

SUPPLEMENTARY MATERIAL

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Phylogeography and morphometric variation of the spike-heeled lark *Chersomanes albofasciata* complex

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Supplementary Table S1. Sample collection details

Sample Name	Sample Source	Haplotype	GenBank Accession	Taxon (Clancey)	Taxon (Roberts VII)	Haplogroup	Locality	Coordinates
Spike-heeled Lark <i>Chersomanes albofasciata</i> complex								
ABD1	NF180045	A	MG706025	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	20 km W Aberdeen, E Cape	32°29'S; 23°42'E
CAL2	NFI 80061	A	MG706026	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	Die Bos, 63 km S Calvinia, N Cape	31°58'S; 19°52'E
BW1	NFI 80051	A	MG706027	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	18 km SE Beaufort West, W Cape	32°27'S; 22°42'E
SG1	NFI 80036	A	MG706028	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	5 km E Seekoegat, W Cape	33°02'S; 22°05'E
GK2	NFI 80052	A	MG706029	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	35 km N Prince Albert, W Cape	32°58'S; 21°56'E
GR2	NFI 80040	B	MG706030	<i>latimerae</i>	<i>macdonaldi</i>	Karoo	10 km S Graaff-Reinet, E Cape	32°24'S; 21°56'E
CAL1	NFI 80057	C	MG706031	<i>macdonaldi</i>	<i>garrula</i>	Karoo	40 km N Calvinia, N Cape	31°23'S; 20°07'E
RB1	NFI 80050	C	MG706032	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	10 km W Rietbron, E Cape	32°54'S; 22°42'E
PS1	NFI 80064	C	MG706033	<i>bushmanensis</i>	<i>garrula</i>	Karoo	100 km NE Springbok, N Cape	29°26'S; 18°29'E
PK1	NFI 80063	C	MG706034	<i>bushmanensis</i>	<i>garrula</i>	Karoo	110 km S Pofadder, N Cape	29°53'S; 19°06'E
KBL	NFI 80059	C	MG706035	<i>bushmanensis</i>	<i>garrula</i>	Karoo	74 km S Kenhardt, N Cape	29°51'S; 20°41'E
PAF	NFI 80067	C	MG706036	<i>bushmanensis</i>	<i>garrula</i>	Karoo	8 km E Pofadder, N Cape	29°04'S; 19°24'E
BV1	NFI 80054	C	MG706037	<i>bushmanensis</i>	<i>garrula</i>	Karoo	10 km S Brandvlei, N Cape	30°32'S; 20°20'E
GR1	NFI 80048	D	MG706038	<i>latimerae</i>	<i>macdonaldi</i>	Karoo	40 km SE Graaff-Reinet, E Cape	32°32'S; 25°02'E
SE1	NFI 80049	D	MG706039	<i>latimerae</i>	<i>macdonaldi</i>	Karoo	30 km S Somerset East, E Cape	32°58'S; 25°34'E
OR1	NFI 80035	D	MG706040	<i>albofasciata</i>	<i>albofasciata</i>	Karoo	8 km N Orania, N Cape	29°49'S; 24°22'E
DA1	NFI 80038	D	MG706041	<i>albofasciata</i>	<i>albofasciata</i>	Karoo	5 km NE De Aar, N Cape	30°36'S; 24°03'E
PMB	NFI 80039	D	MG706042	<i>baddleyi</i>	<i>albofasciata</i>	Karoo	3 km W Owendale, N Cape	28°18'S; 23°20'E
VGD	NFI 80044	D	MG706043	<i>baddleyi</i>	<i>albofasciata</i>	Karoo	midway bw Kuruman & Upington, N Cape	28°09'S; 22°19'E
KEN1	NFI 80058	E	MG706044	<i>bushmanensis</i>	<i>garrula</i>	Karoo	30 km N Kenhardt, N Cape	29°09'S; 21°04'E
UP1	NFI 80056	E	MG706045	<i>arenaria</i>	<i>albofasciata</i>	Karoo	35 km N Upington, N Cape	28°17'S; 21°02'E
STF1	NFI 80062	F	MG706046	<i>bushmanensis</i>	<i>garrula</i>	Karoo	80 km N Stofvlei, N Cape	30°15'S; 19°06'E
TK2	NFI 80055	G	MG706047	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	30 km N Karooport, W Cape	32°54'S; 19°38'E

Sample Name	Sample Source	Haplotype	GenBank Accession	Taxon (Clancey)	Taxon (Roberts VII)	Haplogroup	Locality	Coordinates
TK1	NFI 80053	H	MG706048	<i>macdonaldi</i>	<i>macdonaldi</i>	Karoo	130 km S Calvinia, W Cape	32°32'S; 19°31'E
WAK1	blood	I	MG706049	<i>alticola</i>	<i>alticola</i>	Eastern	15 km N Wakkerstroom, Mpumalanga	27°15'S; 30°05'E
BH1	NFI 80042	J	MG706050	<i>albofasciata</i>	<i>albofasciata</i>	Eastern	5 km E Boshoff, Free State	28°33'S; 25°12'E
SR1	NFI 80047	K	MG706051	<i>bathoeni</i>	<i>albofasciata</i>	Eastern	10 km N Schweizer Reneke, NW Prov	27°07'S; 25°22'E
VBRG	NFI 80041	L	MG706052	<i>bathoeni</i>	<i>albofasciata</i>	Eastern	5 km SE Vryburg, NW Prov	27°08'S; 24°21'E
DEL	NFI 80043	M	MG706053	<i>bathoeni</i>	<i>alticola</i>	Eastern	Eastern 5 km S Delareyville, NW Prov	26°42'S; 25°28'E
MB1	NFI 80037	M	MG706054	<i>albofasciata</i>	<i>albofasciata</i>	Eastern	10 km S Middelburg, E Cape	31°36'S; 25°01'E
KV1	NFI 80060	N	MG706055	<i>garrula</i>	<i>garrula</i>	Namaq	10 km E Vanrhynsdorp, W Cape	31°33'S; 18°52'E
LF	NFI 80065	O	MG706056	<i>garrula</i>	<i>garrula</i>	Namaq	40 km W Loeriesfontein, N Cape	30°50'S; 18°52'E
STF2	NFI 80066	O	MG706057	<i>garrula</i>	<i>garrula</i>	Namaq	25 km N Stofvlei, N Cape	30°29'S; 18°41'E
PN	NFI 80069	P	MG706058	<i>garrula</i>	<i>garrula</i>	Namaq	60 km E Port Nolloth, N Cape	29°16'S; 17°17'E
WPH	NFI 80068	P	MG706059	<i>garrula</i>	<i>garrula</i>	Namaq	Wildeperdhoek Pass, N Cape	29°56'S; 17°33'E
SHL203	NFI 80065	-	MG706063	<i>boweni</i>	<i>boweni</i>		70 km SE Van Zyl's Pass, NW Namibia	17°28'S; 12°16'E
TAN1	blood	-	MG706060	<i>beesleyi</i>	-		11km NE Oldonyo Sambu, N Tanzania	03°08'S; 36°45'E
TAN2	blood	-	MG706061	<i>beesleyi</i>	-		11km NE Oldonyo Sambu, N Tanzania	03°08'S; 36°45'E
TAN3	blood	-	MG706062	<i>beesleyi</i>	-		11km NE Oldonyo Sambu, N Tanzania	03°08'S; 36°45'E
Gray's Lark <i>Ammomanopsis grayi</i>								
GRA8	PFP 207/228	GA	MG706064	<i>grayi</i>			NW Namibia	18°52'S; 12°59'E
GRA1	PFP 206/231	GC	MG706065	<i>grayi</i>			NW Namibia	17°28'S; 12°16'E
GRA2	PFP 11/231	GD	MG706066	<i>grayi</i>			NW Namibia	17°42'S; 12°17'E
GRA7a	PFP 3/299	GD	MG706067	<i>grayi</i>			NW Namibia	18°52'S; 12°59'E
GRA7b	PFP 3/299	GD		<i>grayi</i>			NW Namibia	18°52'S; 12°59'E
GRA5	PFP 12/232	GE	MG706068	<i>grayi</i>			NW Namibia	18°07'S; 12°21'E
GRA3	PFP 1/111	GE	MG706069	<i>grayi</i>			NW Namibia	17°42'S; 12°17'E
GRA4	PFP 10/234	GE	MG706070	<i>grayi</i>			NW Namibia	17°51'S; 12°09'E
GRA6	PFP 9/230	GE	MG706071	<i>grayi</i>			NW Namibia	18°10'S; 12°24'E

Supplementary Table S2. Model outputs for Clancey vs morphometric measurements.

<i>Type: OLS linear regression; Standard errors: Robust, type = HC3</i>																
	<u>MODEL INFO:</u> <i>lm</i> = Tail ~ Clancey+Sex <i>Observations:</i> 324 <u>MODEL FIT:</u> <i>F</i> (15,308) = 37.47, <i>p</i> = 0.00 <i>R</i> ² = 0.65 <i>Adj. R</i> ² = 0.63				<u>MODEL INFO:</u> <i>lm</i> = Wing ~ Clancey+Sex <i>Observations:</i> 326 <u>MODEL FIT:</u> <i>F</i> (15,310) = 73.08, <i>p</i> = 0.00 <i>R</i> ² = 0.78 <i>Adj. R</i> ² = 0.77				<u>MODEL INFO:</u> <i>lm</i> = Head ~ Clancey+Sex <i>Observations:</i> 277 <u>MODEL FIT:</u> <i>F</i> (14,262) = 65.86, <i>p</i> = 0.00 <i>R</i> ² = 0.78 <i>Adj. R</i> ² = 0.77				<u>MODEL INFO:</u> <i>lm</i> = Tarsus ~ Clancey+Sex <i>Observations:</i> 331 <u>MODEL FIT:</u> <i>F</i> (15,315) = 21.70, <i>p</i> = 0.00 <i>R</i> ² = 0.51 <i>Adj. R</i> ² = 0.48			
	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p
(Intercept)lati	49.78	1.59	31.29	0.00	83.83	1.24	67.66	0.00	39.22	0.64	61.55	0.00	26.75	0.53	50.31	0.00
Clanceymacd	-0.72	1.67	-0.43	0.67	-1.34	1.30	-1.03	0.30	-1.11	0.67	-1.66	0.10	-0.10	0.56	-0.18	0.86
Clanceygarr	-4.36	1.7	-2.56	0.01	-1.70	1.32	-1.29	0.20	0.10	0.70	0.14	0.89	0.27	0.57	0.47	0.64
Clanceybush	-2.98	1.7	-1.75	0.08	-2.04	1.32	-1.54	0.12	-1.48	0.68	-2.17	0.03	0.17	0.57	0.30	0.76
Clanceyalbo	-3.47	1.64	-2.12	0.03	-3.60	1.27	-2.82	0.01	-1.56	0.67	-2.34	0.02	-0.33	0.55	-0.61	0.54
Clanceybadd	-1.34	1.85	-0.73	0.47	-2.41	1.44	-1.67	0.10	-0.33	0.75	-0.45	0.66	0.08	0.62	0.13	0.90
Clanceyalti	-5.66	1.69	-3.34	0.00	-5.43	1.32	-4.12	0.00	-1.72	0.68	-2.54	0.01	-0.17	0.57	-0.3	0.77
Clancey bath	-5.69	2.13	-2.67	0.01	-5.30	1.66	-3.19	0.00	-1.82	0.85	-2.13	0.03	-1.08	0.71	-1.52	0.13
Clanceyaren	-3.43	1.66	-2.07	0.04	-2.44	1.29	-1.89	0.06	-0.31	0.67	-0.47	0.64	-0.73	0.56	-1.31	0.19
Clancey subp	-4.84	1.96	-2.47	0.01	-5.23	1.53	-3.42	0.00	-2.08	0.78	-2.65	0.01	-1.21	0.66	-1.85	0.07
Clancey kala	-5.22	1.83	-2.85	0.00	-4.62	1.43	-3.23	0.00	-1.77	0.75	-2.37	0.02	-0.61	0.61	-1.00	0.32
Clancey bowe	-5.56	1.93	-2.89	0.00	-7.01	1.50	-4.67	0.00	-2.59	0.77	-3.37	0.00	-1.92	0.64	-2.98	0.00
Clancey erik	-6.90	1.93	-3.58	0.00	-9.25	1.48	-6.26	0.00	-3.01	0.77	-3.91	0.00	0.08	0.63	0.13	0.90
Clancey bees	-16.25	1.96	-8.29	0.00	-10.96	1.53	-7.17	0.00	-3.29	0.78	-4.19	0.00	-0.85	0.66	-1.30	0.19
Clancey bees_l	-15.67	1.83	-8.54	0.00	-10.64	1.43	-7.45	0.00	-	-	-	-	-1.44	0.61	-2.34	0.02
SexM	6.37	0.40	15.8	0.00	8.94	0.31	28.52	0.00	5.7	0.18	32.49	0.00	2.44	0.13	18.14	0.00

Type: OLS linear regression; Standard errors: Robust, type = HC3

	<u>Bill Depth</u>				<u>Culmen 1</u>				<u>Culmen 2</u>			
	<u>MODEL INFO:</u>				<u>MODEL INFO:</u>				<u>MODEL INFO:</u>			
	<i>lm</i> = Bill Depth ~ Clancey+Sex				<i>lm</i> = CL1 ~ Clancey+Sex				<i>lm</i> = CL2 ~ Clancey+Sex			
	Observations: 276				Observations: 315				Observations: 277			
	<u>MODEL FIT:</u>				<u>MODEL FIT:</u>				<u>MODEL FIT:</u>			
	$F(14,261) = 23.87, p = 0.00$				$F(14,300) = 60.56, p = 0.00$				$F(14,262) = 59.10, p = 0.00$			
	$R^2 = 0.56$				$R^2 = 0.74$				$R^2 = 0.76$			
	$Adj. R^2 = 0.54$				$Adj. R^2 = 0.73$				$Adj. R^2 = 0.75$			
	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p
(Intercept)lati	4.93	0.15	33.05	0.00	20.15	0.51	39.15	0.00	13.81	0.39	35.27	0.00
Clanceymacd	0.00	0.16	0.03	0.98	-0.67	0.54	-1.25	0.21	-0.68	0.41	-1.65	0.10
Clanceygarr	0.11	0.16	0.69	0.49	-0.73	0.55	-1.32	0.19	-0.68	0.43	-1.59	0.11
Clanceybush	-0.06	0.16	-0.39	0.69	-0.55	0.55	-1.01	0.31	-0.54	0.42	-1.29	0.20
Clanceyalbo	0.14	0.16	0.89	0.38	-1.36	0.53	-2.57	0.01	-0.67	0.41	-1.65	0.10
Clanceybadd	0.20	0.18	1.15	0.25	0.00	0.60	0.01	0.99	0.71	0.46	1.55	0.12
Clanceyalti	-0.15	0.16	-0.95	0.34	-1.91	0.55	-3.48	0.00	-1.05	0.42	-2.52	0.01
Clancey bath	-0.15	0.20	-0.77	0.44	-1.92	0.69	-2.78	0.01	-0.88	0.52	-1.67	0.10
Clanceyaren	-0.10	0.16	-0.67	0.50	-0.39	0.54	-0.73	0.46	0.24	0.41	0.58	0.56
Clancey subp	-0.43	0.18	-2.34	0.02	-1.99	0.63	-3.14	0.00	-1.03	0.48	-2.14	0.03
Clancey kala	0.01	0.18	0.04	0.97	-1.09	0.59	-1.85	0.07	-0.32	0.46	-0.69	0.49
Clancey bowe	-0.34	0.18	-1.87	0.06	-2.19	0.62	-3.51	0.00	-1.05	0.47	-2.23	0.03
Clancey erik	-0.35	0.18	-1.92	0.06	-1.98	0.61	-3.23	0.00	-1.21	0.47	-2.56	0.01
Clancey bees	0.14	0.18	0.76	0.45	-2.54	0.63	-4.01	0.00	-2.49	0.48	-5.16	0.00
Clancey bees_1	-	-	-	-	-	-	-	-	-	-	-	-
SexM	0.74	0.04	17.87	0.00	3.99	0.13	30.21	0.00	3.28	0.11	30.47	0.00

Supplementary Table S3. Model outputs for Latitude vs morphometric measurements.

Type: OLS linear regression; Standard errors: Robust, type = HC3

	Tail <u>MODEL INFO:</u> <i>lm</i> = Tail ~ Latitude+Sex Observations: 310 <u>MODEL FIT:</u> $F(2,307) = 176.42, p = 0.00$ $R^2 = 0.53$ $Adj. R^2 = 0.53$				Wing <u>MODEL INFO:</u> <i>lm</i> = Wing ~ Latitude*Sex Observations: 317 <u>MODEL FIT:</u> $F(3,327) = 257.07, p = 0.00$ $R^2 = 0.71$ $Adj. R^2 = 0.71$				Head <u>MODEL INFO:</u> <i>lm</i> = Head ~ Latitude*Sex Observations: 272 <u>MODEL FIT:</u> $F(3,268) = 312.31, p = 0.00$ $R^2 = 0.78$ $Adj. R^2 = 0.78$				Tarsus <u>MODEL INFO:</u> <i>lm</i> = Tarsus ~ Latitude+Sex Observations: 37 <u>MODEL FIT:</u> $F(2,309) = 154.74, p = 0.00$ $R^2 = 0.50$ $Adj. R^2 = 0.50$			
	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p
(Intercept)	34.27	1.10	31.23	0.00	72.57	1.25	58.11	0.00	37.21	0.64	58.52	0.00	25.25	0.36	70.63	0.00
Latitude	-0.42	0.04	-10.93	0.00	-0.29	0.04	-6.47	0.00	-0.03	0.02	-1.12	0.27	-0.04	0.01	-3.45	0.00
SexM	6.58	0.43	15.17	0.00	5.75	1.73	3.32	0.00	3.28	0.89	3.70	0.00	2.44	0.14	17.2	0.00
Latitude:SexM	-	-	-	-	-0.11	0.06	-1.81	0.07	-0.09	0.03	-2.85	0.00	-	-	-	-
	Bill Depth <u>MODEL INFO:</u> <i>lm</i> = Bill Depth ~ Latitude+Sex Observations: 271 <u>MODEL FIT:</u> $F(2,268) = 145.39, p = 0.00$ $R^2 = 0.52$ $Adj. R^2 = 0.52$				Culmen 1 <u>MODEL INFO:</u> <i>lm</i> = CL1 ~ Latitude+Sex Observations: 310 <u>MODEL FIT:</u> $F(2,307) = 396.88, p = 0.00$ $R^2 = 0.72$ $Adj. R^2 = 0.72$				Culmen 2* <u>MODEL INFO:</u> <i>lm</i> = CL2 ~ Latitude+Sex Observations: 272 <u>MODEL FIT:</u> $F(2,269) = 375.88, p = 0.00$ $R^2 = 0.74$ $Adj. R^2 = 0.73$							
	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p
(Intercept)	4.67	0.10	44.71	0.00	17.43	0.36	47.80	0.00	12.02	0.30	40.58	0.00				
Latitude	-0.01	0.00	-2.16	0.03	-0.06	0.01	-4.70	0.00	-0.04	0.01	-4.08	0.00				
SexM	0.74	0.04	16.86	0.00	4.10	0.14	27.75	0.00	3.36	0.12	27.02	0.00				

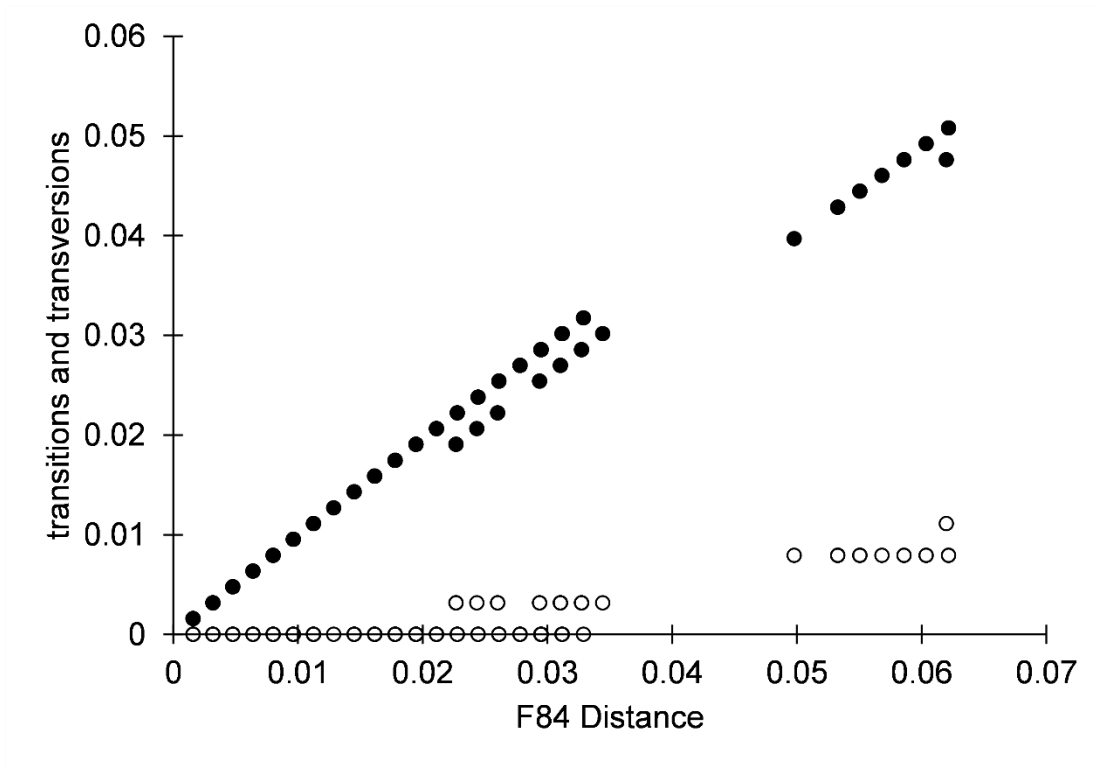
*data do not meet the model fit assumptions

Supplementary Table S4. Model outputs for haplogroups in South Africa vs morphometric measurements.

Type: OLS linear regression; Standard errors: OLS																
	Tail				Wing				Head				Tarsus			
	<u>MODEL INFO:</u> <i>lm</i> = Tail ~ Haplogroup+Sex <i>Observations:</i> 224 <u>MODEL FIT:</u> $F(3,220) = 88.44, p = 0.00$ $R^2 = 0.55$ $Adj. R^2 = 0.54$				<u>MODEL INFO:</u> <i>lm</i> = Wing ~ Haplogroup+Sex <i>Observations:</i> 225 <u>MODEL FIT:</u> $F(3,221) = 245.66, p = 0.00$ $R^2 = 0.77$ $Adj. R^2 = 0.77$				<u>MODEL INFO:</u> <i>lm</i> = Head ~ Haplogroup+Sex <i>Observations:</i> 195 <u>MODEL FIT:</u> $F(3,191) = 285.44, p = 0.00$ $R^2 = 0.82$ $Adj. R^2 = 0.81$				<u>MODEL INFO:</u> <i>lm</i> = Tarsus ~ Haplogroup+Sex <i>Observations:</i> 225 <u>MODEL FIT:</u> $F(3,221) = 74.53, p = 0.00$ $R^2 = 0.50$ $Adj. R^2 = 0.50$			
	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p
(Intercept)Eastern	43.96	0.53	81.29	0.00	78.06	0.41	190.06	0.00	37.27	0.25	152.13	0.00	26.29	0.18	142.49	0.00
Karoo	4.09	0.54	7.49	0.00	3.74	0.42	8.98	0.00	0.82	0.25	3.31	0.00	0.46	0.19	2.48	0.01
Namaq	0.13	0.99	0.13	0.90	4.14	0.74	5.63	0.00	1.87	0.53	3.57	0.00	0.39	0.33	1.18	0.24
SexM	6.44	0.47	13.64	0.00	9.07	0.36	25.23	0.00	6.05	0.21	28.74	0.00	2.36	0.16	14.64	0.00
	Bill Depth				Culmen 1				Culmen 2							
	<u>MODEL INFO:</u> <i>lm</i> = Bill Depth ~ Haplogroup+Sex <i>Observations:</i> 194 <u>MODEL FIT:</u> $F(3,190) = 75.43, p = 0.00$ $R^2 = 0.54$ $Adj. R^2 = 0.54$				<u>MODEL INFO:</u> <i>lm</i> = CL1 ~ Haplogroup+Sex <i>Observations:</i> 224 <u>MODEL FIT:</u> $F(3,220) = 259.74, p = 0.00$ $R^2 = 0.78$ $Adj. R^2 = 0.78$				<u>MODEL INFO:</u> <i>lm</i> = ICL2 ~ Haplogroup+Sex <i>Observations:</i> 195 <u>MODEL FIT:</u> $F(3,191) = 220.15, p = 0.00$ $R^2 = 0.78$ $Adj. R^2 = 0.77$							
	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p	Est.	S.E.	t val.	p				
(Intercept)Eastern	4.76	0.06	82.49	0.00	18.26	0.18	102.12	0.00	12.71	0.16	79.46	0.00				
Karoo	0.22	0.06	3.71	0.00	1.09	0.18	5.99	0.00	0.59	0.16	3.65	0.00				
Namaq	0.23	0.13	1.74	0.08	1.00	0.32	3.13	0.00	0.53	0.34	1.54	0.13				
SexM	0.71	0.05	14.30	0.00	4.21	0.16	26.97	0.00	3.46	0.14	25.16	0.00				

Supplementary Table S5. Haplotypes identified amongst 35 Spike-heeled Lark samples from South Africa based on 630 bp of the cytochrome *b* gene. Each haplotype is defined by a unique sequence for the 33 variable bases. Also indicated is the frequency of occurrence (*n*) and localities at which each haplotype was found. Dashes indicate identity to the base in the reference sequence of haplotype A.

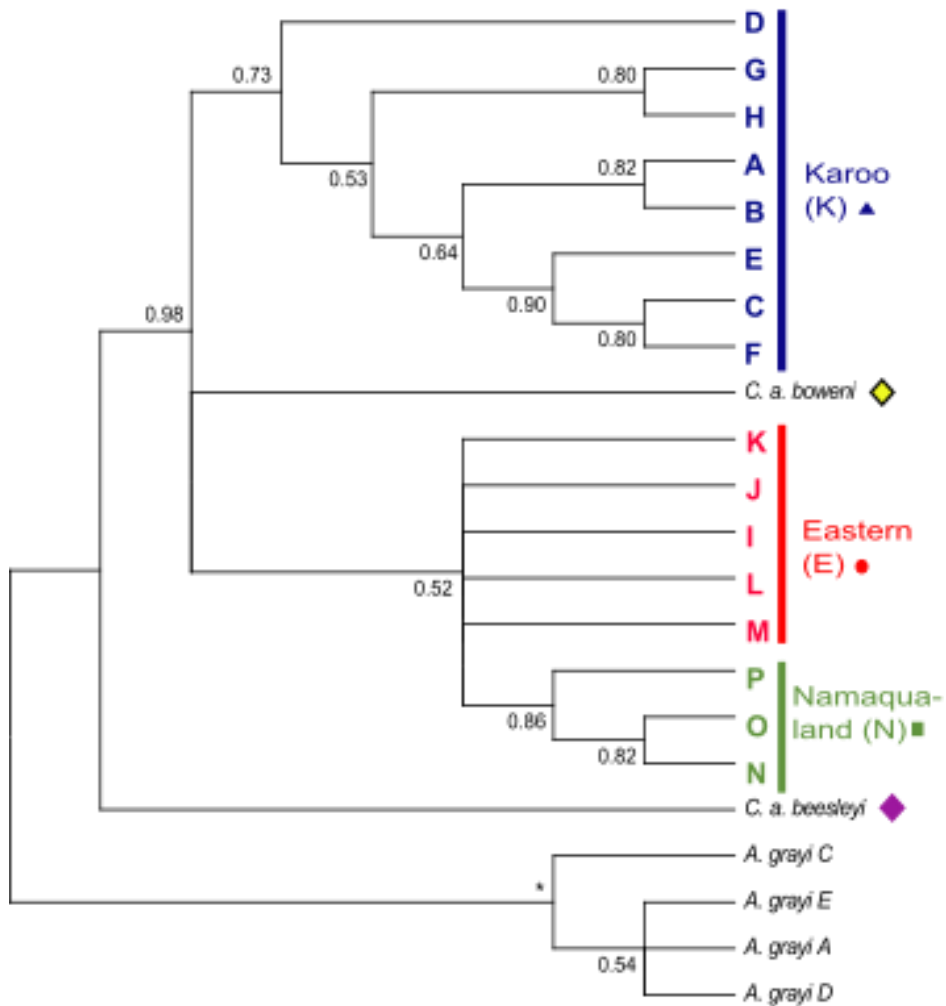
Haplotype	Variable bases	<i>n</i>	Localities
	00111111111222233334455555555666 040124567791249556824145667889002 552167651426034796404665168891034		
A	TCACATTCGTAGATGACGCCCGTACTTGCACT	5	Aberdeen, E Cape; Beaufort West & Seekoegat, W Cape
B	-----T-----	1	Graaff Reinet, E Cape
C	-----A-----T-----	7	Springbok, Pofadder, Kenhardt & Brandvlei, N Cape; Rietbron, E Cape
D	-----C-A-----A---C	6	Graaff-Reinet & Somerset East, E Cape; Orania, De Aar & Owendale, N Cape
E	-----A-----T-----G--	2	Kenhardt & Upington, N Cape
F	C-----A-----A---T-----	1	Stofvlei, Bushmanland, N Cape
G	-----A---G-----A---C-----	1	Karooport, W Cape
H	---T---A--AG-----A---C-----	1	130 km south of Calvinia, W Cape
I	----GC- AC-A-C-----T---T---T---	1	Wakkerstroom, Mpumalanga
J	----GC--AC-A-C-----T---GT---T---	1	Boshoff, Free State
K	----GCC-AC-A-C-----T---T---T---C	1	Schweizer Reneke, NW Province
L	----GC--ACGA-C---A--T---T---T---	1	Vryburg, NW Province
M	----GC--AC-A-C---A--T--C-T---T---	2	Delareyville, NW Province; Middelburg, E Cape
N	--G-GC--AC-A-C-G-A-TTT-C-T-C---T-	1	Vanrhynsdorp, W Cape
O	-TG-GC--AC-A-C-G-A-TTT-C-T-C---T-	2	Loeriesfontein & Stofvlei, N Cape
P	-TG-GC-TAC-A-----A--TT---T-C---TC	2	Port Nolloth & Wildeperdhoek Pass, N Cape



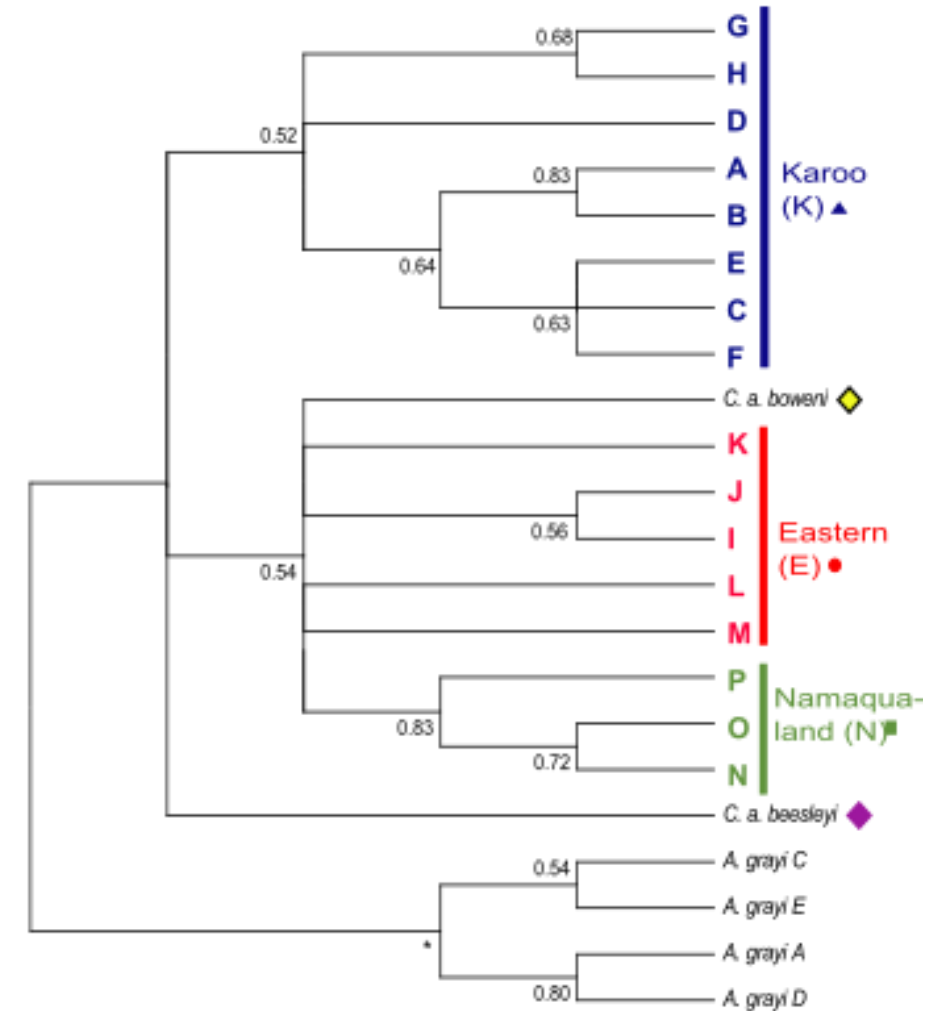
Supplementary Figure S1: Transitions vs transversions

Substitution saturations as determined in DAMBE6 by plotting transition and transversion substitutions against F84 distances. Data for all sequences were included. Closed symbols represent transitions and open symbols represent transversions.

(A) Maximum Parsimony

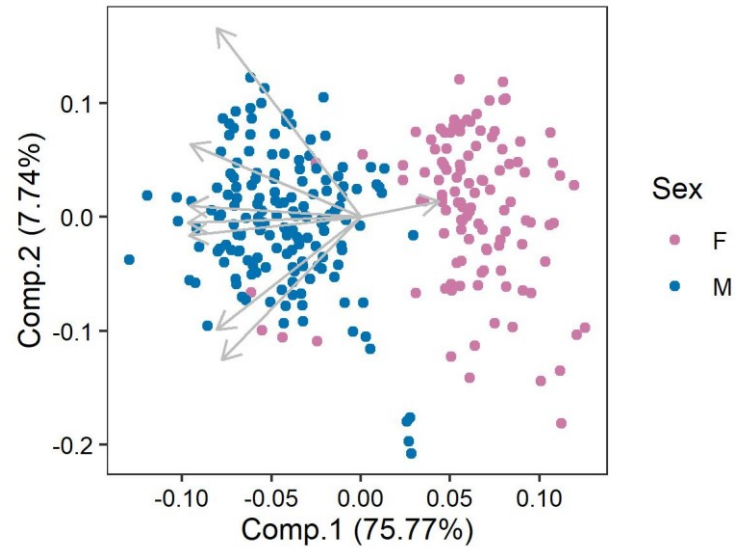


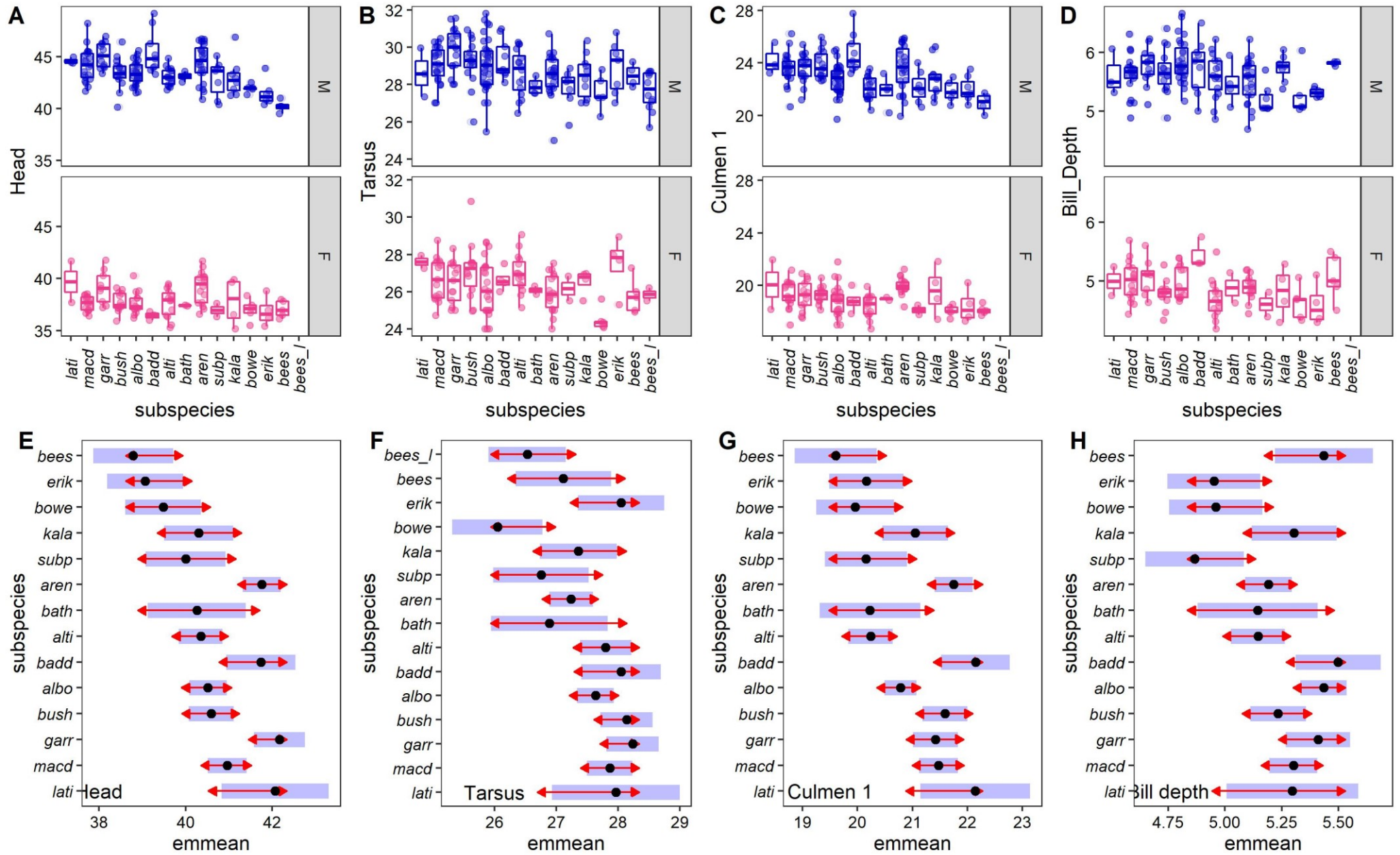
(B) Maximum Likelihood



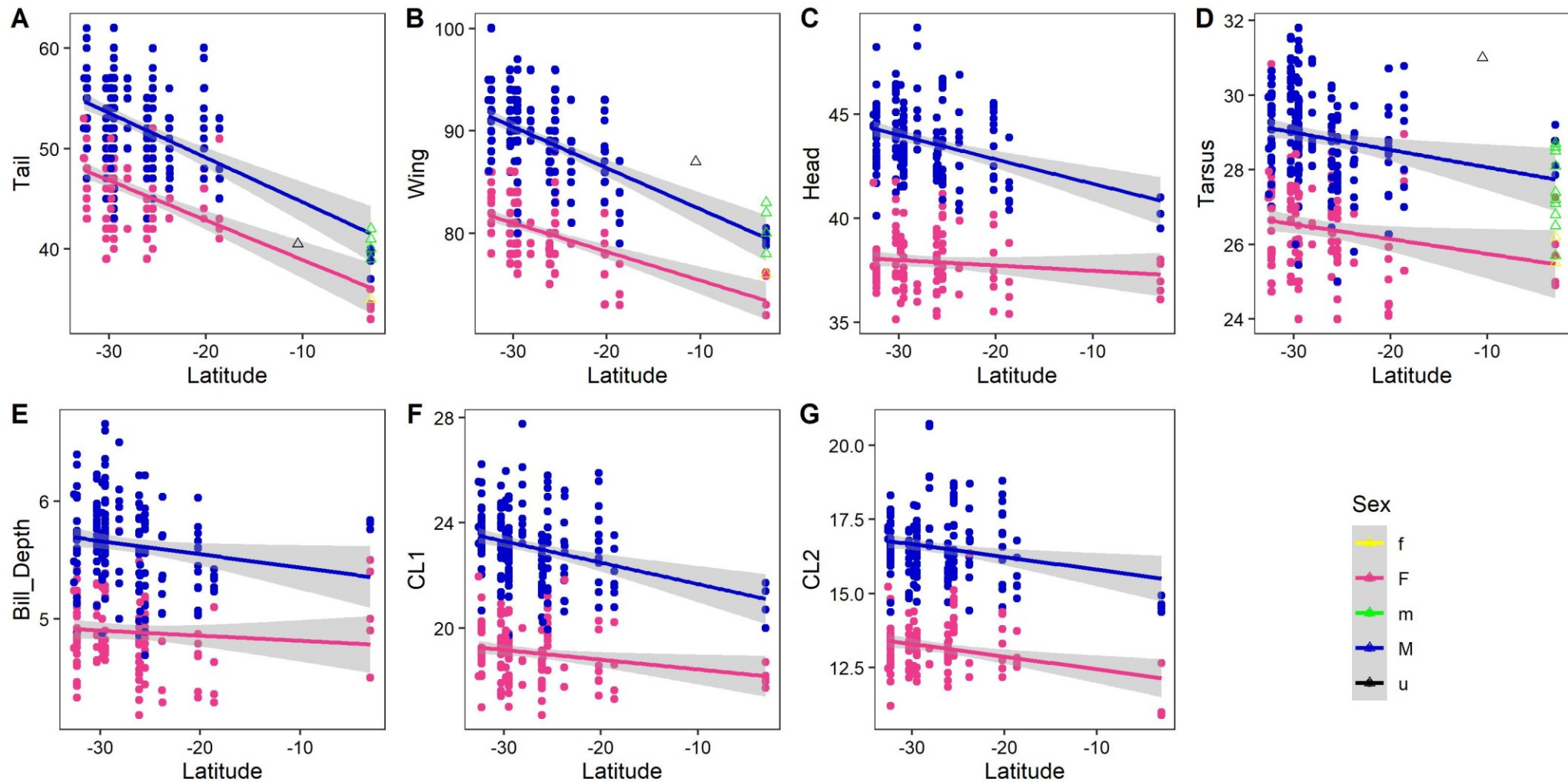
Supplementary Figure S2. The phylogenetic relationship within the spike-heeled lark complex inferred using (A) Maximum Parsimony (MP) and (B) Maximum Likelihood (ML). All trees are rooted on *Ammomanopsis grayi*. The HKY+G model was used for ML. MP and ML trees are collapsed at the 50% consensus level and bootstrap values are shown at nodes (as fractions rather than percentages); * indicates 100% bootstrap support. Proposed genetic haplogroups are indicated on both trees.

Supplementary Figure S3. Principle Component Analysis (PCA) of Spike-heeled Lark morphometric measurements including five outliers, labelled as female, but suspected males based on measurements.





Supplementary Figure S4. Spike-heeled Lark morphometric measurements not included in main manuscript plotted by Clancey (1980) subspecies designations (A-D) with corresponding EMMs based on linear regression analyses (E-H).



Supplementary Figure S5. Morphometric variation in the spike-heeled lark complex plotted against approximate latitude (average latitude for subspecies designation according to Clancey (1980)). A) Tail; B) Wing; C) Head; D) Tarsus; E) Bill Depth; F) Culmen CL1; G) Culmen CL2. Linear regression models are based on data from this publication (M – male; F – female). Additional data for 14 *C. [a.] beesleyi* specimens (Lanham 1997) and one from DRC (Louette and Hasson 2017) were plotted and labelled with lower case letters (f - female, m - male, u - unknown). These data were not included in the modelling.

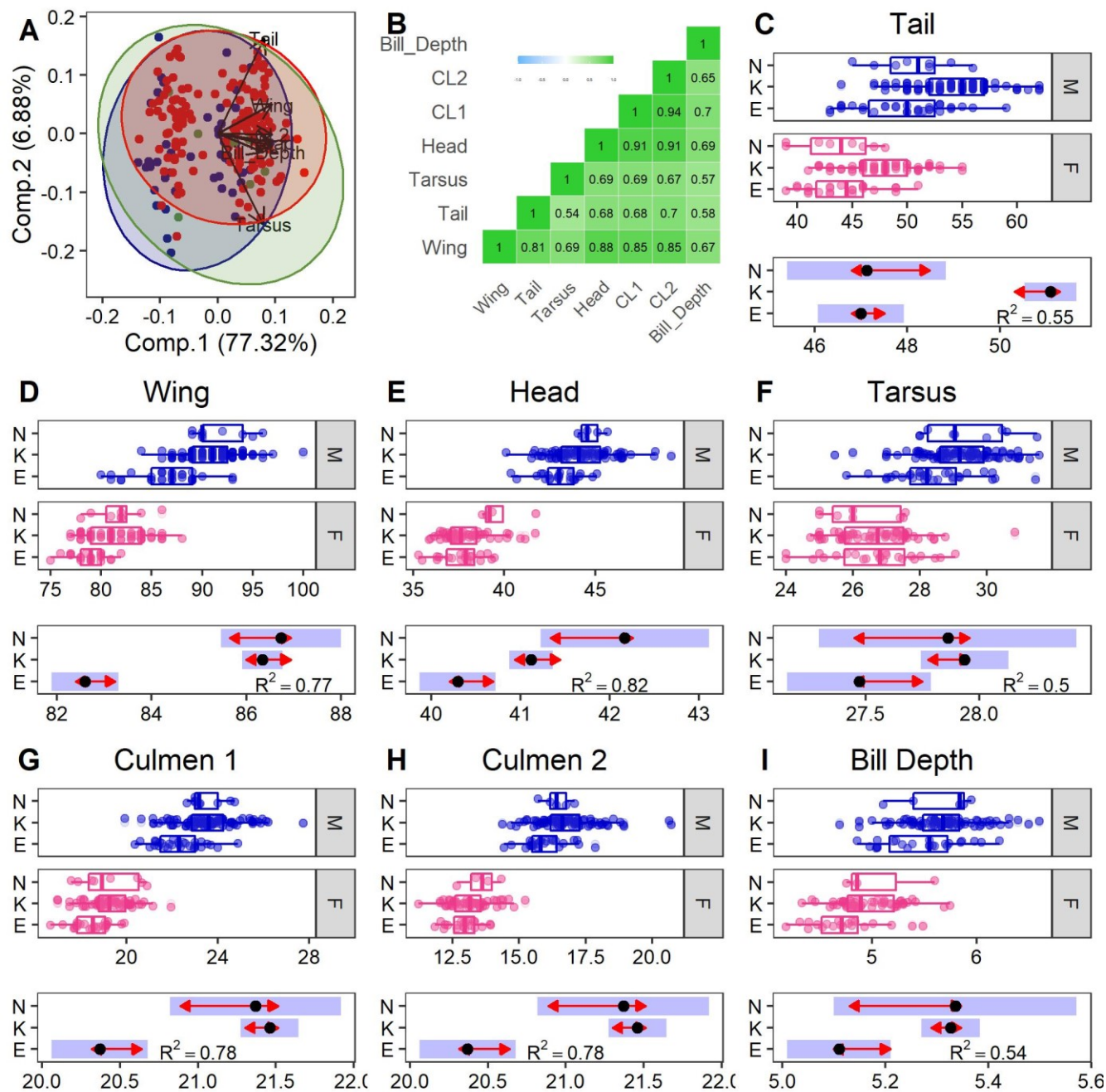


Figure S6. Morphometric analysis of South Africa Spike-heeled Larks grouped by proposed genetic haplogroups (N – Namaqualand; K – Karoo; E – Eastern). (A) PCA analysis. (B) Correlation between all morphometric measurements. Variation in (C) tail, (D) wing chord, (E) head, (F) tarsus, (G-H) culmen (C1 and C2) and (I) bill depth and sex (M – male; F – female). Estimated Marginal Means (EMMs) based on linear regression analyses appear below boxplots for each measure. Non-overlapping arrows in the EMM plots indicates significant differences between groups after Tukey adjustment ($\alpha < 0.05$).