

Supplementary Materials

Table SError! No text of specified style in document.: *Theileria parva* antigens Tp1 and Tp2 reference gene sequences, with accession numbers and the respective epitope regions

TpAg gene	<i>T. parva</i> reference ID/Name	Sequence accession number	Sample origin	CD8+ T-cell reference epitope(s)	Reference
Tp1	Muguga	XM_757880	Kenya	VGYPKVKEEML (Tp1 ₂₁₄₋₂₂₄)	Graham <i>et al.</i> , 2008 Pelle <i>et al.</i> , 2011
	Kiambu 5	JF451939	Kenya	VGYPKVKEEML (Tp1 ₂₁₄₋₂₂₄)	
	Serengeti	JF451940	Kenya	VGYPKVKEEML (Tp1 ₂₁₄₋₂₂₄)	
	Chitongo	JF451975	Zambia	VGYPKVKEEII (Tp1 ₂₁₄₋₂₂₄)	Pelle <i>et al.</i> , 2011
	Katete KL 11	LC645844	Zambia	VGYPKVKEEML (Tp1 ₂₁₄₋₂₂₄)	Muleya <i>et al.</i> , 2022
	6C5	LC645876	Zambia	VGYPKVKEEII (Tp1 ₂₁₄₋₂₂₄)	
	89C58	LC645939	Zambia	VGYPKVKEEML (Tp1 ₂₁₄₋₂₂₄)	
	20BA89	LC645961	Zambia	VGYPKVKEEML (Tp1 ₂₁₄₋₂₂₄)	
	26BA95	LC645967	Zambia	VGYPKVKEEII (Tp1 ₂₁₄₋₂₂₄)	
	Buffalo 5641	JF452001	Kenya	VGYPKVKEEML (Tp1 ₂₁₄₋₂₂₄)	
Tp2	Chitongo	JF451884	Zambia	SDDELDTLGML (Tp2 ₂₇₋₃₇)	Pelle <i>et al.</i> , 2011
	Muguga	JF451861	Kenya	SHEELKKLGML (Tp2 ₂₇₋₃₇)	
	Katete	JF451863	Zambia	SHEELKKLGML (Tp2 ₂₇₋₃₇)	
	Kiambu 5	JF451880	Kenya	SDEELNKLGMML (Tp2 ₂₇₋₃₇)	
	Serengeti	JF451862	Kenya	SHEELKKLGML (Tp2 ₂₇₋₃₇)	
	Buffalo 7344	JF451899	Kenya	SDEELES LGML (Tp2 ₂₇₋₃₇)	
	13BA60	LC645835	Zambia	SDNELDTLGLL (Tp2 ₂₇₋₃₇)	
	22BA64	LC645839	Zambia	SHEELNKLGMML (Tp2 ₂₇₋₃₇)	
	38C23	LC645723	Zambia	SHEELKKLGML (Tp2 ₂₇₋₃₇)	
	75C48	LC645748	Zambia	SHEELNKLGMML (Tp2 ₂₇₋₃₇)	
	80C51	LC645751	Zambia	SHEELKKLGML (Tp2 ₂₇₋₃₇)	
	86C54	LC645753	Zambia	SEDELDTLGML (Tp2 ₂₇₋₃₇)	
	19C10	LC645710	Zambia	SDDELDTLGML (Tp2 ₂₇₋₃₇)	

Table S2: Allele frequency ranges from Central, Eastern, Lusaka and Southern provinces.

Population	Allele frequency range per locus											
	MS7		MS8		MS19		MS25		MS33		MS39	
	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo
Central	0.08 - 0.33	0.25	0.08 - 0.17	0.25	0.08 - 0.17	0.25 - 0.5	0.08 - 0.42	0.25	0.08 - 0.42	0.25	0.08 - 0.33	0.25
Eastern	0.17 - 0.5	0.17	0.17 - 0.5	0.17	0.17 - 0.33	0.17 - 0.5	1	1	0.17 - 0.5	0.17	0.17	0.17
Lusaka	0.06 - 0.44	-	0.06 - 0.19	n/a	0.06 - 0.38	n/a	0.06 - 0.31	n/a	0.06 - 0.38	n/a	0.06 - 0.5	n/a
Southern	0.09 - 0.27	0.25	0.09 - 0.27	0.25	0.09 - 0.27	0.5	0.09 - 0.27	0.25	0.09 - 0.56	0.25	0.09 - 0.5	0.25
Katete	1	-	1	-	1	-	1	-	1	-	1	-
Chitongo	1	-	1	-	1	-	1	-	1	-	1	-

n/a = not available; - = no samples analysed

Table S3: Alleles shared between populations from Central, Eastern, Lusaka and Southern provinces.

Populations	Common alleles per locus					
	MS7	MS8	MS19	MS25	MS33	MS39
Cattle	<u>n=5</u> 145 146 311 372 309	<u>n=5</u> 242 311 312 322 331	<u>n=8</u> 302 303 304 308 309 311 312 372	<u>n=3</u> 261 323 337	<u>n=5</u> 185 186 248 260 261	<u>n=1</u> 261
Buffalo	<u>n=0</u>	<u>n=1</u> 178	<u>n=2</u> 312 332	<u>n=0</u>	<u>n=0</u>	<u>n=0</u>
Cattle vs buffalo	<u>n=2</u> 311 372	<u>n=3</u> 148 242 292	<u>n=3</u> 303 311 312	<u>n=2</u> 240 336	<u>n=2</u> 220 309	<u>n=2</u> 245 295

Table S4: Predominant alleles detected from Central, Eastern, Lusaka and Southern provinces.

Population	Predominant alleles (bp) per locus											
	MS7		MS8		MS19		MS25		MS33		MS39	
	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo
Central	309	none	302, 311 , 312	none	310	332	261	none	185	none	261, 323	none
Eastern	260	none	242	none	372	312	336	336	185	none	none	none
Lusaka	372	-	311	-	303	-	261	-	260	-	260	-
Southern	309	none	331	none	303	242, 332	245	none	260	none	245	none
Katete	146	-	231	-	268	-	201	-	248	-	377	-
Chitongo	146	-	143	-	268	-	200	-	146	-	201	-

- = no samples analysed, Bold = predominant alleles in multiple populations

Table S5: Linkage analysis of field parasites from Central, Eastern, Lusaka, and Southern Provinces of Zambia, together with the Chitongo and Katete vaccine stocks.

Population	I_A^S	V_D	L_{para}	L_{MC}	Linkage
Central cattle	0.1716	2.7792	1.7035	1.9481	LD
Central buffalo	0.3302	3.3778	1.8117	2.0444	LD
Central Province	0.1117	2.2342	1.5731	1.7157	LD
Eastern cattle	0.3623	5.1000	2.3863	2.8000	LD
Eastern buffalo	0.2416	2.9905	1.6646	1.5905	LD
Eastern Province	0.1675	2.9565	1.7849	1.8137	LD
Lusaka Province	0.1411	2.5764	1.6417	1.6875	LD
Southern cattle	0.1987	3.5245	2.0985	2.3245	LD
Southern buffalo	0.1926	2.2778	1.6554	1.8333	LD
Southern Province	0.1578	2.9461	1.8131	1.8131	LD
All cattle combined	0.0536	2.0661	1.6715	1.7102	LD
All buffalo combined	0.0815	2.1288	1.6486	1.6288	LD
All populations combined	0.0453	1.9647	1.6100	1.6040	LD
All combined + Vaccine	0.0440	1.9504	1.6103	1.6191	LD