

FLORISTIC ANALYSIS OF THE “ZMEYOVA DUPKA” NATURAL LANDMARK, STARA ZAGORA REGION, SOUTH BULGARIA

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The article casts light upon the contemporary condition of the flora of the “Zmeyova dupka” Natural landmark, Stara Zagora Region, South Bulgaria. Significant floristic diversity is registered on an area of 40 hectares - 129 species of higher plants (mosses excluded), belonging to 101 genera and 40 families. Investigation is conducted in the 2006 - 2008 time span and up to date in 2012.

Taxonomic structure, ecological and biological type, and the floristic belonging of the components of the flora are analyzed. 4 Balkan endemics and 2 species with Nature preservation status according to the Bulgarian and international legislation are found. According to the existing legislation the territory protects object of the inanimate nature (rocky cave), but the established endemic, tertiary relicts, rare, and medicinal plants require introduction of plant preservation measures.

Keywords: higher plants, nature preservation, Stara Zagora Region, South Bulgaria.

Conference participant,
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Because of its unique bio-geographical situation and rough mountain relief, the Southern parts of Bulgaria have long ago attracted the attention of explorers. Analyzing the plant cover of the Balkan Peninsula in the beginning of the last century, Adamovič (1909) pays special

attention to the climatic factors defining the composition of xero-thermic oak forests in the Stara Zagora Field. Later on Veltchev, Gantchev (1968) implement ecologic and geographical investigations on the Ihtimanska Sredna Gora and the Sastinska Sredna Gora Mountain, and Gantchev, Dentchev (1963) and Stanev (1973, 1975) on the Eastern Sredna Gora Mountain and the Stara Zagora Field. Data gathered for the Sredna Gora Mountain chain show not only substantial floristic variety, but also its participation in the processes of morphology and species formation. The registered even then massive presence of Mediterranean and sub Mediterranean species supports the thesis of a deeper penetration of Mediterranean influence along the Maritsa river valley. Updating information with respect to the Sarnena Sredna Gora Mountain is forced by the fact that in the recent years the Gornotrakiiska

lowlands subregion is determined as one of the most anthropogenized parts of Bulgaria. The aim of the present research is to analyze the floristic diversity in an unexplored for the Sarnena Sredna Gora Mountain region. At this stage the preservation status of the Natural landmark is the Sarnena Sredna Gora Mountain (809 m). The lack of abrupt boundary between the vegetation on the rocky complexes and that on the surrounding hills made it necessary to analyze the vegetation of a whole section (according to the Forest Management Plan) with an area of 40 hectares.

The territory analyzed gets into the Gornotrakiiska District of the Macedonian and Thracian province, characterized with transient continental climate with Mediterranean influence. The route method with transect passages was used for the establishment of the species diversity. A frame of an area of 1 m² was utilized when the number of populations was measured. The floristic belonging of taxa was determined according to the works of Asyov & all (2002). Nature preservation status of species was defined on the basis of Regulation Documents of Bulgarian and international legislation, and of the works of Veltchev (ed.) (1984); Andreev & all. (1992), Red Data Book (Peev, D. (ed.) - on line) (2011).

The results of the investigation can be divided in the following parts (for more details see Appendix 1, 2 & 3):

– Taxonomic analysis of the flora - 129 species, referring to 101 genera and

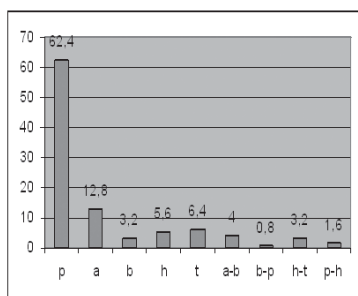


Fig. 1. Biological spectrum of the flora.

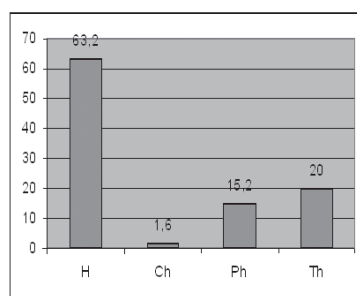


Fig. 2. Distribution of the vital forms according to Raunkier (%).

solely based on the protection of a rocky formation, but the results obtained may lead to reconsideration of the protected territory status. The above mentioned Natural landmark is located on the land of the village of Zmeyovo, Stara Zagora Region, Bulgaria. It includes rocky formations and a cave, all situated on an area of 1 hectare in the vicinity of the Zmeyovo stone-pit and Betera summit, one of the highest for

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Table 1.

Taxonomic structure of the higher flora of the “Zmeyova dupka” Natural Landmark

Taxonomic Division	Families	Genera	Species
Division Magnoliophyta			
Class Pinopsida	1	1	2
Subdivision Magnoliophytina	39	100	127
Class Magnoliopsida	35	80	104
Class Liliopsida	5	21	25
Total	40	101	129

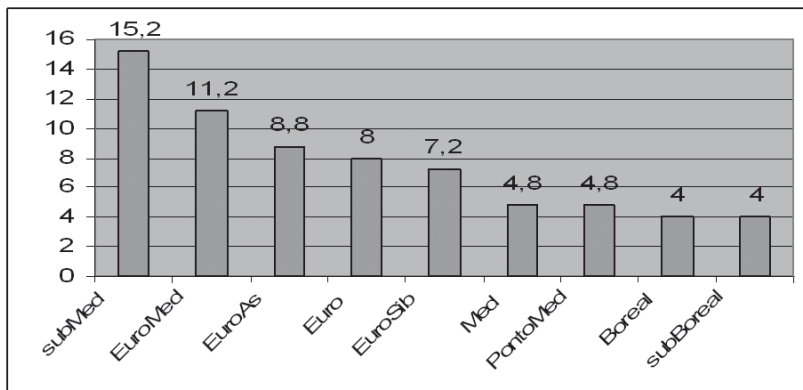


Fig.3. Chorological spectrum of the flora

40 families were established as a result of the study accomplished (Table 1).

The representatives of Gymnosperms (class Pinopsida) - *Pinus sylvestris* L. and *P. nigra* Arn. are product of artificial forestations.

Plant diversity was specified by Angiosperms (Magnoliophytina). Dicotyledonous (Magnoliopsida) are represented by 35 families, 80 genera and 104 species, while Monocotyledonous (Liliopsida) are represented by 5 families, 221 genera and 25 species.

The following trend is emerging in

Appendix 1. Species and genus distribution in families

Family	Genus		Species	
	Number	%	Number	%
Pinaceae	1	1,0	2	1,6
Acanthaceae	1	1,0	1	0,8
Anacardiaceae	1	1,0	1	0,8
Apiaceae	7	7,1	7	5,6
Asclepiadaceae	1	1,0	1	0,8
Asparagaceae	1	1,0	1	0,8
Asteraceae	10	10,2	14	11,2
Betulaceae	1	1,0	1	0,8
Boraginaceae	1	1,0	1	0,8
Brassicaceae	1	1,0	1	0,8
Campanulaceae	2	2,0	4	3,2
Caryophyllaceae	4	4,1	4	3,2
Chenopodiaceae	1	1,0	2	1,6
Cistaceae	1	1,0	1	0,8
Cornaceae	1	1,0	1	0,8
Convolvulaceae	1	1,0	1	0,8
Crassulaceae	1	1,0	1	0,8
Cyperaceae	1	1,0	3	2,4
Dipsacaceae	1	1,0	1	0,8
Fabaceae	8	8,2	13	10,4
Fagaceae	1	1,0	4	3,2
Gentianaceae	1	1,0	1	0,8
Hypericaceae	1	1,0	2	1,6
Lamiaceae	9	9,2	12	9,6
Liliaceae	2	2,0	2	1,6
Linaceae	1	1,0	2	1,6
Oleaceae	1	1,0	1	0,8
Orhidaceae	2	2,0	2	1,6
Orobanchaceae	1	1,0	1	0,8
Paeniaceae	1	1,0	1	0,8
Plantaginaceae	1	1,0	1	0,8
Poaceae	12	12,2	14	11,2
Polygonaceae	1	1,0	1	0,8
Primulaceae	2	2,0	2	1,6
Ranunculaceae	2	2,0	2	1,6
Rosaceae	7	7,1	7	5,6
Rubiaceae	2	2,0	4	3,2
Scrophulariaceae	2	2,0	2	1,6
Smilaceae	1	1,0	1	0,8
Tiliaceae	1	1,0	1	0,8
Violaceae	1	1,0	1	0,8
Total	98	100	125	100

Appendix 2. Species with nature preservation status

Species	Red book (2011)	CITES (1992)	Bern conv. (1998)	Nature preserv. law (2002)	Endemits, relicts
<i>Achillea clypeolata</i> Sibth. & Sm.					Balkan endemit
<i>Bupleurum flavum</i> Forsk.	R	+		+	
<i>Carpinus orientalis</i> Miller					Tertiary relict
<i>Clematis vitalba</i> L.					Tertiary relict
<i>Cotinus coggygria</i> Scop.					Tertiary relict
<i>Fraxinus ornus</i> L.					Tertiary relict
<i>Fritillaria pontica</i> Wahn.	R	+		+	
<i>Himantoglossum hircinum</i> (L.) Koch.		+	+	+	
<i>Hypericum rumeliacum</i> Boiss.					Balkan endemit
<i>Linum thracicum</i> (Griseb.) Deg.					Balkan endemit
<i>Quercus cerris</i> L.					Tertiary relict
<i>Silene gigantea</i> L.					Balkan endemit
<i>Thymus striatus</i> Vahl.					Balkan endemit

reference to the variety of genera and species - it is small families, composed of 1 genus with 1-2 species that prevail. The families with biggest species multiplicity are 6 (Asteraceae - 11,6 %; Poaceae - 11 %; Fa - 10,4 %; Lamiaceae - 9,4 %; Apiaceae - 5,4 %; Rosaceae - 5,4 %) and represent 14.6% of plant diversity in the region.

The region of the "Zmeyova dupka" Natural landmark is one of the few cases where natural restoration of coniferous species is observed - a process obviously favoured by the soil and climatic conditions.

Ecological and biological analysis of the flora - the analysis of the biologic spectrum of the flora shows predominant participation of the perennial biologic type - 78 species (62, 8%), followed by the group of annual species - 16 taxa (12.8%) (Fig.1). Comparatively poor is the representation of the group of transitional forms. Analysis of the vital forms shows prevailing partaking of hemocryptophytes (63, 4%), followed by the terrophytes (20%) (Fig.2).

The well expressed share of phanerophytes (15, 4%) is determined by the woody character of the countryside.

- Phyto-geographical belonging - taxa established can be related to 26 floristic types. It is the species with subMediterranean origin that predominate (subMed) - 19 taxa (15,

5%), followed by those with Euro Mediterranean (EuroMed) origin - 14 taxa (11, 2%), and by the taxa with Euro Asian (EuroAs) descent - 11 species (8, 6%) (Fig.3).

- Species with Nature preservation status - 4 Balkan endemics are found on the territory of the Natural landmark: *Hypericum rumeliacum* - it forms small populations, scattered everywhere in the lower altitude glades of the area (550-600 m above sea level, on limestone). It is frequently found for the Stara Zagora Region species; *Linum thracicum* - populations of the species are situated along the road to the peak. They are scanty, observed while blossoming. The species is registered in different places in the Stara Zagora Region; *Silene gigantea* - it is represented by sole blossoming specimen on the rocky glades along the way to the summit; *Thymus striatus* - forms numerous high density populations both in the lower parts of the area, and on the open glades of the rocky complex (760 m of altitude).

- Habitats of rare and medicinal plants - Red Data Book of People's Republic of Bulgaria (2011) protects 2 species: *Bupleurum flavum* Forsk. in the "Rare" (R) rank and *Himantoglossum hircinum* (L.) Koch. in the "Endangered" (E) rank. Both species are under the protection of Biological Diversity Law

(2002), which incorporates several international conventions (CITES, Bern).

Bupleurum flavum Forsk. forms not numerous (up to 10 specimen) populations, located amid the grass vegetation in the lower parts of the slope, and beside the road. Populations of the *Centaureum erythraea* Rafn. medicinal plant are situated there too - a species rarely registered in Stara Zagora Region. The rocky glades on the summit offer suitable conditions for the development of *Campanula rapunculoides* L., *Jasione heldreichii* Boiss. et Orph., *Sedum hispanicum* L., and various species of the *Carex* genus. The *Cephalanthera longifolia* (L.) Fritsch. - species is rarely found as an undergrowth in the oak and hornbeam forests in the higher altitude parts of the area.

Populations of *Paeonia peregrina* Miller. (medicinal, rarely found in the region plant) are located to the left off the road, winding over the rocky complex, while on the grassy glades above it, scattered sole specimen of *Himantoglossum hircinum* (L.) Koch. are situated.

The results obtained give reason for the following interpretation:

Taxonomic structure of the "Zmeyova dupka" Natural landmark, Stara Zagora Region, Bulgaria shows the distinguishing features of the moderate belt flora - low share of Gymnosperms and predominance of Angiosperms; prevailing of Dicotyledonous over Monocotyle-

Appendix 3. Taxonomic structure of higher plants "Zmeiova dupka" Natural landmark

Family	Species	Biol. type	Floristic type	Life forms Raunkiaer
Division Magnoliophyta				
Class Pinopsida				
Pinaceae	<i>Pinus sylvestris</i> L.	t	sub Boreal	Ph
	<i>P. nigra</i> Arn.	t	sub Med	Ph
Subdivision Magnoliophytina				
Acanthaceae	<i>Acanthus spinosus</i> L.	p	Med	H
Anacardiaceae	<i>Cotinus coggygria</i> Scop.	h	Med-As	Ph
Apiaceae	<i>Buplerum flavum</i> Forsk.	a	Med	Th
	<i>Eryngium campestre</i> L.	p	Pont-Med	H
	<i>Ferulago sylvatica</i> (Bess.) Rchb.	p	sub Med	H
	<i>Laser trilobum</i> (L.) Borkh.	p	Euro Med	H
	<i>Orlaya grandiflora</i> (L.) Hoffm.	a	Ap-Bal	Th
	<i>Physospermum cornubiensis</i> (L.) DC.	p	Euro Med	H
	<i>Pimpinella peregrina</i> L.	b	Pont Med	Th
Asclepiadaceae	<i>Vincetoxicum hirundinaria</i> Medicus. L.	p	Euro Sib	H
Asteraceae	<i>Achillea clypeolata</i> Sm.	p	EuroSib	H
	<i>A. millefolium</i> L.	p	Euro Sib	H
	<i>Anthemis arvensis</i> L.	a	Euro Med	H
	<i>A. cotula</i> L.	a	Euro Sib	Th
	<i>Centaurea scabiosa</i> L.	p	Euro Sib	Th
	<i>Cichorium intybus</i> L.	a-b	Euro Sib	H
	<i>Crupina vulgaris</i> Cass.	a	sub Med	Th
	<i>Hieracium hoppeanum</i> Schult.	p	Euro Med	Th
	<i>H. pseudopilosella</i> Ten	p	Med	H
	<i>Inula britannica</i> L.	p	Euro Med	H
	<i>I. ensifolia</i> L.	p	Euro Med	H
	<i>Serratula tinctoria</i> L.	p	Euro Sib	H
	<i>Tanacetum corymbosum</i> (L.) Schultz. Bip.	p	Euro Med	H
	<i>T. vulgare</i> L.	p	Euro Sib	H
	<i>Xeranthemum annuum</i> L.	a	Sub Med	Th
Betulaceae	<i>Carpinus orientalis</i> Miller.	h-t	sub Med	Ph
Boraginaceae	<i>Echium vulgare</i> L.	b	Euro As	Th
Brassicaceae	<i>Sinapis arvensis</i> L.	a	Med	Th
Campanulaceae	<i>Campanula persicifolia</i> L.	p	Euro Sib	H
	<i>C. rapunculoides</i> L.	p	Eur	H
	<i>C. trachelium</i> L.	p	Boreal	H
	<i>Jasione heldreichii</i> Boiss. et Orph.	a-b	Euro Med	Th
Caryophyllaceae	<i>Agrostemma githago</i> L.	a	Euro As	Th
	<i>Dianthus giganteus</i> L.	p	Pann-Bal	H
	<i>Silene compacta</i> Fisch.	p	Med	H
	<i>Viscaria vulgaris</i> Rohl.	p	Euro Sib	H
	<i>Silene gigantea</i> L.	p	Bal	H
Chenopodiaceae	<i>Kochia laniflora</i> (S.G.Gmel.) Borb.	a	Pont-Sib	Th
	<i>K. prostrata</i> (L.) Schrab.	a	Euro As	Th
Cistaceae	<i>Helianthemum nummularium</i> (L.) Mill.	h-t	Alp-Med	Ph
Cornaceae	<i>Cornus mas</i> L.	h-t	subMed	Ph
Convolvulaceae	<i>Convolvulus cantabrica</i> L.	p	Pont	H
Crassulaceae	<i>Sedum hispanicum</i> L.	a-b	Euro Med	Th
Cyperaceae	<i>Carex glauca</i> Murr.	p	Boreal	H
	<i>C. hirta</i> L.	p	Boreal	H
	<i>C. panicea</i> L.	p	Boreal	H
Dipsacaceae	<i>Dipsacus fullonum</i> L.	b	Euro-OT	Th

Fabaceae	<i>Chamaecytisus ciliatus</i> (Wahlb.) Rothm.	h	Pont Med	Ph
	<i>Dorycnium herbaceum</i> Vill.	p	Euro Med	H
	<i>Genista depressa</i> Bieb.	h	sub Med	Ph
	<i>G. ovata</i> Waldest. et Kit.	h	Eur	Ph
	<i>G. tinctoria</i> L.	h	Euro Sib	Ph
	<i>Lotus corniculatus</i> L.	p	Euro Med	H
	<i>Medicago falcata</i> L.	p	Euro As	H
	<i>Melilotus officinalis</i> (L.) Pall.	a		Th
	<i>Ononis arvensis</i> L.	p	Euro As	H
	<i>Trifolium angustifolium</i> L.	a	Med	Th
	<i>T. hybridum</i> L.	p	Euro Med	H
	<i>T. pannonicum</i> Jacq.	p	sub Med	H
	<i>T. pratensis</i> Schreb.	p	sub Med	H
	Fagaceae	<i>Quercus petraea</i> (Mart.) Liebl	t	Eur
<i>Q. frainetto</i> Ten.		t	Eur	Ph
<i>Q. cerris</i> L.		t	Eur	Ph
<i>Q. pubescens</i> Willd.		t	sub Med	Ph
Gentianaceae	<i>Centaurium erythraea</i> Rafn.	p	sub Med	H
Hypericaceae	<i>Hypericum perforatum</i> L	p	Cos	H
	<i>H. rumeliacum</i> Boiss.		Bal	H
Lamiaceae	<i>Acinos arvensis</i> (Lam.) Dandy.	a-b	Euro Med	Th
	<i>Betonica officinalis</i> L.	p		H
	<i>Clinopodium vulgare</i> L.	p	sub Boreal	H
	<i>Origanum vulgare</i> L.	p	Euro As	H
	<i>Prunella laciniata</i> (L.) L.	p	Eur	H
	<i>P. vulgaris</i> L.	p	Cos	H
	<i>Salvia sclarea</i> L.	p	Med-As	H
	<i>Stachys angustifolia</i> MB.	p	Pont Med	H
	<i>S. germanica</i> L.	p	sub Med	H
	<i>Teucrium chamaedrys</i> L	p	sub Med	H
	<i>T. polium</i> L.	p	Pont Med	H
	<i>Thymus striatus</i> Vahl.	p	Bal	H
Liliaceae	<i>Anthericum ramosum</i> (L.)	p	Eur	H
	<i>Leopoldia tenuiflora</i> (Tausch.) Heldr.	p		H
	<i>Asparagus officinalis</i> L.	p	Eur	H
	<i>Fritillaria pontica</i> Wahn.	p	Med	H
	<i>Himantoglossum hircinum</i> (L.) Koch.		Med	H
Linaceae	<i>Linum tenuifolium</i> L.	p	Pont Med	H
	<i>L. thracicum</i> (Griseb.) Deg.	p	Bal	H
Oleaceae	<i>Fraxinus ornus</i> L.	t	sub Med	Ph
Orchidaceae	<i>Himantoglossum hircinum</i> (L.) Koch.	p	Med	H
	<i>Cephalanthera longifolia</i> (L.)Fritsch.	p	Euro-OT	H
Orabanchaceae	<i>Orobanche minor</i> L.	p	Med	H
Paeoniaceae	<i>Paeonia peregrina</i> Miller.	p	sub Med	H
Plantaginaceae	<i>Plantago media</i> L.	p	Boreal	H
Poaceae	<i>Brachypodium sylvaticum</i> (Huds.) Beauv.	p	Euro As	H
	<i>Briza media</i> L.	p	Eur	H
	<i>Calamagrostis epigeios</i> (L.) Roth.	p	Euro As	H
	<i>Chrysopogon gryllus</i> (L.) Trin.	p	Pont Med	H
	<i>Dasypyrum villosum</i> (L.) Borb.	p	sub Med	H
	<i>Festuca arundinacea</i> Schreb.	P	Pont-SAs	H
	<i>F. elatior</i> L.	p	Pont-SAs	H
	<i>F. pseudovina</i> L.	p	sub Med	H
	<i>Lolium perenne</i> L.	p	Euro As	H
	<i>Melica ciliata</i> L.	p	Euro-sub Med	H
	<i>Phleum platense</i> L.	p	Euro-sub Med	H
	<i>Poa nemoralis</i> L.	p	Boreal	H
	<i>Sorghum halepense</i> L.	p	subMed-As	H
	<i>Tragus racemosus</i> (L.) All.	a	sub Boreal	Th

Polygonaceae	<i>Polygonum aviculare</i> L.	a	Cos	Th
Primulaceae	<i>Anagallis arvensis</i> L.	a-b	Cos	Th
	<i>Lysimachia punctata</i> L.	p	Pont Med	H
Ranunculaceae	<i>Clematis vitalba</i> L.	h	Eur	Ch
	<i>Helleborus odorus</i> Waldst. et Kit.	p	Euro-sMed	H
Rosaceae	<i>Agrimonia eupatoria</i> L.	p	Euro Med	H
	<i>Crataegus monogyna</i> Jocg.	h-t	sub Boreal	Ph
	<i>Potentilla argentea</i> L.	p	SPont	H
	<i>Prunus spinosa</i> L.	h	SPont	Ch
	<i>Rosa canina</i> L.	p-h	sub Med	Ph
	<i>Rubus caesius</i> L.	p-h	Euro As	Ph
	<i>Sanaguisorba officinalis</i> L.	p	sub Boreal	H
Rubiaceae	<i>Galium rivale</i> (S.et S.) Grisb.	p	Pont-subMed	H
	<i>G. tricornutum</i> Dandy.	a	Euro As	Th
	<i>G. verum</i> L.	p	Euro As	H
	<i>Sherardia arvensis</i> L.	a	Med	H
Scrophulariaceae	<i>Digitalis lanata</i> Ehrh.	b-p	sub Med	Th
	<i>Verbascum banaticum</i> Schrader.	b	Bal-Dac	Th
Smilacaceae	<i>Tamus communis</i> L.	p	sub Med	H
Tiliaceae	<i>Tilia platyphyllos</i> Scop.	t	Eur	Ph
Violaceae	<i>Viola odorata</i> L.	p	Euro Med	H

donous. According to the structure of the first triad of predominant families (As, Po, Fa) the spectrum of the flora can be referred to the southern (Fa) type.

Distribution of the flora with respect to the biological type is direct reflection of the climatic influences prevailing in the region. The superiority of perennials and of hemicryptophytes is a consequence of the influence of the transient continental climate, and the good representation of annuals and terrophytes - a result of the Mediterranean climatic ascendancy.

Climatic peculiarities are also a decisive factor in the phyto-geographic distribution of the species. Predominant are taxa settled in different places in the Mediterranean lands, Central Europe and Asia. The reasons for the poor appearance of the endemic element can be

sought in the strongly expressed anthropogenic influence in the region.

The implemented analyses of the unexplored in floristic aspect area, a part of the Sarnena Sredna Gora Mountain, allows data obtained to be added to the knowledge concerning the floristic diversity of the country, and be used as a base for comparison.

The objective laws established regarding the taxonomic structure, ecologic and biologic type, and floristic belonging support fundamental trends, documented for the Southern parts of the country. According to the existing legislation the territory protects object of the inanimate nature (rocky cave), but the established endemic, tertiary relicts, rare, and medicinal plants require introduction of plant preservation measures.

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