	.	II
Teucrium polium	+2	+2	.	+2	.	.	+2	.	.	.	II
Coronilla parviflora	.	.	+1	.	+1	+1	+1	.	.	.	II
Minuartia subtilis	+1	+1	.	+1	.	.	.		+1	.	II
Catapodium rigidum subsp. *rigidum* var. *majus*	+1	+1	+1	.	.	+1	.	.	.	.	II

Tab. 4. *Scutellario santolinoidis-Astragaletum angustifolii* VAROL ass. nova, type: rel. 11.

Number of relevé	11	12	13	14	15	16	17	18	19	20	C
Size of relevé (m^2)x10	50	50	50	50	50	50	50	50	50	50	
Altitude (m)x10	159	159	161	160	161	160	160	159	158	158	
Exposure	SW	S	SW	S	SW	S	S	S	SW	SW	
Inclination (°)	10	5	10	10	10	5	5	5	10	10	
Coverage of herbs (%)	90	90	90	90	90	90	90	90	90	90	
Height of herbs (cm)	20	20	20	20	20	20	20	20	20	20	
Characteristic species of association											
Astragalus plumosus var. *plumosus*	33	33	33	33	33	33	33	33	33	33	V
Astragalus angustifolius ssp. *angustifolius*	33	33	33	33	33	33	33	33	33	33	V
Scutellaria orientalis ssp. *santolinoides*	22	22	22	22	22	22	22	22	22	22	V
Achillea biebersteinii	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	IV
Alyssum strictum	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	IV
Stachys iberica ssp. *stenostachya*	+1	+1	+1	+1	.	+1	+1	.	+1	+1	III
Characteristic species of *Astragalo-Brometea*											
Teucrium polium	12	22	12	12	12	12	12	22	12	12	IV
Myosotis alpestris	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
Characteristic species of *Quercetea pubescentis*											
Cerastium brachypetalum ssp. *roeseri*	12	12	12	12	12	12	12	12	12	12	V
Cnidium silaifolium ssp. *orientale*	.	.	.	+1	+1	.	+1	+1	.	.	II
Astragalus schizopterus	.	.	.	.	+1	+1	.	.	.	+1	II
Companions											
Trifolium arvense	12	12	12	+2	+2	+2	+2	12	12	12	V
Bromus arvensis	12	12	12	12	12	12	12	12	12	12	V
Helloborus vesicarius	+2	12	+2	.	12	12	+2	.	+2	+2	IV
Crepis sancta	+1	+1	.	+1	+1	+1	.	+1	+1	+1	IV
Anthemis cretica ssp. *pontica*	+2	12	+2	.	12	.	12	+2	+2	12	IV

Number of relevé	11	12	13	14	15	16	17	18	19	20	C
Thlaspi densiflorum	+1	+1	.	+1	+1	+1	.	+1	+1	+1	IV
Legousia speculum-veneris	+1	+1	.	+1	+1	+1	+1	.	+1	+1	IV
Asperula arvensis	.	11	12	12	12	.	11	11	12	12	IV
Scorzonera cana ssp. *radicosa*	.	+1	+1	+1	.	+1	+1	+1	.	.	III
Potentilla detommasii	+1	.	+1	.	+1	.	+1	.	.	1	III
Paracaryum reuteri	+1	+1	.	.	+1	+1	.	+1	.	.	III
Pilosella piloselloides ssp. *megalomastix*	.	.	+2	.	+2	.	.	.	+2	+2	II
Ziziphora capitata	.	+1	.	+1	.	+1	+1	.	.	.	II
Arenaria serpyllifolia	.	+1	.	+1	.	.	.	+1	+1	.	II
Logfia arvensis	11	.	+1	.	.	11	.	.	.	+1	II
Allium scorodoprasum ssp. *rotundum*	.	.	+1	+1	.	.	+1	+1	.	.	II
Minuartia multinervis	12	.	12	.	.	12	.	.	12	.	II
Medicago minima var. *minima*	+1	+1	.	.	.	.	+1	+1	.	.	II
Scleranthus annuus ssp. *annuus*	.	.	+1	+1	.	+1	.	.	+1	.	II

Tab. 5. Comparison of the floristic similarity of the associations described in other studies in different areas with *Arbutus unedo* association described in our study area.

Study area	% Similarity ratio
Mersin and Silifke Uslu (1977)	25.58
West-Black Sea Region (KETENOĞLU et al. 1983)	15.67
Seashore of Black Sea Region (KILINÇ et al. 1992)	11.71
Alaçam-Gerze and Boyabat-Durağan (ÖZEN & KILINÇ 1995)	17.39