

Mitochondrial DNA analysis of donkeys from Bonaire Island

Mitochondrial DNA sequencing is a highly informative tool to investigate maternal lineages, animal domestication and the origin of many species. We sequenced 500 bp of the mtDNA D-loop of four donkeys from Bonaire to get a general idea about the maternal diversity and phylogenetic relationships of donkeys from Bonaire Island with other donkeys.

The results showed that all four samples had the identical sequence as a single haplotype revealing in common maternal origin. The phylogenetic comparison with other published mitochondrial data available in the National Center for Biotechnology Information (NCBI) showed that the samples from Bonaire Island had perfect match to haplotypes of historic Nubian Wild Ass samples as shown in the figure below. The Nubian Wild Ass is the direct ancestor of domesticate donkeys but is now probably extinct in the wild. This result indicates that the Bonaire donkeys are direct descendants of the Nubian. Further testing is needed to fully determine the relationship of the Bonaire to the Nubian Wild Ass using additional samples and testing microsatellite DNA markers (mSat) as well. The additional samples will give us a clearer picture of the maternal diversity within the population and if other mtDNA haplotypes are found we will compare them to the database to look at ancestry. The microsatellite data will give indications of overall genetic diversity and can be compared to publish data from other domesticated donkey populations. It will likely be necessary to collect data from some other domestic donkey populations, especially regarding the mtDNA haplotypes as there is only limited information from other donkey groups in the public data bank. I do have a fair amount of mSat data in my data files which will be used for comparison and compare diversity of the Bonaire donkeys to other domestic and feral herds.



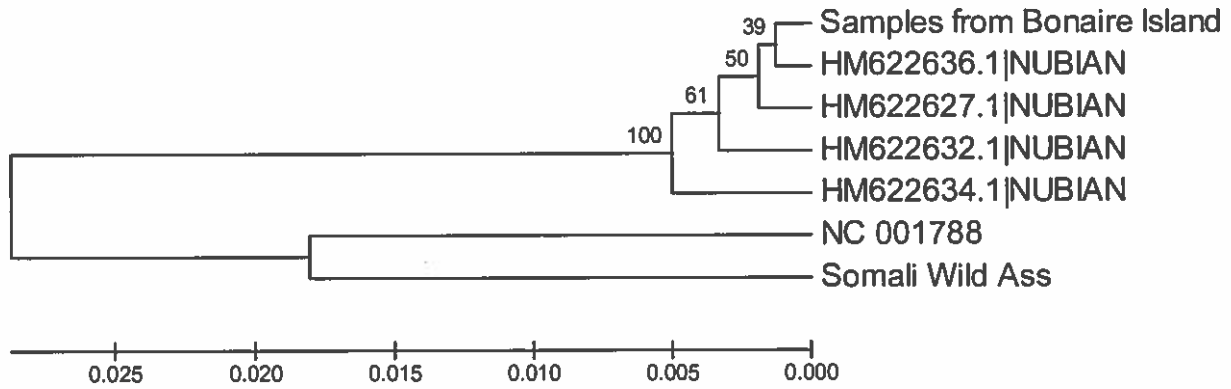
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The first Figure is a Tree Diagram showing the relationship among the Bonaire donkey sequence, 4 Nubian Wild Ass sequences obtained from NCBI, a Somali Wild Ass sequence and a domestic donkey sequence both also from NCBI.

The first Table shows variable sites in the donkey mtDNA D-loop sequence from base position 411 to 652. NC_001788 is the control domestic donkey sequence. The Bonaire sequence is highlighted. The is followed by Nubian Wild Ass sequences collected in historic times but some are from museum specimens, an ancient specimen and four Somali Wild Ass sequences. A dash indicates that the base found at that site was the same between the domestic donkey and the specimen shown. If they differ the letter of the base from the specimen is shown in the column. The Bonaire sequence is different at sites 484,490, 503, 569, 580, 598, 599, 644 and 652. The Nubians show the same base at those sights in almost every case while the Somali are different.

The second Table shows the same type of information as above except from sites 662 through 822. Overall the Bonaire differed from the control by 17 of 35 sites but was exactly the same or almost exactly the same as four of the Nubian sequences.



NC_001788: *Equus asinus* mitochondrion sequence used as control.

Polymorphic sites using 500 bp of Mitochondrial DNA of D-Loop (Nubian and Somali data are from Kimura et al 2011)

Position	Sample ID	411	484	489	490	503	536	539	541	569	579	580	598	599	621	636	637	644	652	Clade
Reference	NC 001788	T	G	T	C	T	C	T	T	A	C	A	C	A	A	T	C	G	C	2
Bonaire samples		-	A	-	T	C	-	-	-	G	-	G	T	G	-	-	-	A	T	1
Nubian wild ass (historic)	BSZM1963	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	2
	NHMML1935, PCM 53, 54, 55	-	A	-	T	C	-	-	-	G	-	G	T	G	G	-	-	A	T	1
	NHMML1904	-	A	-	T	C	-	-	-	G	-	G	T	G	G	-	-	A	T	1
	BSZM1952	-	A	-	T	C	-	C	-	G	-	G	T	G	G	-	-	A	T	1
	RMCA31155	-	A	-	T	C	-	-	-	G	-	G	T	G	G	-	-	A	T	1
	NHMML1939	-	A	-	T	C	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Uan Muhaggiag (ancient)		-	A	-	T	C	-	-	-	G	-	G	-	-	-	-	-	-	-	1
Somali wild ass (modern and historic)	WA 2, 5, 7, 11, 14, 15, 17, 19, WD 1, 2, 3, 11, 13, Era 4, 6	C	-	C	-	-	T	-	C	-	T	-	T	-	-	-	T	-	T	Somali wild ass
	WA 6, 20, 23, WD 6, 8, 14, Era3	C	-	C	-	-	T	-	C	-	T	-	T	-	-	-	T	-	T	Somali wild ass
	WA 21, WD 12	C	-	C	-	-	T	-	C	-	T	-	T	-	-	-	C	-	T	Somali wild ass
	NHMML1886, WA 1, 4, 6, 12, 13, 18, WD 4, 9, Era2	C	-	C	-	-	T	-	C	-	T	-	T	-	-	C	T	-	T	Somali wild ass

Reference	15000+	662	667	698	704	707	713	714	718	770	771	801	802	803	806	820	821	822	
	NC 001788	A	A	C	C	A	C	C	C	T	T	C	T	A	C	C	G	G	2
Bonaire samples		G	-	T	-	-	-	-	-	C	-	T	-	-	T	T	A	A	1
Nubian wild ass (historic)	BSZM1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	NHML1935, PCM 53, 54, 55	G	-	T	-	-	-	-	-	C	-	T	-	-	T	T	A	-	1
	NHML1904	G	-	T	-	-	-	-	-	-	-	T	-	G	T	T	A	A	1
	BSZM1952	G	-	T	-	-	-	-	-	C	-	T	C	-	T	T	A	A	1
	RMCA31155	G	-	T	-	-	-	-	-	C	-	T	-	-	T	T	A	A	1
	NHML1939			T	-	-	-	-	-	-	-	T	-	-	T	T	A	A	1
Van Muhagiyag (ancient)				T	-	-	-	-	-	-	-	T	-	G	T	T	A	A	1
Somali wild ass (modern and historic)	WH2	G	G	-	T	G	T	A	T	-	C	T	C	-	-	-	A	-	Somali wild ass
	WH3	G	G	T	T	G	T	A	-	-	C	T	C	-	-	-	A	-	Somali wild ass
	WH4	G	G	T	T	G	T	A	-	-	C	T	C	-	-	-	A	-	Somali wild ass
	WH1, NHML1886	-	G	-	T	-	T	A	T	-	-	-	-	-	-	-	A	-	Somali wild ass