

Dermatoglyphics in Bulgarians – Palm Main Lines

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The aim of the present work is to give detailed characteristics of main lines in representative group of healthy Bulgarians from both sexes (1161 males, 1270 females), at the age of 30-40 years from 116 settlements. Data about frequency of DCBA-termination, their types and principle formulae are presented. Bilateral and intersexual differences are studied, as well. The bilateral differences prevail over the intersexual ones. Most frequent are: on the right hand – type 11(+12+13) of line D, type 9(+10+11+12+13) of line C, type 6(+7+8+9) of line B; on the left hand – type 9(+10) of line D, type 4(+5'+5''+6+7) of line C, type 3(+4+5'+5'') of line B. Only about line A, the types are identical both in right and left – type 3(+4). The formula 11.9.7 is typical for right hands, and 9.7.5 for left ones in both sexes.

Key words: dermatoglyphics, main lines (frequency, types, formulae), healthy Bulgarians.

The main lines' running and termination in the different palm areas is a part of the dermatoglyphic characterization of the individual. There are scanty data about main line characteristics in Bulgaria. The publications about main line running and termination are mainly in ethnical aspect [11, 12], or they are about control groups of healthy Bulgarian population in some dermatoglyphic investigations of patients with different diseases [13, 14]. On the one hand, representative dermatoglyphic data about palmar main lines of the Bulgarian population are lacking, and on the other hand, their complete dermatoglyphical characterization is missing, too.

Material and Methods

The aim of the present work is to give detailed dermatoglyphic characteristics of the palmar main lines in Bulgarians, as well as to investigate the bilateral and the intersexual differences.

The material used in this study consists of dermatoglyphic handprints of 2431 clinically healthy Bulgarians from both sexes (1161 males and 1270 females) at the age of 30-40 years from 116 settlements in Bulgaria.

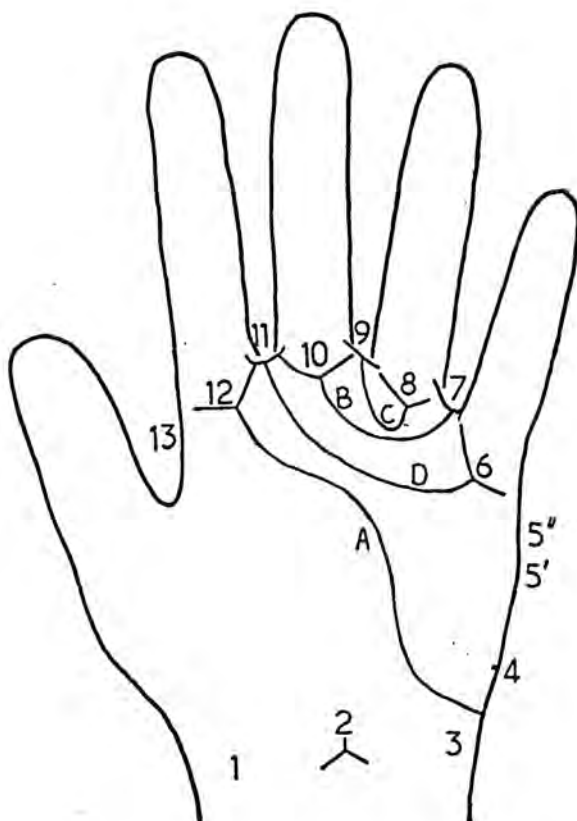


Fig. 1. Scheme of main lines and mainline positions

The main lines ABCD are the proximal radiants of the four finger triradii "a", "b", "c", "d" at the basis of II — V digits. The tracing of the palmar main lines is made by the methods of C u m m i n s, M i d l o [1] and P e n r o s e [4]. The periphery of the palm is divided conditionally into 14 areas starting from Thenar (area 1), and ending in the first inter-digital area (IA)(area 13)(Fig. 1). The area 5 is divided into area 5' and area 5''. The border between them is the proximal flexion crease. The main lines' termination is put down opposite to the alphabetic order DCBA like a formula, in which the numbers pointed out the corresponding position around the periphery of the palm. In the investigation are studied the frequency of main lines termination on separate palm areas, the modal types of main lines, and the principle main-line formulae. The bilateral and the intersexual differences are studied by the *T*-criterion of Student.

Results

The frequency of main lines DCBA in different positions on the palm are given in the tables 1 and 2 respectively for males and females, and for both hands separately.

Table 1. Termination of the main lines in male (%)

Position	Main line							
	D		C		B		A	
	right	left	right	left	right	left	right	left
1							4.53±0.62*	9.15±0.85*
2							1.74±0.38	1.99±0.41
3						0.26±0.15	54.58±1.47	50.60±1.47
4				0.09±0.09	0.17±0.12	0.09±0.09	7.15±0.76	7.25±0.76
5'			0.26±0.15	0.17±0.12	7.23±0.76	8.26±0.81	26.76±1.31	27.72±1.32
5''		0.26±0.15	7.87±0.79	12.75±0.98	28.05±1.32*	53.61±1.46*	4.45±0.61	3.20±0.52
6			2.07±0.42	1.89±0.40	1.55±0.36	2.75±0.48	0.35±0.17	
7	8.98±0.84*	13.41±1.00*	18.50±1.14*	33.50±1.38*	57.05±1.45*	34.34±1.39*	0.44±0.20	0.09±0.09
8	1.73±0.38	2.08±0.42	0.09±0.09		4.65±0.62	0.43±0.19		
9	24.01±1.26*	47.32±1.47*	55.23±1.46*	29.46±1.34*	0.95±0.28			
10	3.71±0.56	5.19±0.65	4.58±0.61	0.26±0.15				
11	61.14±1.43*	31.57±1.37*	0.86±0.27					
12	0.09±0.09							
13	0.34±0.17							
X			7.52±0.78*	15.16±1.05*	0.09±0.09			
O		0.17±0.12	3.02±0.50*	6.72±0.73*	0.26±0.15	0.26±0.14		

*P < 0.05 (right/left)

Table 2. Termination of the main lines in female (%)

Position	Main line							
	D		C		B		A	
	right	left	right	left	right	left	right	left
1							5.32±0.63	7.91±0.76
2							2.46±0.44	4.15±0.56
3					0.08±0.08	0.24±0.14	49.88±1.41	51.51±1.41
4					0.08±0.08	0.08±0.08	2.94±0.48	3.04±0.48
5'				0.24±0.14	3.47±0.51	5.61±0.65	36.78±1.36	31.63±1.31
5''		0.08±0.08	8.22±0.77*	15.99±1.03*	32.49±1.32*	54.30±1.40*	2.46±0.44	1.76±0.37
6			1.90±0.38	1.03±0.28	1.58±0.35	3.48±0.52	0.08±0.08	
7	8.79±0.80*	17.14±1.06*	21.50±1.16*	30.72±1.30*	58.28±1.38*	35.49±1.34*	0.08±0.08	
8	1.90±0.38	1.27±0.32	0.08±0.08		2.99±0.48	0.40±0.18		
9	25.50±1.23*	42.30±1.39*	53.12±1.40*	31.35±1.30*	0.71±0.24	0.08±0.08		
10	2.45±0.44	3.65±0.53	2.85±0.47	0.24±0.14				
11	61.12±1.37*	35.32±1.35*	0.47±0.19			0.08±0.08		
12	0.16±0.11							
13	0.08±0.08							
X		0.08±0.08	7.35±0.73*	13.30±0.96*				
O		0.16±0.11	4.51±0.58*	7.13±0.72*	0.32±0.16	0.24±0.14		

* $P < 0.05$ (right/left)

Line D

This line terminates most often in position 11(61.14%) for males in right, followed by position 9(24.01%). In left the ratio is opposite — highest is the frequency of termination for line D in position 9(47.32%), and in second place — position 11(31.57%). As unusual terminations can be noted: the termination of line D on the right palm in position 12(0.09%), and on four palms in area 13(0.34%)(Fig. 4a). In two palms in left, the triradius "d" is missing, and the main line D is missing too (0.17%). The bilateral differences are good expressed. In right, the D-line termination is more frequent in area 11, and in left it is in areas 9 and 7 ($P < 0.01$)(Table 1, Fig. 2).

In females line D terminates most frequently in position 11(61.12%) in right, and in second place in position 9(25.50%). In left it terminates most frequently in position 9(42.30%), followed by position 11(35.32%). It strikes that both in males and females the difference between frequencies of D-line termination in positions 11 minus 9 in right is very big ($\sigma - 37.13\%$, $\text{♀} - 35.62\%$), while in left this difference is comparatively small ($\sigma - 15.75\%$, $\text{♀} - 6.98\%$). An unusual D-line termination (in position 12 — 0.16%, and in area 13 — 0.08%) is established in females, as well. Absence of triradius "d" and respectively of line D is founded on two palms, as well as, a reduction of D-line — on one palm (Fig. 4-b). The differences of the frequencies for areas 11, 9 and 7 between right and left hand are statistically significant ($P < 0.01$)(Table 2, Fig. 2).

Line C

The line C terminates in males at areas 5' to 11 on the right hand, and at areas from 4 to 10 — on the left one. In right the termination maximum is in position 9(55.23%), and on the second place, but considerably lower is the termination in position 7(18.50%). In left, most frequently line C terminates in position 7(33.50%), but for line C as for line D, the difference between the termination frequency in areas 7 minus 9 is small — only 4.04%, while on the right hands it is — 36.73% (Table 1, Fig. 2).

In females the termination range for line C includes the areas 5" — 11 in right, and 5' — 10 in left. Most frequent is the termination in right and left on position 9, followed by position 7. A big difference in the frequency between position 9(53.12%) and position 7(21.50%) in right hand and their close values in left (position 9 — 31.35%, position 7 — 30.72%) are observed. (Table 2, Fig. 2).

Line C is the one with most frequent abortive form (X), and absence of triradius "c", as well as, the lack of line C (O). The abortive form of the line C, and its absence are nearly twice more frequent in left hand compared with right one, both in males and females ($P < 0.05$)(Fig. 4-c, Fig. 4-d).

Line B

In males, line B terminates on areas from 4 to 10 in right, and on areas from 3 to 8 in left. In right most frequently line B terminates in position 7(57.05%), followed by position 5"(28.05%). It is quite the opposite in left: the B-line termination is most frequent in position 5"(53.61%), followed by position 7(34.34%). The difference in the termination frequencies of line B in positions 5" minus 7 is smaller in left (19.27%), and higher — in right (29.00%), as it is for lines D and C. The bilateral differences are well expressed ($P < 0.05$)(Table 1, Fig. 3).

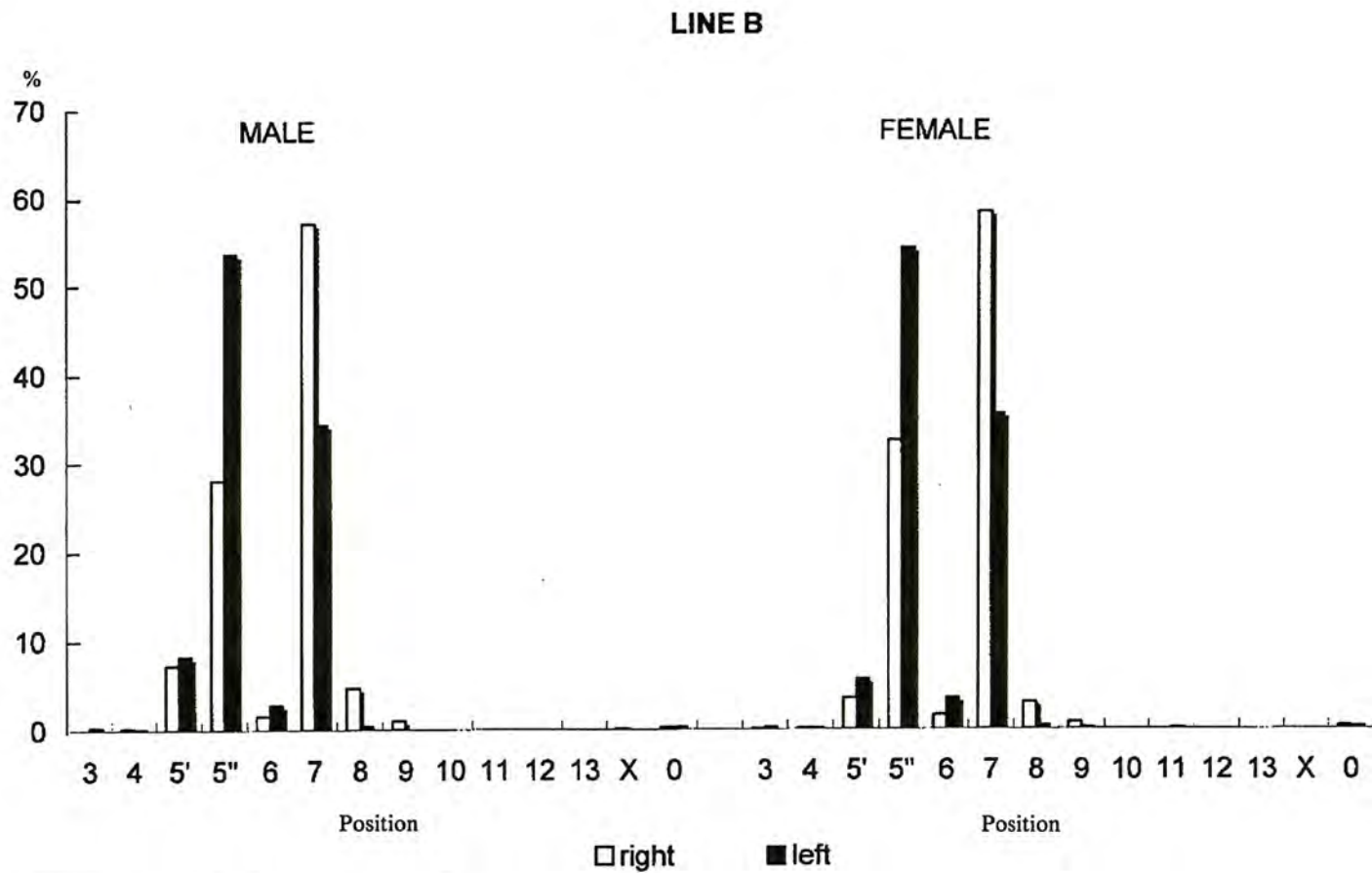


Fig. 3. Termination of the main lines B and A

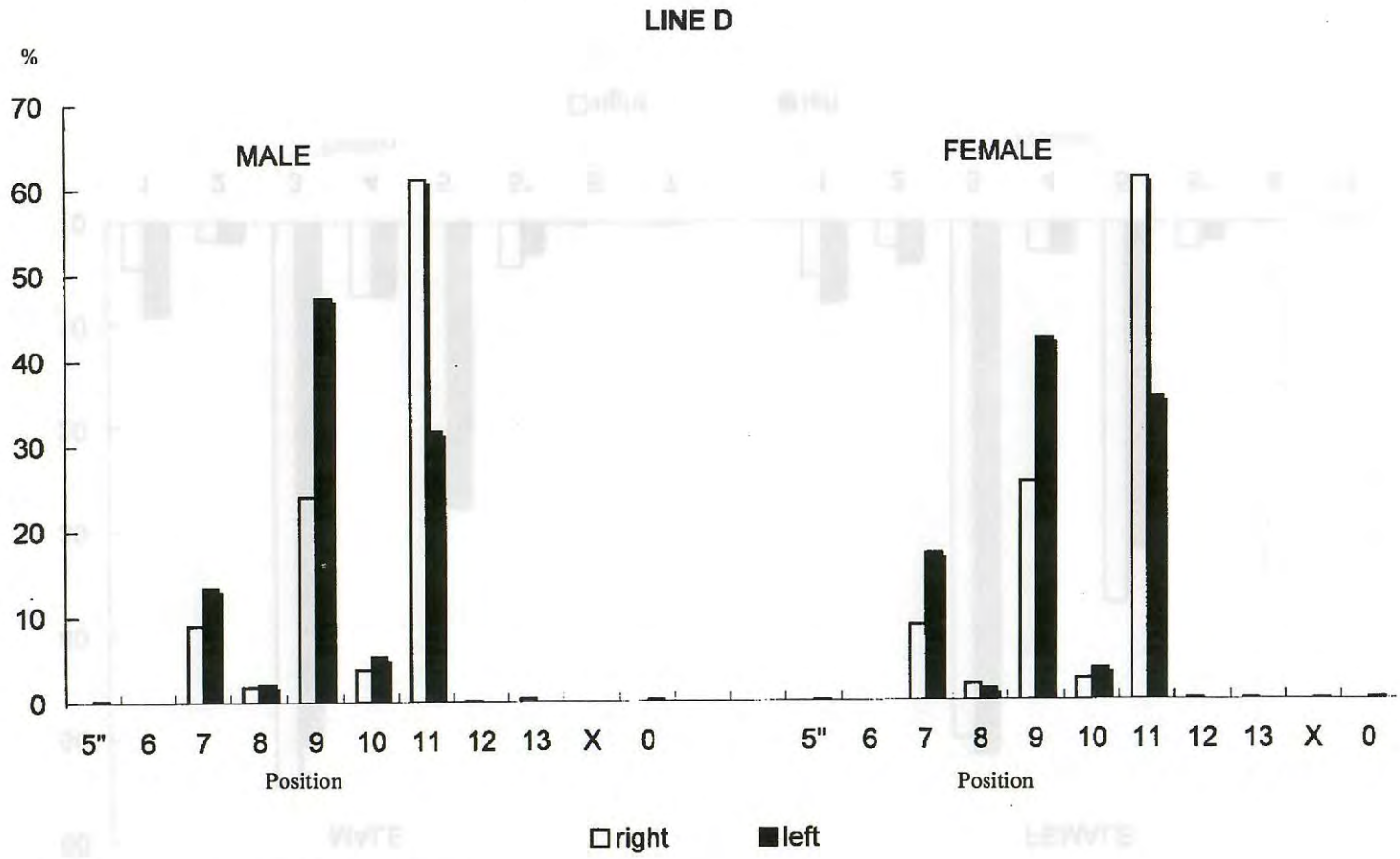
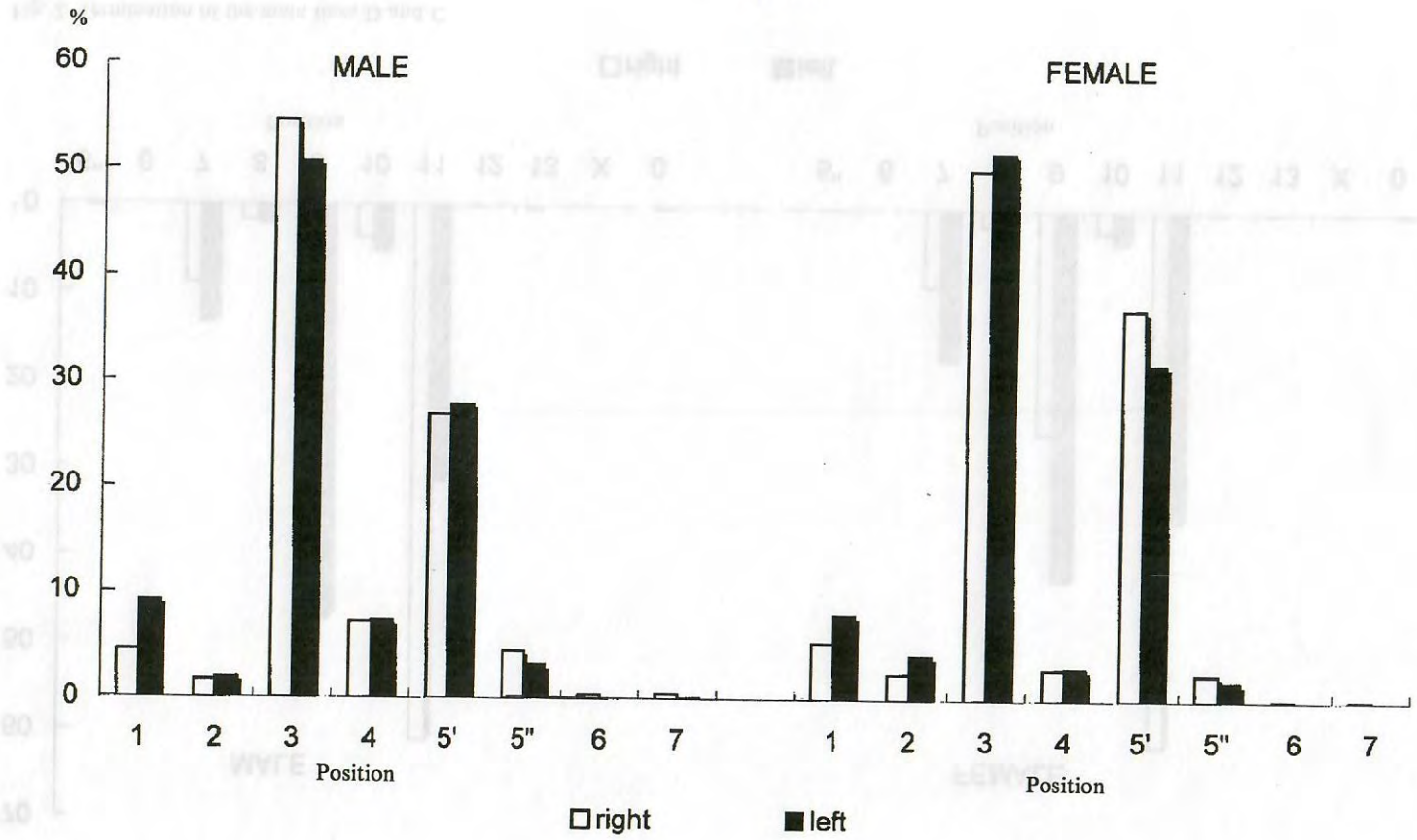


Fig. 2. Termination of the main lines D and C

LINE A



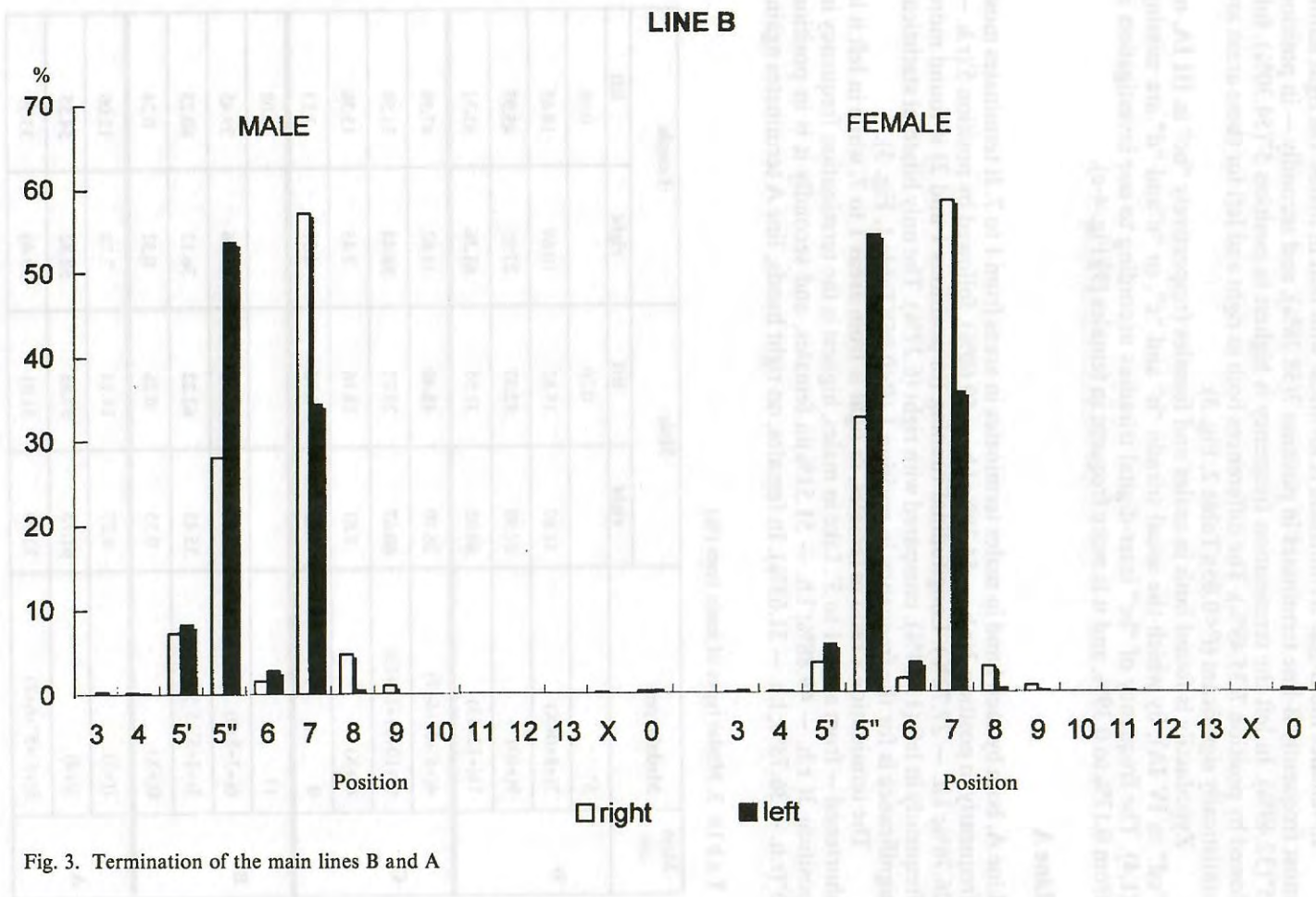


Fig. 3. Termination of the main lines B and A

In females the B-line termination is identical with that in males. On right hands most frequently B-line terminates in position 7(58.28%), and secondly — in position 5”(32.49%). In left the termination frequency is highest in position 5”(54.30%), followed by position 7(35.49%). The differences both in right and left for these areas are statistically significant ($P < 0.05$)(Table 2, Fig. 3).

Zygodactily is found both in males and females (respectively “bc” in III IA, or “cd” in IV IA), by which the usual triradii “b” and “c”, or “c” and “d” are missing (1,4). The frequency of “bc” inter-digital triradius according to our investigation is from 0.17% to 0.39%, and it is more frequent in females [9](Fig. 4-e).

Line A

Line A, both by each hand in males terminates in areas from 1 to 7. It terminates most frequently in position 3(r.h. — 54.38%; l.h. — 50.60%), followed by position 5”(r.h. — 26.76%; l.h. — 27.72%). Longitudinal running (in positions 1 and 2) is found more frequently in left (11.14%), compared with right (6.27%). The only bilateral statistical significance is for the frequency in position 1 ($P < 0.05$)(Table 1, Fig. 3).

The termination’s ratio in females, in right is from areas 1 to 7, while in left it is shortened — from areas 1 to 5’. Like in males, highest is the termination frequency in position 3(r.h. — 49.88%; l.h. — 51.51%)in females, and secondly it is in position 5”(r.h. — 36.78%; l.h. — 31.63%). In females, on right hands, line A terminates again,

T a b l e 3. Modal types of main lines (%)

Main line	Modal types	Male		Female	
		right	left	right	left
D	5”		0.26		0.08
	7(+8+0+X)	11.07	15.82	10.69	18.65
	9(+10)	27.98	52.37	27.95	45.95
	11(+12+13)	60.95	31.55	61.36	35.32
C	4(+5'+5"+6+7)	28.70	48.40	31.62	47.98
	9(+10+11+12+13)	60.67	29.72	56.44	31.59
	8(+X)	7.61	15.16	7.43	13.30
	0	3.02	6.72	4.51	7.13
B	11				0.08
	6(+7+8+9)	64.20	37.52	63.56	39.45
	3(+4+5'+5"')	35.45	62.22	36.12	60.23
	0(+X)	0.35	0.26	0.32	0.24
A	1(+2)	6.27	11.14	7.78	12.06
	3(+4)	61.73	57.85	52.82	54.55
	5(+5'+5"+6+7)	32.00	31.01	39.40	33.39

Table 4. Principal main line formulae (%)

Formula	Male		Female	
	right	left	right	left
11.10.8.	4.60	0.26	3.01	0.24
11.9.7.	43.87	13.36	45.12	17.06
11.7.7.	4.34	7.37	3.81	7.94
11.X.7.	4.60	8.50	5.31	6.82
11.0.7.	1.39	2.08	2.70	2.62
9.9.5.	7.38	13.10	5.79	11.59
9.7.5.	12.60	23.07	16.18	20.63
9.X.5.	2.43	5.38	1.51	5.24
9.0.5.	1.30	3.99	1.51	4.05
7.5.5.	7.91	12.75	7.93	16.03
other combinations	9.58	10.14	7.13	7.78

more frequently longitudinally (positions 1 and 2): r.h. — 7.78%; l.h. — 12.06%. For line A termination, the bilateral differences are missing (Tabl. 2, Fig. 3).

The comparison between data in tables 1 and 2 (for both sexes, respectively) shows that significant intersexual differences are missing, with the exception of those for line A in areas 4 and 5'.

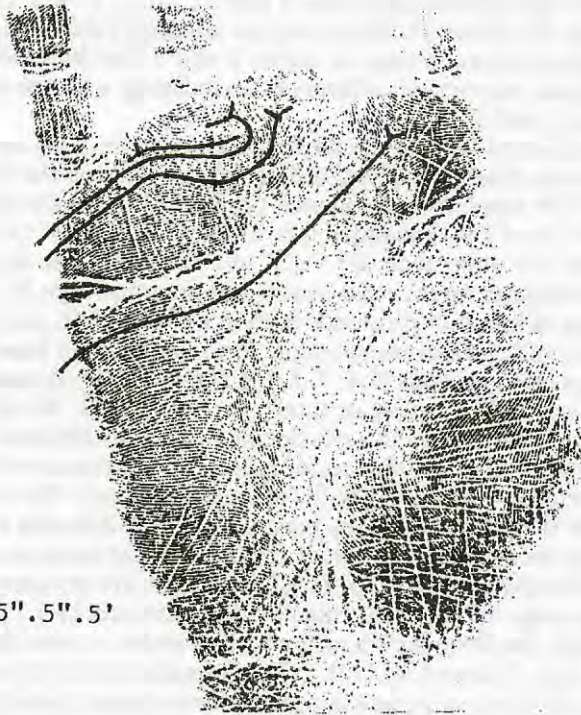
As it was mentioned before, the modal types of main lines are investigated too (Table 3). It is obvious, that the bilateral differences prevail over the intersexual ones. In both sexes on the right hand, most frequent is type 11(+12+13) for line D, and in left — type 9(+10) for the same line. The radial type of line C 9(+10+11+12+13) is more frequent in right, and the ulnar type 4(+5'+5''+6+7) in left. The distal type of line B 6(+7+8+9) predominates on the right hands, and the ulnar type 3(+4+5'+5'') on left ones. Only the type of line A corresponds both in right and left, and it is type 3(+4).

The frequency of the different principle formulae of main lines is studied also in some of the foreign investigations [3, 6, 7, 8, 10]. But in these publications, the data are discussed mainly in ethnical aspect, or totally for both hands. We determined the frequency of main lines formulae, as well. Because of the established by us significant bilateral differences of the main line termination, the frequency of the principle formulae are given in table 4 separately both for hands and sexes. We restrict to formulae including only the three lines DCB, by reason of the big diversity of A-line termination in the different palm areas. Commonly 64 different formulae are established (♂ — 56, ♀ — 45). The frequencies of 10 principle formulae are presented in the Table 4. Obviously in both sexes, in right most frequent is the formula 11.9.7 (Fig. 4-f), followed by 9.7.5, and in left, the frequency is in the reverse order — most frequent is the formula 9.7.5 (Fig. 4-g), followed by 11.9.7. The formulae 13.9.7 (5 palms totally) and 12.9.7 (3 palms) can be given as an example for uncommon formulae.



13.9.7.11-7

a



X.5".5".5'

b

Fig. 4



11.X.7.3



11.0.7.5'

d

Fig. 4

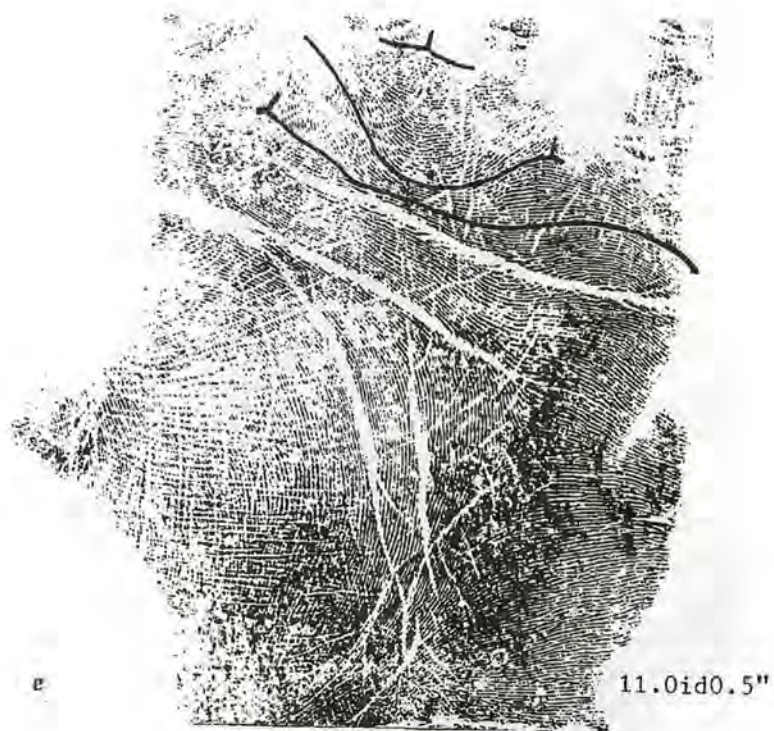


Fig. 4



Fig. 4. Examples of different mainline formulae

The comparison between our data and the data of foreign authors [2, 5, 8] about European populations shows that the tendencies in the distribution of main lines termination are the same. The published data for 287 Bulgarians from Middle North Bulgaria [12] could not be compared with ours, since they are totally for both sexes, and the methods are different. The results obtained by us showed a coincidence with the data of Karev [11] in his investigation of individuals from Northeast Bulgaria, excepting the data for main line A. According to our results, line A terminates most frequently in area 3, but in his study the line runs more transversal and terminates in area 5'. According to the results obtained by us for the type of line C, the data are analogous with those of the author. But to our regret, data about the types of the other main lines are missing.

The characterization presented by us about main lines' running and termination in different palm areas for a representative Bulgarian population from both sexes supplements their entire dermatoglyphical status.

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