Genetic diversities of 20 novel autosomal STRs in Chinese Xibe ethnic group and its genetic relationships with neighboring populations

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ABSTRACT

In the present study, we investigated the genetic polymorphisms of 20 novel STR loci and one previously studied locus in the Xibe ethnic group from China, as well as its genetic relationships with neighboring populations. Totally 226 unrelated healthy Xibe individuals were involved in the study. At least 5 alleles were observed for each locus, with the minimum and maximum allelic frequencies of 0.0022 and 0.5221, respectively. We obtained the lowest and highest observed heterozygosity and expected heterozygosity at locus D1S1627 and D19S433, respectively. The values of combined power of discrimination and probability of exclusion of all the 21 STR loci were 0.9999999999999999997310 and 0.999998650, respectively. Analyses of interpopulation differentiation, principal component analysis, genetic distance and phylogenetic tree revealed the relationships between Xibe group and its neighboring groups, showing that the studied Xibe group had a close genetic relationship with the Mongolian group. The present results indicated that these 21 STR loci had high genetic polymorphisms in the studied Xibe group, and were capable for the paternity testing and individual identification in forensic application.

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1. Introduction

Short tandem repeats (STRs), also known as microsatellites, were the most common genetic makers applied in forensic DNA labs for both individual identification and paternity testing (Ziętkiewicz et al., 2012; Manasatienkij and Ra-ngabpai, 2012). Previous studies have provided the population genetic data of STRs for many ethnic groups such as Bai (Shen et al., 2013) and Tibetan groups (Zhu et al., 2011). Since China is a multi-ethnic country with Han nationality and 55 ethnic minority groups, population genetic profiles of more ethnic groups should be obtained in order to get a better understanding of the genetic background of different ethnic groups in China. The Xibe ethnic group is widely distributed over northern China from the Ili area in the Xinjiang Uygur Autonomous Region in the northwest to Jilin and Liaoning provinces in the northeast. According to the 6th China population census in 2010, the Xibe ethnic group had a population of 190,481, ranking the 31st of all the ethnic groups in China. The Xibes have their own language which belongs to the Manchu-Tungusic branch of the Altaic language family and believe in Polytheism, Shamanism and Buddhism. Living in different areas, the Xibes in northeast and northwest China have each formed their own characteristics. While the Xibes in the northeast have been influenced by the local Han and Manchu groups, Xibes living in Xinjiang have preserved more of the characteristics of their language script and lifestyles (http://english.peopledaily.com.cn/102759/7567650.html). Liu et al. had studied 6 autosomal STR loci (CSF1PO, D13S317, D5S818, D16S539, TH01 and TPOX) and 15 STR loci in 150 Xibes from Liaoning province, northeastern China, respectively (Liu et al., 2011, 2014); He et al. studied 15 autosomal STR loci (Goldeneye®16A kit, Peoplespot, Beijing, China) in a Xibe group from the same region (He and Guo, 2013). Hence, the abovementioned studies were all conducted on the northeastern Xibe group. In this study, we collected the Xibe

Table 1
The distribution of allelic frequencies and forensic statistical parameters of the 21 STR loci in Chinese Xibe ethnic group ($n = 226$).

Allele	D6S474	D12ATA63	D22S1045	D10S1248	D1S1677	D11S4463	D1S1627	D3S4529	D2S441	D6S1017	D4S2408	D19S433	D17S1301	D1GATA113	D18S853	D20S482	D14S1434	D9S1122	D2S1776	D10S1435	D5S2500
7											0.0022		0.0288	0.4757							
8				0.0022					0.0022	0.2544	0.1903		0.0022	0.0044						0.0243	
9									0.0088	0.0044	0.2898		0.0265			0.0022		0.0044	0.1150	0.0022	
9.1									0.0088												
10							0.0420		0.2212	0.3761	0.2765		0.0708	0.0022	0.0133	0.0420	0.1305	0.0996	0.0907	0.0354	
10.3																				0.0022	
11			0.2434			0.0088			0.4270	0.0111	0.2035		0.2434	0.1615	0.3385	0.0133	0.1549	0.1305	0.3473	0.1150	
11.3									0.0376												
12		0.3496	0.0022	0.0863	0.0265	0.0597	0.0553	0.0022	0.1527	0.2721	0.0332	0.0442	0.3429	0.3075	0.0553	0.0509	0.0133	0.2456	0.3363	0.4204	
12.2												0.0044									
12.3									0.0044												
13		0.0199	0.0066	0.3319	0.0929	0.2080	0.5221	0.1925	0.0265	0.0819	0.0044	0.2699	0.2168	0.0487	0.2323	0.2456	0.2633	0.4115	0.0996	0.2257	0.0022
13.2												0.0354									0.0066
14	0.4071	0.0531	0.0066	0.2566	0.4646	0.3451	0.3673	0.2301	0.1106			0.2500	0.0597		0.3031	0.3761	0.4115	0.0907	0.0088	0.1416	0.3009
14.2												0.0863									
15	0.3319	0.0199	0.2478	0.2235	0.3208	0.2345	0.0133	0.3850	0.0044			0.0752	0.0088		0.0575	0.1991	0.0221	0.0133	0.0022	0.0243	
15.2												0.1659									
15.3						0.0022															
16	0.0885	0.1659	0.2854	0.0708	0.0796	0.1062		0.1394	0.0022			0.0199				0.0664	0.0044	0.0044		0.0022	
16.2												0.0354									
17	0.1261	0.3451	0.1903	0.0265	0.0088	0.0354		0.0509				0.0022				0.0044					0.3031
17.2												0.0088									
18	0.0465	0.0376	0.0177	0.0022	0.0066																0.2832
18.2												0.0022									
19		0.0088																			0.0044
20																					0.0885
23																					0.0177
PD	0.8552	0.8834	0.9041	0.9051	0.8355	0.9019	0.7580	0.8865	0.8925	0.8623	0.9005	0.9346	0.9084	0.8207	0.8810	0.8983	0.8778	0.8885	0.8809	0.9014	0.8711
PIC	0.6471	0.6809	0.7196	0.7228	0.6108	0.7311	0.5099	0.6986	0.6949	0.6602	0.7195	0.7964	0.7308	0.5895	0.6863	0.7122	0.6754	0.6975	0.6922	0.7016	0.6791
EPP	0.4067	0.4407	0.4691	0.4477	0.3149	0.6007	0.2477	0.4836	0.4763	0.4836	0.5366	0.6766	0.5289	0.3379	0.4836	0.4910	0.4338	0.4547	0.5212	0.4619	0.5060
HO	0.6858	0.7080	0.7257	0.7124	0.6195	0.8009	0.5619	0.7345	0.7301	0.7345	0.7655	0.8407	0.7611	0.6372	0.7345	0.7389	0.7035	0.7168	0.7566	0.7212	0.7478
HE	0.6983	0.7261	0.7613	0.7609	0.6654	0.7665	0.5875	0.7398	0.7309	0.7129	0.7608	0.8190	0.7660	0.6507	0.7330	0.7496	0.7196	0.7350	0.7348	0.7366	0.7292
p	0.6468	0.5059	0.1868	0.0761	0.1303	0.2436	0.4118	0.8120	0.9331	0.5053	0.9147	0.4365	0.8139	0.6365	0.9957	0.6675	0.5529	0.4996	0.4906	0.5612	0.5660

PD, power of discrimination; PIC, polymorphism information content; EPP, probability of exclusion; HO, observed heterozygosity; HE, expected heterozygosity; *p*, probability values of exact tests for Hardy–Weinberg equilibrium.