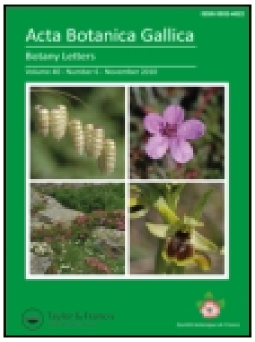

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A synecological and syntaxonomical research of the secondary vegetation caused by overgrazing on Arat Mountain (Şanlıurfa, Turkey)

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Abstract.- Prolonged intervention of forest in Anatolia settled for thousands of years caused to broaden the boundaries of anthropogenic steppe vegetations. This research was carried out for the synecological and syntaxonomical investigation of this vegetation on Arat Mountain. The research area is located in the western part of the Southeastern Anatolia, located between the outer edges of the southeastern arc of Taurus Mountains and Turkey-Syria border, which is notable with a wide plateau view, generally appeals with simple and plain geomorphologic features. The plateau consisting of dish basin integrated with domed mountains and hills of medium height gradually descend from north to south and eventually meet the Mesopotamian plain. Diyarbakır basin located on eastern half of the region is surrounded by Taurus Mountains in the north and northeast side, Mardin-Midyat threshold in the south and Karacadağ volcanoes in the west sides. The vegetation of the research area was analyzed by Braun-Blanquet approach and three new steppe associations are determined.

Key words : Arat Mountain - synecology - syntaxonomy - overgrazing - Turkey.

Résumé.- L'intervention prolongée sur les forêts d'Anatolie depuis des milliers d'années a causé l'avancée des végétations anthropiques steppiques. Cette recherche synécologique et syntaxonomique a été effectuée au Mont Arat, entre les bords externes de l'arc sud-est des monts du Taurus et la frontière syrienne. La végétation a été étudiée selon la méthode de Braun-Blanquet ; trois nouveaux syntaxons sont décrits.

Mots clés : Mont Arat - synécologie - syntaxonomie - surpâturage - Turquie.

I. INTRODUCTION

Steppe vegetation is usually under the influences of arid and semi-arid variants of Mediterranean climate in Irano-Turanian phytogeographic region. Floristic structures of the steppe vegetation are very rich. Unfortunately, the floristic richness of steppes, which are also the broadest grasslands, is under pressure as they are used for grazing over their capacity. Overgrazing causes the over-diffusion of thorny and bitter species like *Acantholimon* Boiss., *Astragalus* L., *Verbascum* L. and *Euphorbia* L., and decline and even disappearance of other rare steppe species in these areas. Due to such senseless overgrazing, rare steppe areas are lost, and there will be no area left suitable for grazing the cattle and sheep or goats.

Southeastern Anatolia steppes usually extend in areas lower than 1000 m. Steppes in Turkey are a continuation of the Eurasiatic steppes which are dominated by plants shorter than 50 cm. The dominant species in the steppes in Southeastern Anatolia are some species of Fabaceae, Asteraceae and Poaceae families. Low plateaus and lowlands in Southeastern Anatolia are completely excluded form forest regime and have the characteristics of « natural lowland steppes ».

Southeastern Anatolian region has characteristics that are specific to itself in terms of phytogeography and flora. A large part of the region is covered by the steppe vegetation of Irano-Turanian origin. 36% of Southeastern Anatolian region flora are Irano-Turanian elements, 32% of it are Mediterranean elements, 2-3% are Eurosiberian elements and the rest of it is covered by the elements of which the origin are unknown (Saya & Ertekin, 1998).

Information on the characteristics of steppe vegetation of the Southeastern Anatolia consists of superficial knowledge obtained depending on physiognomy in general. Knowledge on the synecology and syntaxonomy of the Southeastern Anatolia is far from being sufficient. There are only two studies conducted in this region (Tel, 2001; Kaya, 2006).

According to Zohary (1973), Arat Mountain exists in Mesopotamian sector of Irano-Turanian. It is within the C7 square in Grid System which was created according to latitudes and longitudes in the Flora of Turkey (Davis, 1965-1985).

II. MATERIALS AND METHODS

A. Methods

The climate of the research area is evaluated by the data of Birecik Meteorology Station (Anonymous, 2001). The bioclimate of the research area was determined by Akman & Daget (1971). Ombrothermic climate (precipitation-temperature) diagram is drawn according to the Gaussen method (Bagnouls & Gaussen, 1953). The soil samples were analyzed by the Soil-Water Researches and Agricultural Research Institute (Şanlıurfa) according to Page *et al*. (1982).

In the process of identifying the plant species, we refer to fundamentally *Flora of Turkey and East Aegean Islands* (Davis, 1965-1985; Davis *et al*., 1988; Güner *et al*., 2000) and a survey (Akan *et al*., 2005). In this research, Braun-Blanquet (1965) « floristic unite system » and Frey & Lösch (1998) detailed « abundance-cover » scale were used. According to this scale, r = 1 individual (also rare outside the relevé, small plant), + = 2-5 (small) individuals, cover < 5%, 1 = 6-50 individuals, cover < 5% or few larger individuals (often given as 1-5) with a cover up to 5%, 1m = many individuals (> 50), cover < 5%, 2a

= cover 5-12.4%, 2b = cover 12.5-25%, 3 = cover 25-50%, 4 = cover 50-75%, 5 = cover 75-100%. The ecological data were placed at the top of each relevé forming phytosociological tables.

The size of relevés was determined as 50 m^2 for steppe vegetation by using minimal area method. Evaluations of the syntaxa which belong to steppe vegetation were classified by relying on Quézel (1973) and Akman *et al*. (1985). International Code of Phytosociological Nomenclature principles were followed for naming the new syntaxa (Weber *et al*., 2000).

B. Brief definition of the research area

The research was conducted in the Şanlıurfa province of Southeastern Anatolia. The research area is located between in 73 and 76 km of Şanlıurfa-Birecik road, which is in 15 km east of Birecik district. The research area consists of two 870 m in the south and 920 m in the north high hills and a dry stream bed which separates these hills. There are Arat village in the eastern entry of Arat Mountain, Günışığı (Namazlı) village in the northeast, Yukarı Almaşar village in the northwest and Güllü and Bulutlu villages in the west.

The northeast of Arat Mountain opens to Bozova lowlands. When looked from Suruç, Arat Mountain looks like a continuation of Suruç lowlands; but observed from Birecik, it can be seen that it is a high mountain consisting of very sloped hillsides. Birecik-Suruç macadamized road climbs this mountain starting from the river Euphrates. It has a twisted structure, with soft, tufaceous, white-dark limestone shares. A newly deflowered share looks like Eskişehir meerschaum. Locals call it « crow's soap ». Actually these stones foam when rubbed in hand with water. It is an easily-processable stone. It disintegrates on its own with external impact and consists of Neogene era limestones. In some areas the layers are horizontal. Under these layers, limestone rocks from Eocene era are in discordance (Bengisu, 1968) (Fig. 1).

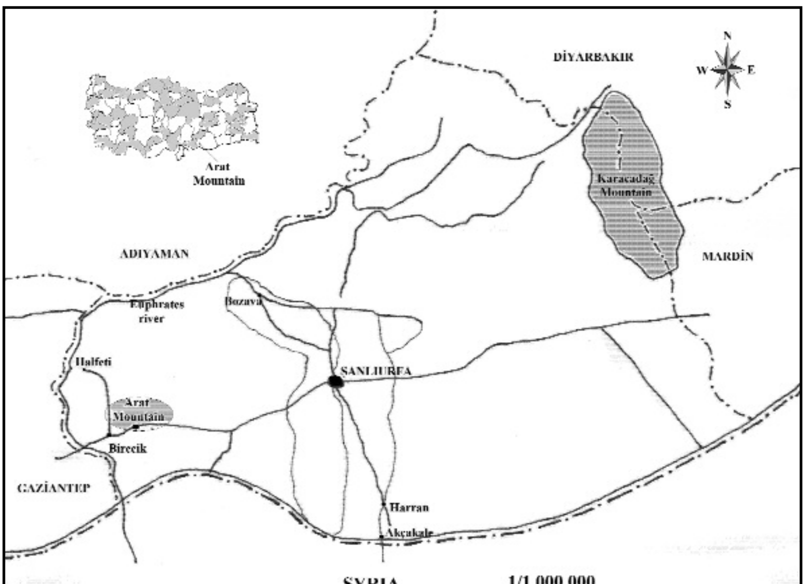

Fig. 1.- Geographical map of the research area (●).

Fig.1.- Carte géographique de la zone étudiée.

III. RESULTS: VEGETATION OF THE RESEARCH AREA

A. Syntaxonomical classification of steppe vegetation of the research area

Hyperico retusi – Gundelietum armatae ass. nov. (Table I)
Holotypus: relevé 8, 685 m, cover 70%, 50 m^2, Lat: 37º 03′ 19″ N, Lon: 038º 07′ 39″ E

This association was identified in the north slope of the south hill (870 m) of the research area and it occupies an altitudinal range of 675-690 m. *Gundelia tournefortii* var. *armata* determines the physiognomy of the association. The other characteristic species of the association is *Hypericum retusum* . The general coverage ranges between 60% and 70%. *Gundelia tournefortii* var. *armata* is an Irano-Turanian element distributed in Turkey (Inner and South Anatolia), Transcaucasica, Cyprus, W. Syria, Syrian Desert, N. Iraq and Iran (except S.). The association spreads on limestone bedrock. The reaction of its soil is slightly alkaline (pH 8.0). It has a soil structure with medium organic matter (2.2-3.4%). The saturation is 61-67%. Texture classes of the soil are loamy (45.4%) and clay (46.6%). When this association is compared with *Sileno capitellatae-Gundelietum tournefortii* identified by Duman (1995) in Engizek Mountain in terms of Sørensen (1948) similarity index, it has a low similarity ratio such as 12%. Therefore, the association is new for science.

Minuartio formosae – Astragaletum diphtheritae ass. nov. (Table II)
Holotypus: relevé 14, 720 m, cover 75%, 50 m^2, Lat: 37º 03′ 18″ N, Lon: 038º 07′ 39″ E

This association resembles the *Hyperico retusi-Gundelietum armatae* as regards habitat. It spreads on limestone bedrock between the altitudes of 690-720 m in the research area. The general coverage ranges between 60% and 75%. The characteristic species of the association are *Astragalus diphtherites* var. *diphtherites*, *Minuartia formosa* and *Argyrolobium crotalarioides*. The reaction of its soil is slightly alkaline (pH 8.1). It has a soil structure with poor organic matter (1.4-2.2%). The saturation is 61-64%. Texture classes of the soil are loamy (41.4%) and clay (48.6%). The physiognomy is dominated by *Astragalus diphtherites* var. *diphtherites*. This species is an Irano-Turanian element mostly diffused in Eastern Anatolia in Turkey. The species is also found in Northern Iraq, Lebanon and Palestine at 400-1100 m height. No similarity of this association with any others introduced before has ever been found. Therefore, this association is new for science.

Astragalo emarginati – Asphodelinetum brevicaulis ass. nov. (Table III)
Holotypus: relevé 24, 720 m, cover 75%, 50 m^2, Lat: 37º 03′ 24″ N, Lon: 038º 07′ 33″ E

This association was identified in the south slope of the north hill (920 m) of the research area. It spreads on limestone bedrock and at the altitudes 680 to 790 m. The general coverage changes between 70% and 80%. The reaction of its soil is slightly alkaline (pH 8.0-8.1). It has a soil structure with poor organic matter (1.5-2.3%). The saturation is 48-63%. Texture classes of the soil are clay-loamy (41.4%), silt-loamy (37.4) and clay-loamy (36.6%). *Asphodeline brevicaulis* subsp. *brevicaulis* var. *brevicaulis*, which is the characteristic species of the association, has spread mainly West and South Anatolia in Turkey. It spreads in Palestine, Syria, N. Iraq and Iran on the world. It is an East Mediterranean element and prefers s.l. 1-1300 m. Plants from open sunny habitats sometimes have paler perianth segments than those from shady places. The other characteristic species are *Astragalus emarginatus* and *A. russelii*. No similarity of this association with any others introduced before has ever been found. Therefore, this association is new for science.

Table I, Tableau I.- *Hyperico retusi – Gundelietum armatae ass. nov.*

	N° rel.	1	2	3	4	5	6	7	8	9	10	Presence
	Size of plot (m²)	50	50	50	50	50	50	50	50	50	50	
	Parent rock	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	
	Inclination (°)	10	10	15	10	15	10	5	10	10	10	
	Altitude (m)	680	680	690	690	680	680	690	685	680	680	
	Exposition	N	N	N	N	N	N	N	N	N	N	
	Coverage (%)	70	65	70	70	70	60	70	70	70	70	
LF												
	Differential and characteristic species											
H	*Gundelia tournefortii* var. *armata*	4	4	4	3	4	3	4	4	3	4	V
H	*Hypericum retusum*	1			1	1		1	1			III
	Characteristic species of *Onobrychido armenae-Thymetalia lecostomi*											
H	*Scabiosa argentea*		+	+					+		+	II
H	*Onobrychis armena*		+				+		+			II
H	*Convolvulus holosericeus* subsp. *h.*			+		+			+			II
H	*Centaurea virgata*					+			+			I
H	*Marrubium parviflorum* subsp. *p.*		+					+				I
	Characteristic species of *Astragalo-Brometea*											
H	*Poa bulbosa*		+		+		+		+	+	+	III
Th	*Medicago radiata*		+		+	1			1		+	III
Th	*Xeranthemum annuum*	+		+			+			+	+	III
H	*Cruciata taurica*				1		1m		1m			II
Th	*Bromus japonicus* subsp. *j.*				+	+			+			II
Ch	*Teucrium polium*	+			+			+			+	II
	Companions											
Th	*Echinaria capitata*	+	+	1	+			1	+	+	1	IV
Ch	*Thymbra spicata* var. *s.*		1	1		1		+	1		1	III
Th	*Galium bracteatum*	+		+			1	+	+		1	III
G	*Anemone coronaria*	+		+	+		+		+	+		III
Th	*Clypeola aspera*	1		1		1			1		1	III
Th	*Euphorbia aleppica*		+	+		+		+	+			III
G	*Gagea chlorantha*	+			+		+		+	+		III
Th	*Aegilops triuncialis* subsp. *t.*		+	1		+	1			+		III
H	*Achillea aleppica* subsp. *a.*	+			+			+		+		II
H	*Anthemis hyalina*		+		+		+		+			II
H	*Centaurea hyalolepis*			+	+			+	+			II
H	*Alkanna megacarpa*			+			+		1	+		II
Th	*Helianthemum salicifolium*	1			+				1	1		II
Th	*Isatis lusitanica*		+		+		+				+	II
Th	*Trigonella mesopotamica*		+				+		+	1		II
Th	*Vicia ervilia*					1			1		+	II
H	*Alcea striata* subsp. *s.*	+				+			+			II
Th	*Avena sterilis* subsp. *s.*					+		+	+			II
H	*Hordeum bulbosum*			+			+				+	II
Th	*Euphorbia petiolata*	+			+			+				II
Th	*Lens orientalis*	+				+			1			II
Th	*Veronica reuterana*		+		+					+		II
H	*Reseda lutea* var. *l.*	+				+			+			II
H	*Scrophularia mesopotamica*			+		+			+			II
Th	*Cicer echinospermum*		+		+				+			II
Th	*Ziziphora capitata*	+			+				+			II
Th	*Filago pyramidata*		+			+	+					II
Th	*Minuartia decipiens* subsp. *d.*					+				+		I
Th	*Centaurea rigida*					+	+					I
Th	*Trifolium pilulare*				+				+			I
Th	*Erodium cicutarium* subsp. *c.*		+					+				I
G	*Geranium tuberosum* subsp. *t.*		+						+			I
Th	*Crupina crupinastrum*			+					+			I
Th	*Nigella arvensis* var. *caudata*			+					+			I

Table II, Tableau II.- *Minuartio formosae – Astragaletum diphtheritae ass. nov.*

	N° rel.	11	12	13	14	15	16	17	18	19	20	Presence
	Size of plot (m²)	50	50	50	50	50	50	50	50	50	50	
	Parent rock	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	
	Inclination (°)	15	20	15	20	15	15	25	15	10	15	
	Altitude (m)	710	710	720	720	710	700	700	710	710	710	
	Exposition	N	N	N	N	N	N	N	N	N	N	
	Coverage (%)	70	60	70	75	70	70	75	70	60	70	
LF												
	Differential and characteristic species											
Ch	*Astragalus diphtherites* var. *d.*	4	3	4	4	4	3	3	3	4	4	V
Th	*Minuartia formosa*	1			1	+		1	1		+	III
Th	*Argyrolobium crotalarioides*		+		+		+			+		II
	Characteristic species of *Onobrychido armenae-Thymetalia lecostomi*											
H	*Marrubium parviflorum* subsp. *p.*		+	1	+					+		II
H	*Scabiosa argentea*		+	+			+		+			II
H	*Euphorbia macroclada*		+				+		+			II
	Characteristic species of *Astragalo-Brometea*											
Th	*Bromus japonicus* subsp. *j.*	+	+			1	+		+		+	III
Ch	*Teucrium polium*	+		+	+		+		+	+		III
H	*Poa bulbosa*	+			1	+		+	+			III
H	*Cruciata taurica*			1	1m		1		1			II
Th	*Xeranthemum annuum*		+		+		+				+	II
H	*Gundelia tournefortii* var. *armata*		+		+			+				II
H	*Chrysopogon gryllus* subsp. *g.*				+				+			I
	Companions											
Th	*Echinaria capitata*	+	+	1	+			1	+	+	1	IV
Th	*Aegilops triuncialis* subsp. *t.*		+	1		+	1		+	+	+	IV
Th	*Callipeltis cucullaria*	+	+		+			+			+	III
Th	*Trifolium pilulare*		+		+	1			1	+	+	III
Th	*Avena sterilis* subsp. *s.*	+	+		+	+		+			+	III
Th	*Filago pyramidata*	+			+			+		+	r	III
H	*Phlomis brugueri*				+		+		1		1	II
H	*Trigonella coelesyriaca*	+			+				+	+		II
H	*Echinops orientalis*			+	+				+	+		II
Th	*Isatis lusitanica*				1	+		+	+			II
H	*Hordeum bulbosum*			+			+	+			+	II
H	*Cicer echinospermum*		+		+	+			+			II
H	*Ptilostemon diacantha* subsp. *turcicus*	+		+	+							II
Th	*Pimpinella eriocarpa*				+				+	+		II
H	*Onobrychis kotschyana*		+						+		+	II
Ch	*Thymbra spicata* var. *s.*		1m		1m			1				II
H	*Convolvulus dorycnium* subsp. *oxysepalus*	1			1		1					II
H	*Echinops viscosus* subsp. *v.*		+		+			+				II
Th	*Lens orientalis*		+		+			+				II
Th	*Ziziphora capitata*	+					+		+			II
G	*Geranium tuberosum* subsp. *t.*		+		+						+	II
Th	*Lathyrus aphaca* var. *modestus*				1			+			+	II
Th	*Campanula strigosa*	+					+		+			II
Th	*Crupina crupinastrum*			+			+	+				II
Th	*Minuartia picta*				+				+			I
H	*Centaurea hyalolepis*		+						+			I
Th	*Alyssum meniocoides*				+					1		I
Th	*Galium bracteatum*	+						+				I
Th	*Paronychia kurdica* subsp. *haussknectii*				+				+			I
Th	*Androsace maxima*					+	+					I
Th	*Helianthemum salicifolium*		+		+							I

Table III, Tableau III.- *Astragalo emarginati – Asphodelinetum brevicaulis ass. nov.*

LF	N° rel.	21	22	23	24	25	26	27	28	29	30	Presence
	Size of plot (m²)	50	50	50	50	50	50	50	50	50	50	
	Parent rock	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	
	Inclination (°)	30	30	40	30	30	25	25	30	20	30	
	Altitude (m)	740	750	780	720	730	740	690	690	685	685	
	Exposition	S	S	S	S	S	S	S	S	S	S	
	Coverage (%)	70	75	70	80	70	70	70	70	70	70	
LF												
	Differential and characteristic species											
H	*Asphodeline brevicaulis* subsp. *b.* var. *b.*	4	4	4	5	4	5	4	4	4	4	V
H	*Astragalus emarginatus*	+		+	1		1	+		+		III
H	*Astragalus russelii*	+			+		+		1			II
	Characteristic species of *Onobrychido armenae-Thymetalia lecostomi*											
H	*Scabiosa argentea*				+	+				+		II
H	*Euphorbia macroclada*		+		+							I
H	*Onobrychis armena*				+						+	I
	Characteristic species of *Astragalo-Brometea*											
Th	*Medicago radiata*	+	+		+			+			+	III
H	*Poa bulbosa*	1			+			+	+		+	III
Th	*Veronica orientalis* subsp. *o.*			+	+			+			+	II
Th	*Bromus japonicus* subsp. *j.*		+			+		+		+		II
Ch	*Teucrium polium*		+		+						+	II
H	*Gundelia tournefortii* var. *armata*	+		+			+					II
	Companions											
Th	*Echinaria capitata*	+		+	+			+	+	+		III
Th	*Aegilops triuncialis* subsp. *t.*		+	1		+	1			+		III
Th	*Avena sterilis* subsp. *s.*	+	+			+		+			+	III
Th	*Trigonella filipes*	+	+		+			+			+	III
G	*Gagea reticulata*	+			+		+		+	+		III
H	*Convolvulus betonicifolius* subsp. *peduncularis*		+	+			+		+		+	III
Th	*Lamium aleppicum*				1			+	1	+		II
Th	*Vicia ervilia*				+		+		1		1	II
H	*Geranium libanoticum*	+				+			1		+	II
G	*Ornithogalum narbonense*			+	+				+	+		II
Th	*Scabiosa persica*		+		+			+				II
Th	*Androsace maxima*			+	+					+		II
G	*Muscari neglectum*		+			+		+				II
H	*Hordeum bulbosum*			+			+				+	II
Th	*Euphorbia aleppica*	+		+				+				II
Th	*Filago pyramidata*							+	+	+		II
Th	*Lens orientalis*		+						+		+	II
Th	*Salvia viridis*					+		+			1	II
H	*Onosma molle*	+			+			+				II
H	*Echium italicum*		+					+			+	II
Th	*Ziziphora capitata*			+	+			+				II
H	*Salvia multicaulis*				+				1			I
H	*Sanguisorba minor* subsp. *magnolii*				+				+			I
G	*Allium trachycoleum*						+	+				I
Th	*Alyssum meniocoides*			+						+		I
Th	*Campanula strigosa*		+					+				I
Th	*Euphorbia petiolata*				+		+					I
Th	*Lathyrus aphaca* var. *modestus*			+				+				I
Th	*Crupina crupinastrum*				+						+	I
Th	*Vicia palaestina*		+				+					I
Th	*Erodium cicutarium* subsp. *c.*									+	+	I
Th	*Cicer echinospermum*				+			+				I
Ch	*Thymbra spicata* var. *s.*				+					+		I
Th	*Trifolium pilulare*			+				+				I
H	*Alkanna megacarpa*										+	I

Table IV.- Climatic data of the Birecik meteorological station (latitude: 370 02' N, longitude: 370 59' E). P: mean annual precipitation in mm; M: mean maximum temperature (˚C) for the hottest month; m: mean minimum temperature (˚C) for the coldest month; Q: Emberger's pluviothermic quotient: 2000 P/M^2-m^2; PE: summer rainfall; PE/M: Emberger's index of xericity; Sp: spring; W: winter; A: autumn; Sm: summer, medit.: Mediterranean.

Tableau IV.- Données climatiques de la station météorologique de Birecik.

Altitude (m)	P (mm)	PE	S	M (˚C)	m (˚C)	Q	Precipitation regime	Bioclimate
347 m	360	7.9	0.19	41.1	1.5	30.9	W.Sp.A.Sm.	Arid cool medit.

Table V.- Climatic data of the station in the research area.

Tableau V.- Données climatiques de la station dans la zone d'étude.

Meteorological elements	Periods (years)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Mean temperature (˚C)	47	5.7	6.8	10.4	15.8	21.5	27.6	31.2	30.2	25	18.7	11.8	7.4	17.8
Max. mean temperature (˚C)	47	10.9	12.6	17.3	23.4	30.1	36.2	41.1	39.5	35.1	27.7	19.3	12.3	25.4
Min. mean temperature (˚C)	47	1.5	1.9	4.4	8.3	12.9	17.4	21	20.1	15.2	10.8	6	3.1	10.2
Mean precipitation (mm)	47	61.4	53.9	50.8	37.5	19.3	5.3	0.3	2.3	3	24.3	40.6	61.2	360
Mean relative humidity (%)	47	76	75	68	57	48	37	34	36	40	54	67	77	56

B. Ecological properties of the research area

The research area is under the influences of arid and cool Mediterranean climate and annual rainfall is 360 mm. Annual mean relative humidity is 56% in Birecik. As the minimum mean precipitation and maximum mean temperatures are witnessed in July, relative humidity is lowest during this month. The wettest month is January with 61.4 mm rainfall, and the driest month is July with 0.3 mm rainfall. First type of the East Mediterranean precipitation regime (W.Sp.A.Sm.) is seen in the research area. Climatic data of the meteorological station are given Table IV and Table V. As can be seen in the ombrothermic diagram, in Birecik the dry season takes six months from the late April-early May to the early November, and precipitation season takes another six months from early November to early May. There is the possibility of frost in January, February, May, November and December (Fig. 2).

Three new associations have been detected belonging to the steppe vegetation. Three associations, two of these have a physiognomy dominated by spinescent taxa, whereas the physiognomy of the third one consists of a rhizomatous taxon. The domination of these taxa in the research area is the result of overgrazing pressure. This biotic effect gave serious harm to the primary vegetation; as the taxa preferred by animals disappeared from the environment, a secondary vegetation formed in this steppe area, which builds a zootic climax which is a type of vegetation different than the climatic climax (which is in certain composition and structure) according to Tansley (1935) who classified the climaxes ecologically.

There is no forest vegetation in the research area, but from place to place phanerophytes like *Rosa canina* L., *Cerasus microcarpa* (C.A. Mey.) Boiss. subsp. *tortuosa* (Boiss. & Hausskn.) Browicz and *Ficus carica* L. subsp. *rupestris* (Hausskn.) Browicz are encountered. Vegetation of the research area is not very rich in term of floristic composition due to overgrazing. Unfortunately, excessive erosion has been observed from place to place in the south and north-looking hillsides of the research area.

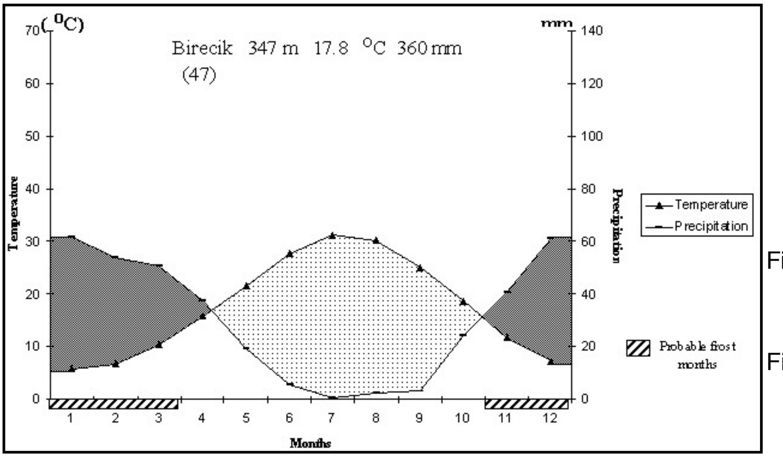

Fig. 2.- Ombrothermic diagram of the research area.
Fig. 2.- Diagramme ombrothermique de la zone d'étude.

When the chorology of taxa identified in the relevés are examined, it can be seen that Irano-Turanian elements have a high rate of dispersal in the research area. This result supports the view that the research area is included in Irano-Turanian phytogeographic area (Zohary, 1973; Fig. 3).

Biological spectrum is an indicator of flora and in general of environment. Life forms of the species in the research area were identified according to Raunkiaer (1934) system. When the life forms of taxa identified in the floristic composition of the associations are examined, it is found out that therophytes ranked first and hemicryptophytes ranked second in terms of ratio in all three associations. According to Zohary (1973), Mesopotamia sector of Irano-Turanian phytogeographic region which includes the research area is characterized by chamaephytes and hemicryptophytes. However, in floristic studies conducted in Turkey, hemicryptophytes are usually dominant in floristic composition. According to this contrast, taxa preferred by animals during overgrazing in the research area consist of climbing, trailing and some biennial plants as well as hemicryptophytes which represent some perennial plants with basal leaves rosulate or not rosulate (Fig. 4).

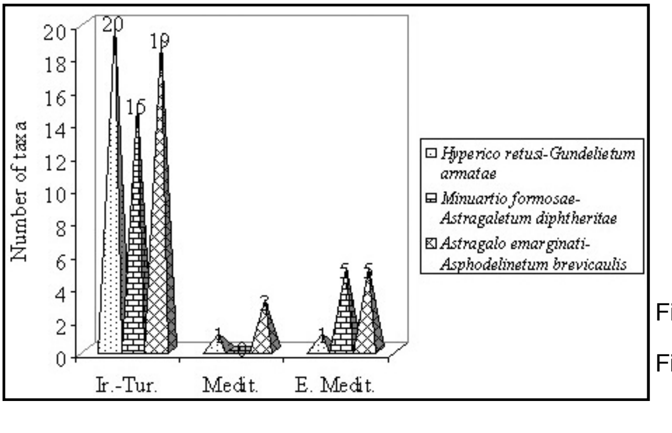

Fig. 3.- Chorological spectrum of associations.
Fig. 3.- Spectre chorologique des associations.

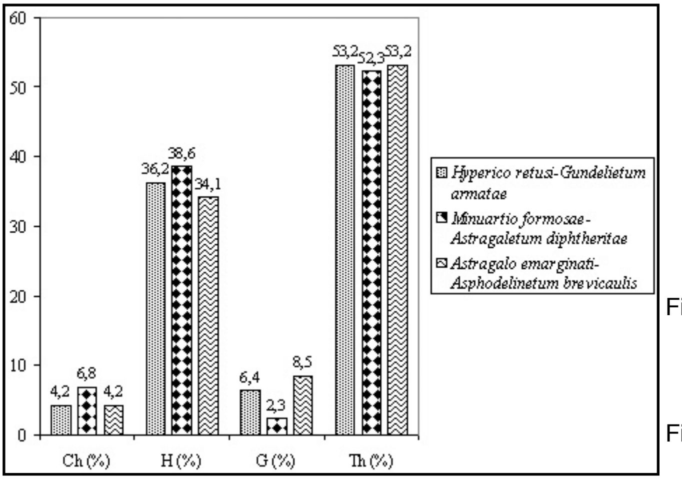

Fig. 4.- Life form spectrum of the associations. Ch: chamaephytes; H: hemicryptophytes; G: geophytes; Th: therophytes.
Fig. 4.- Spectre biologique des associations.

Electrical conductivity (EC) values of the soil over which associations spread in the research area is low, which is an indicator that salt concentration in this soil is low. pH values of all three associations are slightly alkaline. Soils on which the associations grow show considerable differences in terms of lime. *Hyperico retusi – Gundelietum armatae* spreads in rather low-lime, whereas *Minuartio formosae – Astragaletum diphtheritae* spreads in low-lime and *Astragalo emarginati – Asphodelinetum brevicaulis* spreads on very high-lime soil.

In term of organic materials, *Minuartio formosae – Astragaletum diphtheritae* and *Astragalo emarginati – Asphodelinetum brevicaulis* grow on poor soils, whereas *Hyperico retusi – Gundelietum armatae* has a soil structure with medium organic materials. When useful phosphor content of the soils on which associations spread is examined, it is seen that association soils were poor in this element. In terms of absorbable potassium content, it can be understood that in general the association soil has this content.

When the texture class of the soils on which associations spreaded is examined, it is found out that *Minuartio formosae – Astragaletum diphtheritae* and *Hyperico retusi – Gundelietum armatae* spread on clay-loamy soil, whereas *Astragalo emarginati – Asphodelinetum brevicaulis* spreads on clay-loamy and silt-loamy soil, which are heavy-textured types of soil (Table VI).

In term of plant-useful copper, there is no lack of copper in the soil on which there are associations. Then, no lack of manganese is detected in the research area either. When the soils are examined in terms of iron useful for the plants which are analyzed for their microelements, it can be said that, with the exception of the soil on which relevé number 18 of *Minuartio formosae – Astragaletum diphtheritae*, whose iron insufficiency is on the limit, all soils are insufficient in useful iron. With the exception of relevé number 21 of *Astragalo emarginati – Asphodelinetum brevicaulis*, the useful zinc values of soils are found to be sufficient (Table VII).

Table VI.- Soil productivity analysis of associations.
Table VI.- Caractères édaphiques des associations.

Associations	N° rel.	Saturation (%)	EC_{25} 10^3 (mmohs/cm)	pH	$CaCO_3$ (%)	P_2O_5 (kg/da)	K_2O (kg/da)	Organic matter (%)	Loamy (%)	Clay (%)	Silt (%)	Texture
Hyperico retusi-	2	67	0.8	8.0	1.1	1.7	75.6	2.2	45.4	24.5	30	L
Gundelietum armatae	8	61	1.1	8.0	3.0	2.9	103.6	3.4	31.4	46.6	22	C
Minuartio formosae-	14	61	0.5	8.1	15.5	1.7	71.2	1.4	41.4	26.6	32	L
Astragaletum diphtheritae	18	64	0.9	8.1	9.1	3.8	120.9	2.2	27.4	48.6	24	C
Astragalo emarginati-	21	48	0.4	8.0	19.0	2.5	25.9	1.7	41.4	30.5	28	CL
Asphodelinetum brevicaulis	24	48	0.4	8.0	18.6	5.3	27.0	1.5	37.4	12.5	50	SL
	30	63	0.4	8.1	31.1	3.5	45.3	2.3	31.4	36.6	32	CL

Table VII.- Some soil microelements analysis of associations.
Table VII.- Analyse de quelques éléments chimiques dans les sols des associations.

Associations	N° rel.	Cu (mg/kg)	Mn (mg/kg)	Fe (mg/kg)	Zn (mg/kg)
Hyperico retusi-Gundelietum armatae	2	1.0	1.8	1.5	0.6
	8	1.1	3.7	1.7	0.5
Minuartio formosae-Astragaletum diphtheritae	14	0.5	3.2	1.2	0.5
	18	1.1	4.8	2.5	0.8
	21	0.4	1.7	0.1	0.2
Astragalo emarginati-Asphodelinetum brevicaulis	24	0.5	1.3	0.0	0.6
	30	0.2	1.4	0.0	0.5

IV. DISCUSSION

When ecological features including soil characteristics that affect the three associations detected in the research area, unevenness and slope conditions and climatic factors are examined, it can be seen that same conditions apply for all three associations, in which case the major factor for these associations is altitude differences and overgrazing. Biotic factors in the research area consist of humans and animals.

In the case of Turkey's other regions, grazing is conducted unmethodically in this region and, due to excessive and irregular grazing, the pastures which are sources of feed become utterly destroyed. These broad pasture areas, from which everyone can benefit, but for which no one undertakes the responsibility of correct grazing, maintenance, preservation and correction, are left to their own destiny or any kind of destruction. Therefore, the habitats of naturally spreaded plants are affected to a considerable extent (Boydak, 1994).

The research area is rather poor in terms of forests. Lack of forests in this area is due to human pressure and irregular, unmethodical grazing rather than growing environment conditions. Grazing pressure in summer months, exploitation of fresh offshoots and leaves in August and fuel wood need in winter months decreased or completely consumed forests.

Grass deficit caused by the destruction of pastures was compensated by use of the nearby oak forest. This destruction of *Quercus* spp. (*Q. brantii* Lindl. and *Q. infectoria* Oliv. subsp. *boissieri* (Reut.) O. Schwarz) for grazing and leave exploitation deceased their fertility and caused the disappearance of shooting capacity of the root of oaks in time.

Wood is used as the basic fuel in Southeastern Anatolia and the research area. As a result of such extreme destruction, *Quercus* spp. cannot grow any more. In addition, local people uprooted the *Quercus* spp. as they cannot find fuel woods in some places, which claimed their renewability energy source feature. Due to the destruction of oak forest, steppe vegetation shows in most locations.

There is no evidence of a major fire in this area. However, bushfires are witnessed from place to place in the research area. These fires have effects on the soil, flora and fauna in the research area, which can be the subject of another study.

After anthropogenic effect, especially mechanized agriculture, became widespread, vegetation in Southeastern Anatolia has been mostly destroyed. As a result, the plantations in the research area, vineyards and orchards and silviculture (*Pinus* spp. and especially *P. brutia*) also exist. In recent years, the research area has been largely destroyed by opening arable fields (especially for pistachio and olive trees) and natural vegetation has been affected.

Arat Mountain is mainly covered with secondary steppes dominated by the species of Fabaceae, Asteraceae and Poaceae steppes as in most part of the Southeastern Anatolia due to anthropogenic effects.

In conclusion, the syntaxonomical study conducted in the research area found out three new associations belonging to steppe vegetation. When the existing studies were analyzed, any alliance connected with associations could not be found. These associations and their upper syntaxonomic units are as below:

Class: *Astragalo microcephali – Brometea tomentelli* Quézel 1973
Order: *Onobrychido armenae – Thymetalia leucostomi* Akman, Ketenoğlu & Quézel 1985
Association: *Hyperico retusi – Gundelietum armatae ass. nov.*
Association: *Minuartio formosae – Astragaletum diphtheritae ass. nov.*
Association: *Astragalo emarginati – Asphodelinetum brevicaulis ass. nov*.

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