Table S1. Blood parasite lineages found in this study. The different avian host where these lineages were isolated and their prevalence (number of infected hosts/number of sampled individuals) are shown. Transmission areas suggested but not confirmed are indicated with a question mark. Data not recorded is indicated as "nr" while "CI" denotes Canary Islands, "SG" Selvagens, and "MD" Madeira. Data gathered from MalAvi public database (Bensch *et al*. 2009). Illera *et al*. (2008) suggested that *Culex pipiens* could be the vector of the *Plasmodium* lineage LK6, yet it was not confirmed. Njabo *et al*. (2009) identified the mosquito *Coquillettidia aurites* as a true vector of the *Plasmodium* lineage P_ACCTAC01 in Cameroon, Africa, by confirming the presence of sporozoites in mosquito salivary glands. In addition, the same lineage P_ACCTAC01 was isolated from other mosquito species of the genera *Aedes*, *Coquillettidia* and *Culex* (Njabo *et al*. 2011). * The effect of parasite infection was analyzed considering different lineages together. Spurging *et al*. (2012) also combined different strains, but LK6 was the commonest lineage.

Parasite genus	Lineage	Transmission area	Avian hosts (prevalence)	Location	Effects on host's fitness	Reference
Plasmodium	LK6	Africa?	*Falco eleonorae (0.07)*	Spain (CI)	nr	This study
			Falco eleonorae (0.06)	Spain (CI)	nr	Gutiérrez-López *et al*. (2015)
		Africa?	*Falco naumanni (0.05)*	Spain	nr	Ortego *et al*. (2007a)
		mainland Spain?			nr	Ortego *et al*. (2007b)
		Africa?			Productivity (- in males)	Ortego *et al*. (2008)
		Canary Islands?	*Anthus berthelotti (0.15)*	Spain (CI) & Portugal (MD, SG)	nr	Illera *et al*. (2008)
		Canary Islands?	*Anthus berthelotti (0.36)*	Spain (CI)	nr	González-Quevedo *et al*. (2014)
			Anthus berthelotti (0.47)	Portugal (MD)	Body condition (+)*	Spurgin *et al*. (2012)
			Anthus berthelotti (0.20)	Spain (CI)		
			Anthus berthelotti (0)	Portugal (SG)		
			Sylvia conspicillata (0.13)	Cape Verde	nr	Illera *et al*. (2015)
			Sylvia conspicillata (0.40)	Spain (CI)		
			Sylvia conspicillata (0.38)	Portugal (MD)		
			Sylvia conspicillata (0.24)	Iberian Peninsula		
			Sylvia conspicillata (0.2)	Morocco		
			Emberiza cirlus (1)	Morocco	nr	Mata *et al*. (2015)
			Sylvia melanocephala (0.09)			
			Periparus ater (0.05)			
			Galerida cristata (1)			
			Phoenicurus moussieri (0.25)			
			Cyanistes teneriffae (0.09)			
		mainland Spain	*Anthus campestris (0.13)*	Spain	*	Calero-Riestra and García (2016)

		Canary Islands?	*Anthus berthelotti (0.33)*	Spain (CI)	nr	Synek *et al*. (2013)
			Cyanistes teneriffae (nr)			
			Erithacus rubecula (nr)			
			Fringilla coelebs (nr)			
			Phylloscopus cannariensis (nr)			
			Sylvia atricapilla (nr)			
			Sylvia conspicillata (nr)			
			Sylvia melanocephala (nr)			
			Turdus merula (nr)			
	P_ACCTAC01	Africa?	*Falco eleonorae (0.005)*	Spain (CI)	nr	This study
			Ficedula albicollis (nr)	Hungary	*	Szöllősi *et al*. (2009)
		Africa	*Ficedula albicollis (0.005)*	Sweden	nr	Radwan *et al*. (2012)
			Ficedula albicollis (0.003)	Sweden	*	Kulma *et al*. (2013)
			Ficedula albicollis (0.003)	Sweden	*	Kulma *et al*. (2014)
			Alethe fuelleborni (0.09)	Tanzania	nr	Loiseau *et al*. (2012)
			Mirafra rufocinnamomea (0.33)	Malawi	*	Lutz *et al*. (2015)
			Neocichia gutturalis (0.12)			
			Tockus alboterminatus (0.5)			
			Crex crex (0.03)	France	nr	Fourcade *et al*. (2014)
			Crex crex (0)	Germany		
			Crex crex (0)	Czech Republic		
			Crex crex (0)	Poland		
			Crex crex (0)	Latvia		
			Crex crex (0)	Belarus		
			Crex crex (0)	Russia		
			Accicipiter tachiro (nr)	Gabon	nr	Beadell *et al*. (2009)
			Bleda eximius (nr)			
			Bleda syndactylus (nr)			
			Campethera nivosa (nr)			
			Fraseria cinerascens (nr)			
			Neocossyphus fraseri (nr)			
			Neocossyphus poensis (nr)			
			Oriolus brachyrhynchus (nr)			
			Dyaphorophylia castanea (nr)			
			Ploceus nigricollis (nr)			
			Zoothera camaronensis (nr)			
			Merops breweri (nr)			
			Merops malimbicus (nr)			
Haemoproteus	LK4	Africa?	*Falco eleonorae (0.01)*	Spain (CI)	nr	This study
			Falco eleonorae (0.09)	Spain (CI)	nr	Gutiérrez-López *et al*. (2015)
			Falco naumanni (0.007)	Spain	nr	Ortego *et al*. (2007a)
	hBUBIBI01		*Falco eleonorae (0.03)*	Spain (CI)	nr	This study
		Africa?	*Falco eleonorae (0.03)*	Spain (CI)	nr	Gutiérrez-López *et al*. (2015)

			Bubulcus ibis (0.08)	Spain	nr	Ferraguti *et al*. (2013)
	FALELE01	Africa?	*Falco eleonorae (0.005)*	Spain (CI)	nr	This study
Leucocytozoon	L_CIAE02		*Falco eleonorae (0.005)*	Spain (CI)	nr	This study
			Falco eleonorae (0.03)	Spain (CI)	nr	Gutiérrez-López *et al*. (2015)
			Accipiter virgatus (1)	Phillippines	nr	Silva-Iturriza *et al*. (2012)
		Europe	*Crex crex (0.02)*	Poland	nr	Fourcade *et al*. (2014)
			Crex crex (0.05)	Russia		
			Crex crex (0)	France		
			Crex crex (0)	Germany		
			Crex crex (0)	Czech Republic		
			Crex crex (0)	Latvia		
			Crex crex (0)	Belarus		
			Asio otus (1)	Turkey	nr	Ciloglu *et al*. (2016)
			Buteo buteo (0.2)			
			Buteo rufinus (0.08)			
			Circus aeruginosus (0.5)	Germany	nr	Krone *et al*. (2008)
			Dendrocopos minor (0.5)	Portugal	nr	Mata *et al*. (2015)
		Africa	*Milvus migrans (0.07)*	Spain	nr	Pérez-Rodríguez *et al*. (2013)
		Europe	*Larus cachinnans (0.35)*	Poland	nr	Zagalska-Neubauer and Bensch (2016)
			Larus argentatus (0.26)			

References

Beadell JS, Covas R, Gebhard C, Ishtiaq F, Melo M, Schmidt BK, Perkins SL, Graves GR, Fleischer RC. 2009 Host associations and evolutionary relationships of avian blood parasites from West Africa. *Int. J. Parasitol.* **39**, 257-266.

Bensch S, Hellgren O, Pérez-Tris J. 2009 MalAvi: a public database of malaria parasites and related haemosporidians in avian hosts based on mitochondrial cytochrome b lineages. *Mol. Ecol. Resour.* **9**, 1353–1358.

Calero-Riestra M, García JT. 2016 Sex-dependent differences in avian malaria prevalence and consequences of infections on nestling growth and adult condition in the Tawny pipit, *Anthus campestris*. *Malar. J.* **15**, 1.

Ciloglu A, Yildirim A, Duzlu O, Onder Z, Dogan Z, Inci A. 2016 Investigation of avian haemosporidian parasites from raptor birds in Turkey, with molecular characterisation and microscopic confirmation. *Folia Parasitol.* **63**, 023.

Ferraguti M, Martínez-de la Puente J, Ruiz S, Soriguer R, Figuerola J. 2013 On the study of the transmission networks of blood parasites from SW Spain: diversity of avian haemosporidians in the biting midge *Culicoides circumscriptus* and wild birds. *Parasit. Vectors* **6**, 208.

Fourcade Y, Keišs O, Richardson DS, Secondi J. 2014 Continental-scale patterns of pathogen prevalence: a case study on the corncrake. *Evol. Appl.* **7**, 1043–1055.

Gonzalez-Quevedo C, Davies RG, Richardson DS. 2014 Predictors of malaria infection in a wild bird population: landscape-level analyses reveal climatic and anthropogenic factors. *J. Anim. Ecol.* **83**, 1091–1102.

Gutiérrez-López R, Gangoso L, Martínez-de la Puente J, Fric J, López-López P, Mailleux M, Muñoz J, Touati L, Samraoui S, Figuerola J. 2015 Low prevalence of blood parasites in a long-distance migratory raptor: the importance of host habitat. *Parasit. Vectors* **8**, 189.

Illera JC, Emerson BC, Richardson DS. 2008 Genetic characterization, distribution and prevalence of avian pox and avian malaria in the Berthelot's pipit (*Anthus berthelotii*) in Macaronesia. *Parasitol. Res.* **103**, 1435–1443.

Illera JC, Fernández-Álvarez Á, Hernández-Flores CN, Foronda P. 2015 Unforeseen biogeographical patterns in a multiple parasite system in Macaronesia. *J. Biogeogr.* **42**, 1858–1870.

Krone O, Waldenström J, Valkiūnas G, Lessow O, Müller K, Iezhova TA, Fickel J, Bensch S. 2008 Haemosporidian blood parasites in European birds of prey and owls. *J. Parasitol.* **94**, 709–715.

Kulma K, Low M, Bensch S, Qvarnström A. 2013 Malaria infections reinforce competitive asymmetry between two Ficedula flycatchers in a recent contact zone. *Mol. Ecol.* **22**, 4591–4601.

Kulma K, Low M, Bensch S, Qvarnström A. 2014 Malaria-infected female collared flycatchers (*Ficedula albicollis*) do not pay the cost of late breeding. *PloS one*, **9**, e85822.

Loiseau C, Harrigan RJ, Robert A, Bowie RC, Thomassen HA, Smith TB, Sehgal RN. 2012 Host and habitat specialization of avian malaria in Africa. *Mol. Ecol.* **21**, 431–441.

Lutz HL, Hochachka WM, Engel JI, Bell JA, Tkach VV, Bates JM, Hackett SJ, Weckstein JD. 2015 Parasite prevalence corresponds to host life history in a diverse assemblage of afrotropical birds and haemosporidian parasites. *PloS one*, **10**, e0121254.

Mata VA, da Silva LP, Lopes RJ, Drovetski SV. 2015 The Strait of Gibraltar poses an effective barrier to host-specialised but not to host-generalised lineages of avian Haemosporidia. *Int. J. Parasitol.* **45**, 711–719.

Njabo KY, Cornel AJ, Sehgal RN, Loiseau C, Buermann W, Harrigan RJ, Pollinger J, Valkiūnas, Smith TB. 2009 *Coquillettidia* (Culicidae, Diptera) mosquitoes are natural vectors of avian malaria in Africa. *Malar. J.* **8**, 193.

Njabo KY, Cornel AJ, Bonneaud C, Toffelmier E, Sehgal RNM, Valkiūnas G, Russell AF, Smith TB. 2011 Nonspecific patterns of vector, host and avian malaria parasite associations in a central African rainforest. *Mol. Ecol.* **20**, 1049–1061.

Ortego J, Calabuig G, Cordero PJ, Aparicio JM. 2007a Genetic characterization of avian malaria (Protozoa) in the endangered lesser kestrel, *Falco naumanni*. *Parasitol. Res.* **101**, 1153–1156.

Ortego J, Cordero PJ, Aparicio JM, Calabuig G. 2007b No relationship between individual genetic diversity and prevalence of avian malaria in a migratory kestrel. *Mol. Ecol.* **16**, 4858–4866.

Ortego J, Cordero PJ, Aparicio JM, Calabuig G. 2008 Consequences of chronic infections with three different avian malaria lineages on reproductive performance of Lesser Kestrels (*Falco naumanni*). *J. Ornithol.* **149**, 337–343.

Pérez-Rodríguez A, de la Puente J, Onrubia A, Pérez-Tris J. 2013 Molecular characterization of haemosporidian parasites from kites of the genus Milvus (Aves: Accipitridae). *Int. J. Parasitol.* **43**, 381–387.

Radwan J, Zagalska-Neubauer M, Cichón M, Sendecka J, Kulma K, Gustafsson L, Babik W. 2012 MHC diversity, malaria and lifetime reproductive success in collared flycatchers. *Mol. Ecol.* **21**, 2469–2479.

Silva-Iturriza A, Ketmaier V, Tiedemann R. 2012 Prevalence of avian haemosporidian parasites and their host fidelity in the central Philippine islands. *Parasitol. Int.* **6***1*, 650–657.

Spurgin LG, Illera JC, Padilla DP, Richardson DS. 2012 Biogeographical patterns and co-occurrence of pathogenic infection across island populations of Berthelot's pipit (*Anthus berthelotii*). *Oecologia* **168**, 691–701.

Synek P, Albrecht T, Garcia-del-Rey E, Lifjeld JT, Munclinger P. 2013 Hemosporidian parasites in Canarian birds: low lineage diversity and rare lineage expansion. International Conference on Malaria and related Haemosporidian parasites of wildlife (poster), Vilnius, Lithuania.

Szöllősi E, Rosivall B, Hasselquist D, Török J. 2009 The effect of parental quality and malaria infection on nestling performance in the collared flycatcher (*Ficedula albicollis*). *J. Ornithol.* **150**, 519–527.

Zagalska-Neubauer M, Bensch S. 2016 High prevalence of Leucocytozoon parasites in fresh water breeding gulls. *J. Ornithol.* **157**, 525–532.