



TABLE 1. Allele frequencies for 23 autosomal STR loci in Polish population

Allele	CSF1PO	D10S1248	D12S391	D13S317	D16S539	D18S51	D19S433	D151656	D21S11	D22S1045	D251338	D25441	D3S1358	D5S818	D7S820	D8S1179	FGA	Penta D	Penta E	SE33	TH01	TPOX	VWA	
4					0.0005																			
5														0.0005					0.0700			0.0010		
6																			0.0010			0.2287	0.0005	
7	0.0005													0.0038	0.0144			0.0048	0.1558			0.1323		
7.3																						0.0005		
8	0.0014	0.0005		0.1366	0.0105						0.0005		0.0034	0.1510	0.0072			0.0081	0.0101	0.0005		0.1007	0.5738	
9	0.0398			0.0839	0.0906		0.0005				0.0005		0.0523	0.1395	0.0120			0.2435	0.0192			0.1937	0.0858	
9.1															0.0005									
9.3															0.0010							0.3341		
10	0.2872	0.0005		0.0508	0.0441	0.0086	0.0005	0.0014			0.2196		0.0877	0.2963	0.0719			0.1347	0.1184			0.0086	0.0671	
10.1															0.0005									
11	0.2709	0.0038		0.3523	0.2876	0.0158	0.0014	0.1055	0.1481		0.3212	0.0034	0.3298	0.1970	0.0647			0.1630	0.0983			0.0005	0.2430	
11.3										0.0594														
12	0.3169	0.0249		0.2546	0.3337	0.0868	0.0882	0.1318	0.0273		0.0398		0.3605	0.1572	0.1783			0.1759	0.1385	0.0048		0.0297	0.0005	
12.1																						0.0005		
12.3											0.0024													
13	0.0662	0.2181		0.0791	0.1975	0.1103	0.2210	0.0580	0.0043	0.0005	0.0187	0.0048	0.1520	0.0307	0.3126			0.1908	0.1141	0.0115			0.0038	
13.1																								
13.2							0.0125													0.0010				
13.3																				0.0005				
13.4																			0.0010					
14	0.0129	0.3384	0.0005	0.0417	0.0345	0.1611	0.3437	0.0772	0.0537		0.2953	0.1246	0.0096	0.0105	0.2200			0.0594	0.0700	0.0326			0.1059	
14.2							0.0168															0.0034		
14.3								0.0019														0.0005		
15	0.0043	0.2387	0.0316	0.0005	0.0010	0.1548	0.1759	0.1246	0.3356	0.0014	0.0388	0.2368	0.0010	0.0010	0.1088			0.0153	0.0561	0.0355			0.1002	
15.2							0.0479															0.0010		
15.3								0.0527																

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16	0.1409	0.0221	0.0005	0.1630	0.0489	0.1064	0.3351	0.0431	0.0029	0.2507	0.0211	0.0034	0.0417	0.0479	0.1850									
16.2						0.0230														0.0005				
16.3						0.0417														0.0010				
17	0.0312	0.1136	0.1323	0.0048	0.0566	0.1965	0.0781	0.1965	0.2162	0.0029	0.0465	0.0729	0.2809											
17.1																				0.0005				
17.2						0.0038														0.0010				
17.3		0.0144				0.1520																		
18	0.0029	0.1874	0.0796	0.0010	0.0053	0.0158	0.0729	0.1553	0.0005	0.0125	0.0388	0.0614	0.2196											
18.2						0.0086																		
18.3		0.0192				0.0695														0.0005				
18.4																								
19	0.1064	0.1064	0.0436	0.0019	0.1381	0.0853	0.0153	0.0657	0.0877															
19.2						0.0014														0.0029				
19.3		0.0067				0.0144																		
20	0.1112	0.0259	0.1453	0.0005	0.0043	0.0599	0.0163																	
20.2						0.0010														0.0077				
20.3		0.0005				0.0010																		
21	0.1328	0.0096	0.1812	0.0005	0.0264	0.0010																		
21.1						0.0010														0.0010				
21.2						0.0029														0.0101				
21.3		0.0014																						
22	0.1208	0.0067	0.0244	0.0005	0.0062	0.0005	0.0062																	
22.2						0.0125														0.0364				
23	0.0829	0.0014	0.1155	0.0005	0.0014	0.0379																		
23.2						0.0062														0.0379				
24	0.0336	0.0005	0.1151	0.0005	0.0964																			
24.2						0.0024														0.0441				

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25			0.0129								0.1256						0.0729			0.0010			
25.2							0.0005													0.0479			
26			0.0010				0.0048				0.0254						0.0221			0.0503			
26.2																							
27			0.0010				0.0302				0.0024						0.0029						
27.2																					0.0724		
28							0.1793										0.0005			0.0820			
28.2							0.0005																
29							0.2085													0.0005			
29.2							0.0019													0.0566			
30							0.2148																
30.2							0.0609														0.0585		
31							0.0690																
31.2							0.0829														0.0235		
32							0.0115														0.0014		
32.2							0.0935														0.0129		
33							0.0010														0.0010		
33.1							0.0005																
33.2							0.0350														0.0048		
34																					0.0029		
34.2							0.0038														0.0043		
35							0.0005														0.0010		
35.2							0.0010														0.0010		
36																					0.0005		
36.2																					0.0010		

**TABLE 2. Statistical parameters of PowerPlex® Fusion 6C STR loci in the Polish population**

Locus	Alleles	Ho	He	PIC	PD	PE	MP	TPI	HWE
CSF1PO	9	0.7584	0.7376	0.69	0.8810	0.5242	0.1190	2.07	0.5332
D10S1248	10	0.7335	0.7594	0.72	0.9054	0.4819	0.0946	1.88	0.5812
D12S391	19	0.8754	0.8858	0.87	0.9755	0.7454	0.0245	4.01	0.0567
D13S317	9	0.7814	0.7748	0.74	0.9182	0.5650	0.0818	2.29	0.3965
D16S539	9	0.7747	0.7555	0.72	0.8987	0.5529	0.1013	2.22	0.4068
D18S51	15	0.8907	0.8770	0.86	0.9713	0.7765	0.0287	4.57	0.7559
D19S433	17	0.7756	0.7885	0.76	0.9292	0.5547	0.0708	2.23	0.7696
D1S1656	16	0.8993	0.8994	0.89	0.9809	0.7940	0.0191	4.97	1.0000
D21S11	19	0.8370	0.8518	0.84	0.9611	0.6694	0.0389	3.07	0.3891
D22S1045	9	0.7498	0.7432	0.70	0.8934	0.5094	0.1066	2.00	0.1171
D2S1338	14	0.8696	0.8784	0.87	0.9729	0.7339	0.0271	3.83	0.1018
D2S441	13	0.7766	0.7544	0.71	0.8940	0.5564	0.1060	2.24	0,00459*
D3S1358	9	0.8102	0.7946	0.76	0.9225	0.6180	0.0775	2.63	0.1836
D5S818	9	0.7239	0.7276	0.68	0.8772	0.4662	0.1228	1.81	0.1051
D7S820	13	0.7919	0.8052	0.78	0.9353	0.5842	0.0647	2.40	0.7030
D8S1179	11	0.7958	0.8002	0.77	0.9338	0.5912	0.0662	2.45	0.9928
FGA	16	0.8782	0.8576	0.84	0.9623	0.7512	0.0377	4.11	0.8451
Penta D	11	0.8226	0.8248	0.80	0.9456	0.6417	0.0544	2.82	0.4264
Penta E	20	0.9080	0.9008	0.89	0.9812	0.8117	0.0188	5.43	0.8223
SE33	50	0.9588	0.9484	0.95	0.9939	0.9162	0.0061	12.13	0.0663
TH01	9	0.7632	0.7708	0.74	0.9120	0.5326	0.0880	2.11	0.2005
TPOX	6	0.5973	0.5989	0.55	0.7887	0.2877	0.2113	1.24	0.2613
VWA	9	0.7891	0.8094	0.78	0.9383	0.5789	0.0617	2.37	0.4608
CPD	0.999999999999999								
CPE	0.9999999999967								
CMP	1.15E-29								

He – expected heterozygosity; Ho – observed heterozygosity; HWE – Hardy-Weinberg equilibrium; MP – matching probability; PD – power of discrimination; PE – power of exclusion; PIC – polymorphism information content; TPI – typical paternity index

\* Statistically not significant after Bonferroni's correction ( $0.05/23 = 0.0022$ ).

Hardy-Weinberg equilibrium (HWE) was checked with Arlequin v.3.5.2.2 [8]. Forstat [9] was used to obtain allele frequencies, observed (Ho), and expected (He) heterozygosity. Familias v.3.4 [10] was used to calculate Typical Paternity Index (TPI), Power of Exclusion (PE), Power of Discrimination (PD), and Polymorphism Information Content (PIC). Bonferroni correction was applied for multiple tests ( $0.05/23 = 0.0022$ ).

## RESULTS

PowerPlex® Fusion 6C allele frequency distributions in the studied Polish population are shown in Table 1, while the corresponding statistical parameters are presented in Table 2. All analyzed loci met Hardy-Weinberg equilibrium (HWE) after Bonferroni correction. The highest observed heterozygosity (Ho = 0.9588) and power of discrimination (PD = 0.9939) were

obtained for the SE33 locus, which also showed the greatest allelic diversity (50 variants). This locus also had the highest PIC (0.95) confirming its high polymorphic and heterozygotic character. High values were also observed for Penta E (Ho = 0.9079, PD = 0.9812), D1S1656 (Ho = 0.8993, PD = 0.9809), and D18S51 (Ho = 0.8907, PD = 0.9713). The lowest heterozygosity and discriminatory power were noted for TPOX (Ho = 0.5973, PD = 0.7887) and D5S818 (Ho = 0.7239, PD = 0.8772), which exhibited 6 and 9 allelic variants, respectively.

As shown in Figure 1, loci characterized by a higher number of allelic variants generally exhibited increased values of observed heterozygosity (Ho) and power of discrimination (PD). Notably, the D19S433 locus, despite a relatively high number of detected alleles, showed comparatively lower Ho and PD values, which may result from the fact that three allelic variants account for approx. 74% of the total allele frequency at this locus.

