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Comparative Anthropological Characterization of few local Bulgarian Populations

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Anthropological data from 20 samples of adult Bulgarians from different local populations are processed statistically and analyzed with Michalski's methods and compared with each other by cluster and principal component analysis. The results show that they can be divided into two major groups (clusters), each of which with two subclusters. The first cluster includes populations with Centraleuropean characteristics – a combination of Nordic, Armenoid (Balkano-Caucasian) and Lapponoid (Uralo-Lapponoid) elements. The second cluster includes population with the typical Atlanto-Mediterranian (Atlanto-Pontic) combination of Nordic and Mediterranian elements. The subclusters of the first cluster differ on the basis of predominance of Armenoid or Lapponoid elements, the subclusters of the second cluster – on the more expressed Nordic or Mediterranian traits. The first group of population spreads mostly in Northern Bulgaria and the second – in South Bulgaria. Two samples (Melitopol Bulgarians and Crimean Bulgarians) remain outside the two main groups and the reason of this phenomenon is discussed.

Key words: Bulgarians, Michalski's methods, comparative anthropological analysis, Centraleuropean populations, Atlanto-Pontic populations

Introduction

Few national wide ethnoanthropological surveys have been conducted in Bulgaria: by Acad. Stefan Vatev around 1899, by Acad. Methody Popov in 1938-43, by Aris Poulianos in 1963 and the National Anthropological Program in 1989-93 [12, 13, 19, 20]. Their results show that the anthropological structure of the present Bulgarian population is very heterogeneous in territorial aspect. Unfortunately, the results from these studies are published only at national and regional level. Only few data are published on local level [12, 19]. The survey of Krum Dronchilov [2] perhaps the best exact and best known outside Bulgaria, presents anthropological data on local level, but does not cover the whole territory of Bulgaria. The materials of the extensive local anthropological studies of Peter Boev, Luchia Kavgazova and their collaborators, collected during the 1970s and 1980s are only partly published [4, 5, 6]. Resent review and analysis of some

incomplete data of Methody Popov's study also support the idea that more attention to the investigation of the anthropology of local Bulgarian populations should be paid [14].

That is why the authors of this paper in the last years processed statistically and analyzed data of few local populations from the rich collection of unpublished archive materials [15, 16, 17] and also published individual data of former anthropological studies when they are available [2, 8, 9].

Materials and Methods

Anthropological data from the archives of the former Department of Ethnic Anthropology of the former Institute of Morphology of BAS are processed statistically and analyzed. Also have been processed statistically and analyzed published individual data from the anthropological studies of Krum Dronchilov and Anatol Nosov [2,8, 9]. Thus the data of 20 local Bulgarian samples including individual data of 1641 adult men are analyzed in this paper.[1]

The analysis of the anthropological structure has been made according to the methodic of Michalski [3, 7, 10, 11]. In the methodic some minor modifications are made, which are described in previous article of the first author of this paper [15].

Next the samples have been compared between them by cluster analysis (unweighted pair group method of analysis has been used – UPGMA) and by principal component analysis.

Results and Discussion

The basic anthropological characteristics of these 20 local samples are presented in **Table 1**.

The phenotypic combinations of different anthropological elements after Michalski are presented in **Table 2**.

The Euclidean distances between the samples under study are presented in **Table 3**.

The cluster analysis and the principal component analysis on the base of this elementary anthropologic structure and the Euclidean distances between the samples are presented in **Fig. 1** and **Fig. 2**.

The results of our analysis show that the major part of Bulgarian local samples forms two clusters, each with two subclusters **(Fig.3)**

The first cluster includes Balkandjis from Razgrad district [17], Bulgarians from North Bulgaria [16], Turks from Middle North Bulgaria [16], Bulgarians from Pirdop county [2], from Orhanie county [2], from Sofia county – eastern part [2], Gagauzes from Kavarna [15], Bulgarians from Kjustendil county [2], and from Samokov county [2]. It includes populations with typical Centraleuropean characteristics – a combination of Nordic, Armenoid (Balkano-Caucasian) and Lapponoid (Uralo-Lapponoid) elements,

[1] The primary analysis of Dronchilov's individual data from Sofia county forced the author to divide it in two samples, so prominent was the anthropological differences between the eastern and the western part of this county.

first described by Cheboksarov [1]. These populations are brachycephalic, with mixed pigmentation and slight Mongoloid traits (mostly because of old, slightly differentiated Mongoloid anthropologic elements which have been presented in Europe long before the Great migration of peoples [1].

This cluster has two subclusters on the basis of predominance of Armenoid or Lapponoid element. In the first subcluster Armenoid element prevails over Lapponoid (Balkanjis, North Bulgarians, Turks, Pirdop county). On individual level here we find the highest presence of Dinaric type (AH) and of its characteristic traits on population level (greater body height, well expressed brachycephaly, darker pigmentation) – **Table 4.**

In the second subcluster Lapponoid element prevails over Armenoid, also the Nordic element is stronger – **Table 5**. Thus on individual level dominate the Subnordic type (AL) and its traits can be seen on population level (higher nasal index, lighter pigmentation, lower body height). It includes Bulgarians from Orhanie, Sofia-east, the Gagauzes, Bulgarians from Kjustendil and Samokov.

The second cluster includes samples from South Bulgaria (except one[2]) – from Tryn county [2], Pomaks from village Toros [16], mixed sample Bulgarians from South Bulgaria [16], from Panagjurishte county [2], Dupnica county [2], Caribrod county [2], Radomir county [2], Plovdiv county [2] and from the western part of Sofia county [2]. These populations present typical combination of Nordic and Mediterranean elements and the traits of these elements can be seen on population level (mesocephaly, mixed pigmentation). On individual level prevail the Atlanto-Pontic (Atlanto-Mediterranean or Northwestern) anthropological type AE, but also the so called Amoritic type (AK) can be found. This cluster can be also divided into two subclusters on the basis of the force of Nordic element.

The first subcluster includes the samples from Tryn, the Pomaks, from South Bulgaria and from Panagjurishte. Here the Nordic element is best expressed and thus the pigmentation is brighter. The second subcluster includes the samples from Dupnica, Caribrod, Radomir, Plovdiv and Sofia-west. Here the Nordic element is less expressed and consequently the pigmentation is darker.

Outside of these two clusters are the samples of Melitopol Bulgarians and Crimean Bulgarians, studied by Nosov [8, 9]. They are characterized by darker pigmentation, shorter nose with high nasal indexmore concave than convex nasal profiles. Mongoloid traits as prominent cheekbones and Mongolic eyelid fold are often. Thus in the elementary structure the Nordic complex is relatively low and the Eastern complex – high.

We have to say that there is some uncertainty in the individual data of Crimean and Melitopol Bulgarians. First, the pigmentation of the hair and of the eyes is given only in broad categories (dark-dark blond – blond, dark – mixed – light) and this makes the determination of the anthropological types and fractions problematic. Next, in 1939 Żejmo-Żejmis doubts in the proper measuring of the nose by the anthropologists of the Ukraine anthropological school [21], thinking that they underestimate the nasal height and thus overestimate nasal index. However, our analysis of individual anthropological data of the Ukranians from the village of Bondarova, measured by the Ukranian anthropologist Maksym Tkach [18] presents that they are almost identical with Ukranians measured in Buczacz county and analyzed without remarks by Michalski [7].

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[2] This only Atlanto-Pontic sample in North Bulgaria are the Pomaks fron the village Toros. The historical reasons of their exclusivity are discussed in former publication of the first author of this paper [16].

This confirms the correctness of the anthropometry taken by the anthropologists of the Ukrainian school. Also we have to say, that high nasal index usually correlates with nasal concavity and in Europoids usually is a sign of Mongoloid admixture. Mongoloids also have darker hair than Europoids. Thus the combination of darker pigmentation, lower nasal index, nasal concavity, prominent cheekbones and often Mongolic eyelidfold can be real in these two local Bulgarian populations. We also do not know the exact place of their origin before the migration first in Bessarabia and then to Taurian province and what bottle neck and founder effects happened during their migrations. We only know that they originate from Eastern Bulgaria and all other samples except one, the Gagauzes, originate from more western regions. But exactly the Gagauzes are the second closest sample to Melitopol Bulgarians (after the Crimean Bulgarians). Thus the reasons of the specifity of these samples and if it is real remain unclear.

Conclusion

The results of the comparative anthropological characterization of 20 local Bulgarian samples show that they can be divided into two major groups (clusters), each of which with two subclusters. The first cluster includes populations with Centraleuropean characteristics – a combination of Nordic, Armenoid (Balkano-Caucasian) and Lapponoid (Uralo-Lapponoid) elements. The second cluster includes population with the typical Atlanto-Mediterranian (Atlanto-Pontic) combination of Nordic and Mediterranian elements. The subclusters of the first cluster differ on the basis of predominance of Armenoid or Lapponoid elements, the subclusters of the second cluster – on the more expressed Nordic or Mediterranian traits. The first group of population spreads mostly in Northern Bulgaria and the second – in South Bulgaria. Two samples (Melitopol Bulgarians and Crimean Bulgarians) remain outside the two main groups but the reason of this is unclear.

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Table 1. Basic anthropological traits in Bulgarian populations

Sample	N	Height, cm	Head length, mm	Head breadth, mm	Cephalic index, %		Face breadth, mm	Face height, mm	Facial index, %	Nose height, mm	Nose breadth, mm	Nasal index, %	Eye color	Hair color	Nasal profile
					mean	SD									
Balkandzhis	126	168,5	186,0	157,0	84,5	3,5	139,8	126,0	86,7	57,8	33,7	64,3	6,5	49,8	68,5
North Bulgaria	226	172,6	183,8	156,1	85,0	3,9	142,0	123,0	86,7	58,3	36,2	62,3	6,7	51,3	60,5
Turks (Midle North Bulg.)	23	165,0	180,1	151,7	84,3	4,2	137,6	124,4	90,5	58,1	35,7	61,7	7,6	52,6	67,4
Pirdop	38	170,5	187,3	152,0	81,2	3,4	141,6	122,4	86,5	56,6	36,4	64,7	7,9	46,2	-
Orhanie	37	170,7	187,5	155,0	82,7	3,5	141,8	120,8	85,3	55,8	36,5	65,8	7,7	45,7	-
Sofia-east	62	169,6	184,5	153,1	83,1	3,9	142,1	121,1	85,3	55,3	36,6	66,4	7,4	45,3	-
Gagauzes	112	167,3	185,0	153,4	82,9	3,4	140,8	123,5	87,8	55,2	36,5	66,6	7,3	51,3	67,5
Kjustendil	64	169,6	187,8	152,9	81,5	3,3	139,5	120,0	86,1	55,0	35,5	64,8	8,2	43,4	-
Samokov	49	171,0	184,1	152,3	83,0	3,3	140,6	118,5	84,3	54,0	35,7	66,5	7,9	43,3	-
Tryn	53	170,4	191,6	149,5	78,1	3,1	139,3	123,2	88,6	55,9	36,2	65,0	7,3	45,8	-
Pomaks (North Bulg.)	23	167,4	184,1	147,9	80,4	3,2	139,5	124,0	88,9	59,6	38,1	64,3	9,2	47,2	73,3
South Bulgaria	12	171,1	186,0	150,9	81,2	2,6	138,0	122,3	88,7	56,1	36,7	65,9	7,8	48,3	54,6
Panagjurishte	19	168,2	190	148,7	78,4	3,6	137,0	118,8	86,8	55,1	35,6	65,0	8,3	41,1	-
Dupnica	60	168,8	189,7	148,7	78,4	2,9	138,1	118,6	85,9	53,8	35,3	66,0	7,3	43,7	-
Caribrod	67	168,7	190,1	149,8	78,9	3,1	138,9	121,5	87,5	55,4	35,7	64,8	8,0	43,8	-
Radomir	52	171,1	191,3	151,0	79,0	2,9	140,0	122,9	87,9	55,8	36,2	65,1	7,2	48,3	-
Plovdiv	74	168,6	188,7	147,0	78,0	3,7	135,8	119,3	87,9	54,1	35,1	65,2	7,0	46,3	-
Sofia-west	26	170,4	191,1	149,1	78,1	3,7	139,0	122,1	87,9	55,9	36,6	65,8	7,1	48,5	-
Melitopol Bulgarians	356	168,6	189,0	152,8	81,0	3,3	142,0	123,8	87,2	52,2	35,9	69,4	5,7	51,3	52,9
Crimean Bulgarians	162	168,8	192,2	150,0	78,1	3,3	140,0	121,7	87,0	51,0	37,4	73,7	5,6	54,9	48,7

Remarks: Eye color has been given after Martin, hair color - after Michalski (10-light blond, 20-blond, 30-dark blond, 40-blond-chatain (light brown), 50 – chatain (brown), 60 – dark brown (brown-black), 70 black, nasal profile also after Michalski (10 strongly concaved, 20 – concaved, 30 slightly concaved, 40 cancave-wavy, 50 – wavy, 60- straight, 70 wavy-convex, 80 – slightly convex, 90 – convex, 100 – strongly convex.

Table 2. Elementary anthropological structure after Michalski (in %)

	Anthropological element, %										Eastern complex, %	Southern complex, %	formula
Sample	a	y	b	e	u	h	l	m	z	q			
Balkandzhis	29,8	3,0	0,6	11,3	3,2	27,4	22,0	1,2	0,2	1,4	24,8	56,5	ahl(e)
North Bulgaria	31,2	0,6	0,9	6,1	6,7	27,3	14,2	8,1	3,3	2,0	27,6	56,6	ah(l)
Turks (Midle North Bulg.)	27,2	-	-	10,9	5,4	23,9	12,0	6,5	3,3	10,9	32,7	59,7	ah(le=q)
Pirdop	30,9	9,2	1,3	15,8	7,9	21,7	9,9	-	-	3,3	13,2	69,0	ah(e)
Orhanie	41,2	0,7	5,4	12,8	-	16,9	21,6	-	-	1,4	23,0	45,6	al(he)
Sofia-east	36,7	6,0	2,4	10,5	4,8	13,3	22,6	0,8	-	2,8	26,2	42,0	al(he)
Gagauzes	31,9	2,5	2,3	10,3	6,9	18,8	21,6	0,7	0,9	4,1	27,3	52,7	al(he)
Kjustendil	42,2	8,2	1,2	16,0	3,1	11,7	16,0	-	-	1,6	17,6	38,8	a(l=eh)
Samokov	39,3	4,1	1,0	13,3	3,6	7,1	29,6	-	-	2,0	31,6	36,5	al(e)
Tryn	38,2	7,1	2,8	20,8	12,3	4,7	4,7	-	-	9,4	14,1	47,3	ae(k)
Pomaks (North Bulg.)	44,6	1,1	3,3	16,3	8,7	5,4	8,7	-	3,3	8,7	20,7	42,5	a(e0
South Bulgaria	35,4	-	-	14,6	12,5	6,2	8,3	8,3	8,3	6,2	31,1	48,3	a(ek)
Panagjurishte	39,5	15,8	-	17,1	6,6	2,6	10,5	-	3,9	3,9	18,3	32,2	a(eyl)
Dupnica	35,4	8,8	8,3	27,1	4,6	4,2	9,6	-	-	2,1	11,7	50,1	ae
Caribrod	37,3	7,5	4,1	25,0	11,6	5,2	8,2	-	-	1,1	9,3	50,6	ae(k)
Radomir	27,4	4,8	5,3	29,8	11,5	13,5	4,8	-	-	2,9	7,7	59,4	ea(hk)
Plovdiv	29,7	4,7	2,4	28,4	15,5	5,4	12,2	-	-	1,7	13,9	60,0	ae(kl)
Sofia-west	29,8	1,0	12,5	21,2	13,5	4,8	9,6	-	-	7,7	17,3	62,9	ae(kb)
Melitopol Bulgarians	18,3	4,1	0,6	18,3	13,2	13,0	22,3	2,0	1,8	6,5	32,6	66,9	l(a=ekh)
Crimean Bulgarians	13,3	6,2	4,9	20,4	12,2	4,0	17,4	3,2	0,8	17,6	39,0	68,0	e(qlak)

Remarks: The anthropological elements after Michalski (in brackets – synonyms, used by other anthropologists) – a – Nordic (Atlanto-Baltic), y – Cromagnoid (Dalish, Falish), b – berberic (Mediterranoid), e – Mediterranean (Ibero-Insular), k – Oriental (Eastern Mediterranean, Indo-Afgan), h – Armenoid (Balkano-Caucasian), l – Lapponoid, m – Mongolian, z – Pacific, q – Highland (Uralic, Sudetic, Tibetan).

Table 3. Euclidean distances between the samples under study (matrix of Czekanowski)

	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Balkandzhis	**0**																			
2	North Bulgaria	**12,9**	**0**																		
3	Turks (Midle North Bulg.)	**16,2**	**11,8**	**0**																	
4	Pirdop	**16,3**	**17,3**	**15,8**	**0**																
5	Orhanie	**16,8**	21,2	23,3	20,7	**0**															
6	Sofia-east	**16,3**	20,4	21,6	**17,8**	**10,1**	**0**														
7	Gagauzes	**10,2**	**14,7**	**15,5**	**15,0**	**12,9**	**8,6**	**0**													
8	Kjustendil	22,1	24,8	25,1	**17,1**	**12,4**	**10,9**	**16,6**	**0**												
9	Samokov	23,8	29,3	30,0	26,9	**14,4**	**10,5**	**16,9**	**15,5**	0											
10	Tryn	33,8	32,8	28,3	21,4	27,8	24,6	26,7	**19,1**	28,7	**0**										
11	Pomaks (North Bulg.)	31,8	30,2	27,5	23,8	21,6	20,9	24,0	**15,7**	23,9	**11,8**	**0**									
12	South Bulgaria	30,2	25,4	22,6	22,8	26,0	22,6	22,9	21,3	26,9	**16,4**	**14,7**	0								
13	Panagjurishte	32,7	33,4	31,4	22,4	25,9	20,8	26,1	14,6	23,8	**14,7**	**17,1**	20,5	**0**							
14	Dupnica	32,7	34,9	31,6	22,7	25,3	23,9	27,2	17,9	26,3	**14,8**	**19,0**	22,9	**16,1**	**0**						
15	Caribrod	32,1	32,8	30,4	20,7	25,8	23,2	25,9	17,0	26,2	**10,1**	**15,8**	**18,7**	**14,6**	**9,0**	**0**					
16	Radomir	30,6	31,5	26,9	18,7	30,4	28,8	27,4	25,3	33,9	**18,2**	25,1	23,7	25,5	**15,9**	**14,6**	**0**				
17	Plovdiv	32,1	34,0	30,4	22,6	29,4	25,6	26,2	23,1	27,8	**16,2**	22,4	20,8	21,5	**14,6**	**10,6**	**12,4**	**0**			
18	Sofia-west	32,5	32,4	27,7	23,6	27,6	25,1	25,0	24,4	28,8	**15,2**	**19,1**	**19,4**	23,9	**16,0**	**15,3**	**16,5**	**14,6**	0		
19	Melitopol Bulgarians	22,8	26,4	21,9	21,6	28,5	22,3	**18,3**	27,7	26,0	28,5	31,4	25,5	29,9	28,1	27,0	23,8	20,8	23,0	0	
20	Crimean Bulgarians	36,1	37,8	29,6	30,9	38,4	32,3	30,4	35,8	35,1	29,4	34,8	29,7	33,2	30,4	31,1	27,7	25,4	23,0	**16,8**	0

Remarks: Small distances (under 20) are marked in bold.

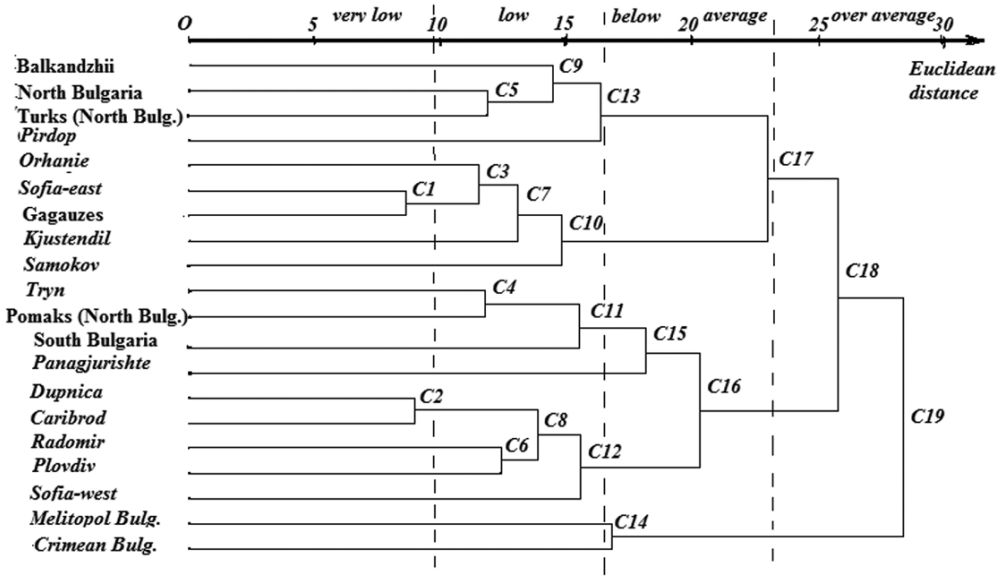

Fig. 1. Cluster analysis of the subsamples under study – Euclidean distances, unweighted pair group method of analysis (UPGMA)

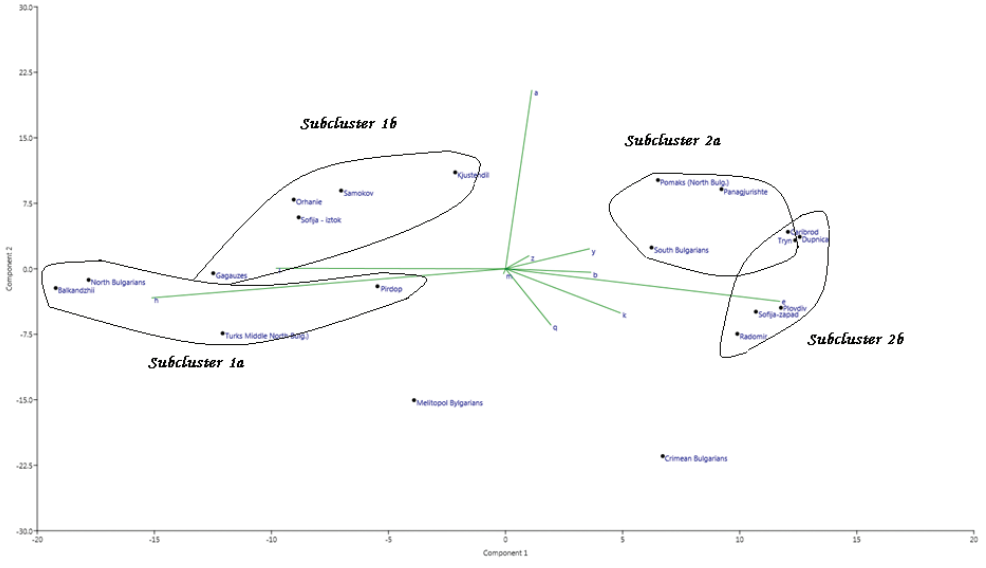

Fig. 2. Principal component analysis on the samples under study

Table 4. Basic anthropological traits in Bulgarian populations by clusters

Cluster/sample	N	Height, cm	Head length, mm	Head breadth, mm	Cephalic index, %		Face breadth, mm	Face height, mm	Facial index, %	Nose height, mm	Nose breadth, mm	Nasal index, %	Eye color	Hair color	Nasal profile
					mean	SD									
1a	413	170,7	184,6	155,8	84,5	3,9	141,0	123,9	86,9	58,0	35,4	63,1	6,8	50,4	(63,6)
1b	324	169,1	185,6	153,3	82,7	3,5	140,9	121,3	86,2	55,1	36,2	66,1	7,6	46,7	(67,5)
2a	107	169,4	189,1	149,2	79,0	3,3	138,8	122,5	88,4	56,6	36,6	65,0	7,9	45,5	(66,9)
2b	279	169,3	190,0	149,0	78,5	3,3	138,1	120,6	87,4	54,8	35,6	65,3	7,4	45,7	-
Melitopol Bulgarians	356	168,6	189,0	152,8	81,0	3,3	142,0	123,8	87,2	52,2	35,9	69,4	5,7	51,3	52,9
Crimean Bulgarians	162	168,8	192,2	150,0	78,1	3,3	140,0	121,7	87,0	51,0	37,4	73,7	5,6	54,9	48,7

Table 5. Elementary anthropological structure after Michalski by clusters (in %)

	Anthropological element, %										Eastern complex, %	Southern complex, %	formula
Sample	a	y	b	e	k	h	l	m	z	q			
1a	30,5	2,1	0,8	8,8	5,7	26,6	16,1	5,2	2,1	2,4	25,8	56,5	ah(l)
1b	37,0	4,3	2,3	12,2	4,5	14,4	21,9	0,4	0,3	2,7	25,3	44,7	al(he)
2a	39,5	6,6	2,1	18,5	10,5	4,6	7,0	0,9	2,3	7,9	18,1	43,6	a(ek)
2b	32,3	5,9	5,6	26,9	11,3	6,5	9,1	-	-	2,4	11,5	56,8	ae(k)
Melitopol Bulgarians	18,3	4,1	0,6	18,3	13,2	13,0	22,3	2,0	1,8	6,5	32,6	66,9	l(a=ekh)
Crimean Bulgarians	13,3	6,2	4,9	20,4	12,2	4,0	17,4	3,2	0,8	17,6	39,0	68,0	e(qlak)

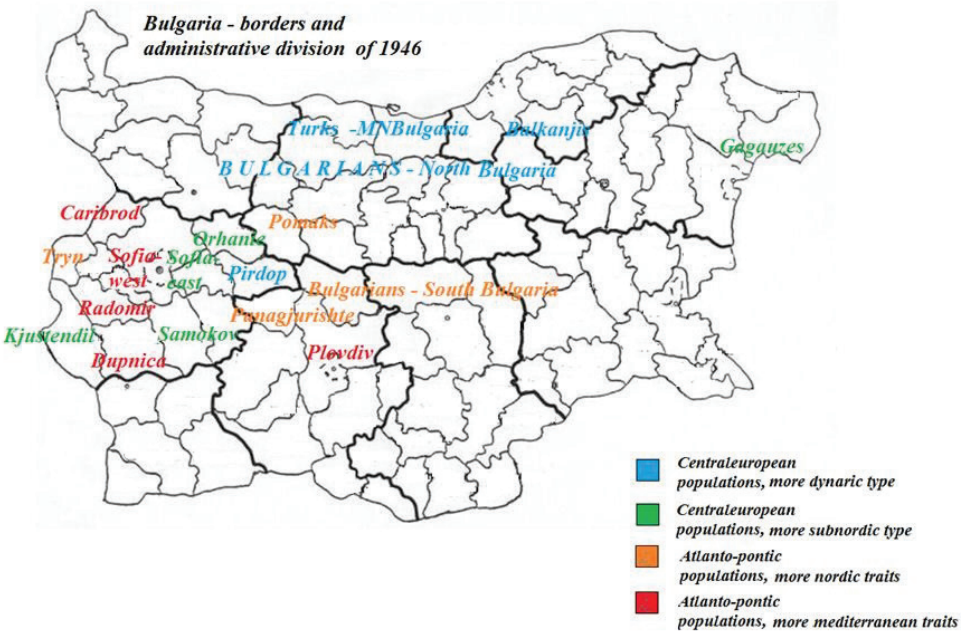

Fig. 3. Geographic distribution of the analysed samples (Melitopol Bulgarians and Crimean Bulgarians excluded)