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M. A. Peirce^a

^a MP International Consultancy, Bexhill-on-Sea, East Sussex, UK and Corresponding Associate, International Reference Centre for Avian Haematozoa, Queensland Museum, South Brisbane, Queensland, Australia

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A checklist of the valid avian species of *Babesia* (Apicomplexa: Piroplasmorida), *Haemoproteus*, *Leucocytozoon* (Apicomplexa: Haemosporida), and *Hepatozoon* (Apicomplexa: Haemogregarinidae)

M. A. PEIRCE

MP International Consultancy, Bexhill-on-Sea, East Sussex, UK and Corresponding Associate, International Reference Centre for Avian Haematozoa, Queensland Museum, South Brisbane, Queensland, Australia

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Abstract

A current checklist of valid avian species of *Babesia*, *Haemoproteus*, *Hepatozoon*, and *Leucocytozoon* is presented. Some taxonomic problems which have arisen since the last review are discussed as too are the remaining host family groups of parasites still requiring review.

Keywords: *Avian Haematozoa*, *Babesia*, *checklist*, *Haemoproteus*, *Hepatozoon*, *Leucocytozoon*, *taxonomy*

Introduction

Bennett et al. (1994) published an annotated checklist of the valid avian species of *Haemoproteus* Kruse, 1890, *Hepatozoon* Miller, 1908, and *Leucocytozoon* Berestneff, 1904 which collated all the major reviews of these parasite groups over the preceding 25 years. Since then only two avian family groups have been reviewed; the haematozoa of the Meliphagidae (Bennett et al. 1994) and the haemoproteids of the Cuculidae (Peirce and Adlard 2005). Additional new species have been described from several families. Peirce (2000) reviewed the avian species of *Babesia* Starcovici, 1893 and this group of parasites is also included in the current checklist to provide a more comprehensive coverage (Table I).

A number of anomalies that occurred in the previous checklist have been addressed. There are, however, still remaining a small number of parasites which require review based on fresh material. Some of these are included in the checklist and together with other species that are probably valid but which also require redescriptions and neohapantotypes from new material are listed in Table II.

Correspondence: M. A. Peirce, MP International Consultancy, 6 Normandale House, Normandale, Bexhill-on-Sea, East Sussex TN39 3NZ, UK.

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Table I. Checklist of the valid species of *Babesia*, *Haemoproteus*, *Hepatozoon*, and *Leucocytozoon*.

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Accipitridae	<i>Babesia moshkovskii</i> (Schurenkova, 1938) Laird and Lari, 1957			
	<i>Haemoproteus elani</i> de Mello, 1935	H	E	15
	<i>Haemoproteus janovskyi</i> Greiner and Munday, 1979	C	E	19
	<i>Haemoproteus nisi</i> Peirce and Marquiss, 1983	H	A	17
	<i>Hepatozoon neophrontis</i> (Todd and Wolbach, 1912) Wenyon, 1926			
Alaudidae	<i>Leucocytozoon toddi</i> Sambon, 1908	RM; FM		
	<i>Babesia kazachstanica</i> (Yakunin and Krivkova, 1971) Peirce, 1975			
	<i>Haemoproteus alaudae</i> Celli and Sanfelice, 1891	H/C	E	10
Alcedinidae	<i>Haemoproteus enucleator</i> Bennett, Okia, Ashford and Campbell, 1972	R	E	15
	<i>Haemoproteus fusca</i> Bennett and Campbell, 1973	C	E	34
	<i>Haemoproteus halcyonis</i> de Mello, 1936	H	E/A	24
	<i>Leucocytozoon alcedinis</i> Bennett, Earlé, Peirce and Nandi, 1993	RM		
	<i>Leucocytozoon daceo</i> Bennett, Earlé, Peirce and Nandi, 1993	RM		
Anatidae	<i>Leucocytozoon huchzermeyeri</i> Bennett, Earlé and Squires-Parsons, 1995	RM; FM		
	<i>Haemoproteus greineri</i> Bennett, Turner and Whiteway, 1984	C	E	38
	<i>Haemoproteus nettionis</i> Johnson and Clelland, 1910	H	E	23
	<i>Haemoproteus gabaldoni</i> Bennett, 1993	H	A	17
	<i>Leucocytozoon simondi</i> Mathis and Leger, 1910	RM; FM		
Apodidae	<i>Haemoproteus apodus</i> Bennett, Caines and Whiteway, 1986	M	E	11
Apterygidae	<i>Babesia kiwiensis</i> Peirce, Jakob-Hoff and Twentyman, 2003			
	<i>Hepatozoon kiwii</i> Peirce, Jakob-Hoff and Twentyman, 2003			
Ardeidae				
Ardeinae	<i>Babesia ardeae</i> Toumanoff, 1940			
	<i>Leucocytozoon ardeae</i> Rodhain, Pons, Vandenbranden and Bequaert, 1913	RM		
Botaurinae	<i>Haemoproteus mathislegeri</i> Helmy Mohammed, 1958	M	E	11
Nycticoracinae	<i>Leucocytozoon sanarellii</i> Babudieri, 1931	RM		
Artamidae	<i>Leucocytozoon artamidis</i> Peirce, Adlard and Lederer, 2005	RM		
Brachypteraciidae	<i>Haemoproteus forresteri</i> Savage and Greiner, 2004	C	E	12
	<i>Haemoproteus goodmani</i> Savage and Greiner, 2004	H	E/A	14
	<i>Leucocytozoon frasca</i> Savage and Greiner, 2004	RM		
Bubalornithidae	<i>Haemoproteus bubalornis</i> Bennett and Peirce, 1991	H	E	9
Bucconidae	<i>Haemoproteus buconis</i> Bennett, Caines and Whiteway, 1986	R/H	E	21
Bucerotidae	<i>Haemoproteus bucerotis</i> Bennett, Earlé and Squires-Parsons, 1995	H	E	23
	<i>Leucocytozoon bucerotis</i> Bennett, Earlé, Peirce and Nandi, 1993	RM		

Table I. (Continued.)

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Burhinidae	<i>Haemoproteus burhini</i> Bennett, Earlé and Squires-Parsons, 1995	H	E	25
Campephagidae	<i>Haemoproteus tephrodornis</i> de Mello, 1936	H	E	?
Capitonidae	<i>Haemoproteus bilobata</i> Bennett and Nandi, 1981	M	E	17
	<i>Haemoproteus cornuata</i> Bennett and Nandi, 1981	H	E	28
	<i>Haemoproteus thereicerycis</i> de Mello, 1936	H	E	31
	<i>Haemoproteus xantholamae</i> Zargar, 1945	H	E	19
	<i>Leucocytozoon capitonis</i> Bennett, Earlé and Peirce, 1993	RM		
	<i>Leucocytozoon pogoniuli</i> Jones, Sehgal and Smith, 2005	RM		
	<i>Leucocytozoon trachyphoni</i> Jones, Sehgal and Smith, 2005	RM		
Caprimulgidae	<i>Haemoproteus caprimulgi</i> Williams, Bennett and Mahrt, 1975	H	E	23
	<i>Leucocytozoon caprimulgi</i> Kerandel, 1913	RM		
Charadriidae	<i>Haemoproteus nascimentoi</i> Tendeiro, 1947	M	A	
	<i>Leucocytozoon sousadiasi</i> Tendeiro, 1947	FM		
Ciconiidae	<i>Haemoproteus crumenium</i> Hirst, 1905	H	IA; ME	11
	<i>Haemoproteus peircei</i> Forrester, Greiner, Bennett and Kigaye, 1977	C	E	30
Coliidae	<i>Haemoproteus undulatus</i> Bennett and Earlé, 1992	H/C	A	23
	<i>Leucocytozoon colius</i> Bennett, Earlé and Peirce, 1993	RM		
Columbidae	<i>Haemoproteus columbae</i> Kruse, 1890	H	E	♀33; ♂17
	<i>Haemoproteus sacharovyi</i> Novy and MacNeal, 1904	H/C/R	E	30–40
	<i>Leucocytozoon marchouxi</i> Mathis and Leger, 1910	RM		
Coraciidae	<i>Haemoproteus coraciae</i> de Mello and Afonso, 1935	H	IA; ME	8
	<i>Haemoproteus eurystomae</i> Bishop and Bennett, 1986	H	E	23
	<i>Leucocytozoon eurystomae</i> Kerandel, 1913	RM; FM		
	<i>Leucocytozoon melloi</i> Bhatia, 1938	RM		
Corvidae	<i>Babesia frugilegica</i> (Yakunin and Krivkova, 1971) Peirce, 1975			
	<i>Haemoproteus danilewskyi</i> Kruse, 1890	C/H	E	23
	<i>Haemoproteus picae</i> Coatney and Roudabush, 1937	H	E	10
	<i>Leucocytozoon sakharoffi</i> Sambon, 1908	RM		
Cracidae	<i>Haemoproteus cracidarum</i> Bennett, Gabaldon and Ulloa, 1982	H	A	22
	<i>Haemoproteus ortalidum</i> Bennett, Gabaldon and Ulloa, 1982	D	E	11
Cuculidae				
Cuculinae	<i>Haemoproteus clamatori</i> Peirce and Adlard, 2005	H	E	14
	<i>Haemoproteus cuculis</i> Peirce and Adlard, 2005	H	A; E	26

Table I. (Continued.)

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Centropodinae	<i>Haemoproteus centropi</i> de Mello, 1936	H	E	13
	<i>Leucocytozoon centropi</i> Fantham, 1921	RM		
Dicaeidae	<i>Haemoproteus dicaeus</i> Bennett and Bishop, 1990	H	E	16
	<i>Haemoproteus nucleophilus</i> Bennett and Bishop, 1990	M	E	8
Dicruridae	<i>Haemoproteus dicruri</i> de Mello, 1936	H	E	15
	<i>Haemoproteus khani</i> Savage and Greiner, 2005	C	E	13
Diomedeidae	<i>Hepatozoon albatrossi</i> Peirce and Prince, 1980			
Emberizidae				
Cardinalinae	<i>Haemoproteus mazzai</i> Parodi and Nino, 1927	H	E	11
Coerebinae	<i>Haemoproteus coereba</i> Burry-Caines and Bennett, 1992	H	E	12
Emberizinae	<i>Babesia emberizica</i> (Yakunin and Krivkova, 1971) Peirce, 1975			
	<i>Haemoproteus coatneyi</i> Burry-Caines and bennett, 1992	H	E	12
	<i>Hepatozoon paroariae</i> (de Beaufaire Aragão, 1911) Hoare, 1924			
	<i>Leucocytozoon cambournaci</i> Franca, 1912	RM		
Icterinae	<i>Haemoproteus quiscalus</i> Coatney and West, 1938	H	E/A	12
	<i>Leucocytozoon icteris</i> Bennett and Squires-Parsons, 1992	RM		
Parulinae	<i>Haemoproteus paruli</i> Burry-Caines and Bennett, 1992	H	E	12
	<i>Leucocytozoon parulis</i> Bennett and Squires-Parsons, 1992	RM		
Thraupinae	<i>Haemoproteus thraupi</i> Burry-Caines and Bennett, 1992	H	E	12
	<i>Hepatozoon rhamphocoeli</i> (de Beaufaire Aragão, 1911) Hoare, 1924			
	<i>Leucocytozoon thraupis</i> Bennett and Squires-Parsons, 1992	RM		
Estrildidae				
Estrildinae	<i>Haemoproteus africanus</i> Bennett and Peirce, 1991	H	E	12
Poephilinae	<i>Haemoproteus orizivorae</i> Anschutz, 1909	H	E	25
	<i>Haemoproteus uraeginthus</i> Bennett and Peirce, 1991	R	E	17
	<i>Hepatozoon estrildus</i> Bennett, Earlé and Peirce, 1992			
	<i>Leucocytozoon roubaudi</i> mathis and Leger, 1911	RM		
Eurylamidae	<i>Haemoproteus eurylaimus</i> Bennett, Bishop and Peirce, 1991	H	E	27
Falconidae	<i>Babesia shortti</i> (Mohammed, 1958) Corradetti and Scanga, 1964			
	<i>Haemoproteus brachiatus</i> Valkiunas and Iezhova, 1989	H/C	A	14
	<i>Haemoproteus tinnunculi</i> von Wasielwski and Wülker, 1918	H	E	23
	<i>Leucocytozoon toddi</i> Sambon, 1908	RM; FM		
Formicaridae	<i>Haemoproteus formicarius</i> Bennett, Caines and Woodworth-Lynas, 1987	H	E	13
Fregatidae	<i>Haemoproteus iwa</i> Work and Rameyer, 1996	H	E	22

Table I. (Continued.)

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Fringillidae				
Carduelinae	<i>Haemoproteus chloris</i> Covaleta Ortega and Gallego Berenguer, 1950	H	E	12
	<i>Leucocytozoon dutoiti</i> Bennett, Earlé and Peirce, 1992	RM		
Fringillinae	<i>Haemoproteus fringillae</i> Labbé, 1894	M	E	12
	<i>Haemoproteus magnus</i> Valkiunas and Iezhova, 1992	H-C	E	10
	<i>Leucocytozoon fringillinarum</i> Woodcock, 1910	RM		
Furnariidae	<i>Haemoproteus furnarius</i> Bennett, Caines and Woodworth-Lynas, 1987	H	IA; ME	10
Glareolidae	<i>Haemoproteus abduzalomovi</i> Subkhanov, 1980	H	E	11-24
Gruidae	<i>Babesia balearicae</i> (Peirce, 1973) Peirce, 1975			
	<i>Haemoproteus antigonis</i> de Mello, 1936	H	E	19
	<i>Haemoproteus balearicae</i> Peirce, 1973	M	A	7
	<i>Leucocytozoon grusi</i> Bennett, Khan and Campbell, 1974	RM; FM		
Hirundinidae	<i>Babesia rustica</i> (Yakunin and Krivkova, 1971) Peirce, 1975			
	<i>Haemoproteus prognei</i> Coatney and Roudabush, 1937	H	E	13
	<i>Haemoproteus stellaris</i> White and Bennett, 1978	H	E	2-3
	<i>Hepatozoon atticorae</i> (de Beaufort Aragão, 1911) Hoare, 1924			
	<i>Leucocytozoon whitworthi</i> Bennett and Peirce, 1992	RM		
Indicatoridae	<i>Haemoproteus indicator</i> Bennett, Caines and Whiteway, 1986	H	E	♀42; ♂24
Irenidae	<i>Haemoproteus aegithinae</i> de Mello, 1936	H	E	20
	<i>Leucocytozoon chloropsidis</i> de Mello, 1935	RM		
	<i>Leucocytozoon irenis</i> Bennett and Peirce, 1992	RM		
Laniidae				
Laniinae	<i>Haemoproteus lanii</i> de Mello, 1936	H	E	12
	<i>Haemoproteus mcleani</i> Bennett, Earlé and Squires-Parsons, 1995	D	E	11
	<i>Hepatozoon lanis</i> Bennett, Earlé and Peirce, 1992			
Malacotinae	<i>Haemoproteus cublae</i> Peirce, 1984	M	IA; ME	10
	<i>Hepatozoon malacotinus</i> Bennett, Earlé and Peirce, 1992			
	<i>Leucocytozoon balmorali</i> Peirce, 1984	RM; FM		
Laridae	<i>Babesia bennetti</i> Merino, 1998			
	<i>Haemoproteus lari</i> Yakunin, 1972	C	E	24
Megapodidae	<i>Haemoproteus megapodius</i> Nandi and Mandal, 1980	M	E	21
Meliphagidae	<i>Haemoproteus ptilotis</i> (Cleland and Johnston, 1909) Coatney, 1936	H	E	10
	<i>Leucocytozoon anellobiae</i> (Cleland and Johnson, 1911) Johnson, 1912	RM		
Meropidae	<i>Haemoproteus manwelli</i> Bennett, 1978	H	E	10
	<i>Haemoproteus meropis</i> (Zargar, 1945) Bennett, 1978	H	E/A	14
	<i>Haemoproteus lairdi</i> Bennett, 1978	R	E	17
	<i>Leucocytozoon nyctiornis</i> Nandi, 1986	RM		

Table I. (Continued.)

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Mimidae	<i>Haemoproteus beckeri</i> Roudabush and Coatney, 1935	H	E	9
Motacillidae	<i>Haemoproteus anthi</i> de Mello, 1936	H	E	11
	<i>Haemoproteus motacillae</i> Bennett and Peirce, 1990	H	IA; ME	16
Muscicapidae				
Monarchinae	<i>Haemoproteus monarchus</i> Bennett, Bishop and Peirce, 1991	H	E	9
Muscicapinae	<i>Haemoproteus balmorali</i> Peirce, 1984	H	E	16
	<i>Haemoproteus pallidus</i> Valkiunas and Iezhova, 1992	H	A	11
	<i>Haemoproteus nipponensis</i> Bennett, Bishop and Peirce, 1991	H/C	E	27
	<i>Leucocytozoon muscicapa</i> Bennett, Siikamäki, Jokimäki, Hovi and Huhta, 1995	RM		
Pachycephalinae	<i>Haemoproteus pachycephalus</i> Bennett, Bishop and Peirce, 1991	M	E	20
Rhipidurinae	<i>Haemoproteus rhipiduris</i> Bennett, Bishop and Peirce, 1991	M	E	12
Sylviinae	<i>Haemoproteus belopolskyi</i> Valkiunas, 1989	C/H	E	17
	<i>Haemoproteus payevskyi</i> Valkiunas, Iezhova and Chernetsov, 1994	M	E	12
	<i>Haemoproteus sylvae</i> Bennett, Bishop and Peirce, 1991	H	E	10
	<i>Haemoproteus wenyoni</i> de Mello, Bras de Sa, de Sousa, Dias and Norhonha, 1916	H	IA; ME	24
	<i>Hepatozoon sylvae</i> Bennett, Earlé and Peirce, 1992			
	<i>Leucocytozoon phylloscopus</i> Subkhanov, 1980	RM		
	<i>Leucocytozoon peircei</i> Bennett, Earlé and Squires-Parsons, 1995	FM		
	<i>Haemoproteus timalus</i> Bennett, Bishop and Peirce, 1991	H	A	11
	<i>Leucocytozoon liothricis</i> Laveran and Marullaz, 1914	RM		
	<i>Leucocytozoon timaliae</i> Bennett, Earlé and Peirce, 1992	RM		
Turdinae	<i>Haemoproteus fallisi</i> Bennett and Campbell, 1972	M	A	13
	<i>Haemoproteus minutus</i> Valkiunas and Iezhova, 1992	M	A	5
	<i>Haemoproteus neseri</i> Bennett and Earlé, 1992	H	E	30
	<i>Leucocytozoon dubreuii</i> Mathis and Leger, 1911	RM		
	<i>Leucocytozoon mcclurei</i> (Greiner, 1976) Bennett, Earlé and Peirce, 1993	FM		
	<i>Leucocytozoon shaartusicum</i> Subkhanov, 1980	RM		
	<i>Haemoproteus montezi</i> Travassos Santos Dias, 1953	H	E	18
Musophagidae	<i>Leucocytozoon dimizi</i> Tendeiro, 1947	RM		
Nectarinidae	<i>Haemoproteus sequeirae</i> Tendeiro, 1947	H	E	7
	<i>Leucocytozoon nectarinae</i> Bennett, Earlé and Peirce, 1992	RM		
Oriolidae	<i>Haemoproteus oriolis</i> de Mello, 1936	H	E	♀21; ♂14
	<i>Leucocytozoon oriolus</i> Bennett and Peirce, 1992	RM		

Table I. (Continued.)

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Otidae	<i>Haemoproteus telfordi</i> Bennett, Forrester, Greiner and Campbell, 1975	C	E	17
	<i>Haemoproteus tendei</i> Travassos Santos Dias, 1953	H	E	18
	<i>Leucocytozoon otidis</i> Adlard, Peirce and Lederer, 2002	RM		
Paradoxornithidae	<i>Leucocytozoon bishopi</i> Bennett and Peirce, 1992	RM		
Paridae	<i>Haemoproteus majoris</i> Laveran, 1902	H	E	8
	<i>Haemoproteus parus</i> Bennett, 1989	D	E	13
	<i>Hepatozoon parus</i> Bennett and Peirce, 1989			
	<i>Leucocytozoon hamiltoni</i> Valkiunas, Iezhova and Mironov, 2002	FM		
	<i>Leucocytozoon majoris</i> (Laveran, 1902) Coatney, 1937	RM		
Passeridae	<i>Babesia mujunkumica</i> (Yakunin and Krivkova, 1971) Peirce, 1975			
	<i>Haemoproteus passeris</i> Kruse, 1890	H	E	13
	<i>Hepatozoon passeris</i> Bennett, Earlé and Squires-Parsons, 1995			
	<i>Leucocytozoon gentili</i> Leger, 1913	RM		
Phasianidae				
Meleagrinae	<i>Haemoproteus meleagridis</i> Levine, 1961	H	E	27
	<i>Leucocytozoon smithi</i> Laveran and Lucet, 1905	RM; FM		
Numidinae	<i>Haemoproteus pratasi</i> Tendeiro, 1947	H	E	11
	<i>Hepatozoon numidis</i> Bennett, Earlé and Peirce, 1992			
	<i>Leucocytozoon neavei</i> Balfour, 1906	RM; FM		
Odontophorinae	<i>Haemoproteus lophortyx</i> O'Roke, 1929	C	IA; ME	9
Phasianinae	<i>Haemoproteus rileyi</i> Malkani, 1936	H	E	40
	<i>Leucocytozoon macleani</i> Sambon, 1908	RM; FM		
	<i>Leucocytozoon schoutedeni</i> Rodhain, Pons, Vandenbranden and Bequaert, 1913	RM		
	<i>Leucocytozoon peaolopesi</i> Travassos Santos Dias, 1951	RM; FM		
Tetraoninae	<i>Haemoproteus mansonii</i> Castellani and Chalmers, 1910	H/C	E	19
	<i>Haemoproteus stableri</i> White and Bennett, 1979	C	A	10
	<i>Leucocytozoon lovati</i> Seligman and Sambon, 1907	RM; FM		
	<i>Leucocytozoon greineri</i> Savage, 2004	RM		
Philepittidae	<i>Haemoproteus bennetti</i> Greiner, Mandal and Nandi, 1977	R	E	20
Picidae	<i>Haemoproteus borgesii</i> Tendeiro, 1947	H	E	12
	<i>Haemoproteus velans</i> Coatney and Roudabush, 1937	C	E	16–34
	<i>Leucocytozoon squamatus</i> Nandi, 1986	RM		

Table I. (Continued.)

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Pittidae	<i>Haemoproteus pittae</i> Bennett, Bishop and Peirce, 1991	H	E	21
	<i>Hepatozoon pittae</i> Bennett, Earlé and Peirce, 1992			
	<i>Leucocytozoon pittae</i> Bennett and Peirce, 1992	RM		
Ploceidae	<i>Haemoproteus quelea</i> (Marullaz, 1912) Coatney, 1936	H	E	18
	<i>Leucocytozoon bouffardi</i> Leger and Blanchard, 1911	RM		
	<i>Leucocytozoon podargii</i> Adlard, Peirce and Lederer, 2002	RM		
Podargidae	<i>Hepatozoon prionopis</i> Bennett and Earlé, 1992			
Prionopidae	<i>Leucocytozoon prionopis</i> Bennett and Earlé, 1992	RM		
Promeropidae	<i>Leucocytozoon deswardti</i> Bennett, Earlé and Peirce, 1992	RM		
Psittacidae	<i>Haemoproteus handai</i> Maqsood, 1943	C	IA; ME	20
	<i>Haemoproteus psittaci</i> Bennett and Peirce, 1992	M	E	11
Pteroclididae	<i>Haemoproteus krylovi</i> Subkhanov, 1980	H	E	20–25
	<i>Haemoproteus pteroclis</i> Shamsuddin and Mohammed, 1981	H	A	11–15
	<i>Haemoproteus otocompsae</i> de Mello, 1936	H	E	10
Pycnonotidae	<i>Haemoproteus philippinensis</i> Rahal, Bishop and Bennett, 1987	M	E	8
	<i>Haemoproteus sanguineus</i> Chakravarty and Kar, 1945	M	E	15
	<i>Leucocytozoon brimonti</i> Mathis and Leger, 1910	RM		
	<i>Leucocytozoon pycnonoti</i> Bennett, Earlé and Peirce, 1992	RM		
	<i>Haemoproteus gallinulae</i> de Mello, 1936	H	E	32
Rallidae	<i>Haemoproteus porzanae</i> Galli-Valerio, 1907	M	A	10
	<i>Leucocytozoon ralli</i> Galli-Valerio, 1930	RM		
Sagittariidae	<i>Leucocytozoon beaurepairei</i> Travassos Santos Dias, 1954	FM		
Scolopacidae	<i>Haemoproteus contortus</i> Bennett, 1979	C	A	24
	<i>Haemoproteus rotator</i> Bennett, 1979	H/C	A	20
	<i>Haemoproteus scolopaci</i> Galli-Valerio, 1929	H	E	16
	<i>Leucocytozoon legeri</i> França, 1912	RM		
	<i>Haemoproteus sittae</i> Bennett, 1989	H	E	13
Sittidae	<i>Babesia peircei</i> Earlé, Huchzermeyer, Bennett and Brossy, 1993			
Spheniscidae	<i>Leucocytozoon tawaki</i> Fallis, Bisset and Anderson, 1977	RM		
	<i>Haemoproteus noctuae</i> Celli and Sanfelice, 1891	C	A	20
Strigidae	<i>Haemoproteus syrnii</i> (Mayer, 1911) Coatney, 1936	H	E	♀21; ♂14
	<i>Leucocytozoon danilewskyi</i> Ziemann, 1898	RM; FM		
Struthionidae	<i>Leucocytozoon struthionis</i> Walker, 1912	RM		

Table I. (Continued.)

Host group	Parasite	Morphological characters		
		Shape	Outline	No. of pigment granules
Sturnidae	<i>Haemoproteus kairullaevi</i> Valkiunas and Iezhova, 1993	M	A	10
	<i>Haemoproteus pastoris</i> de Mello, 1936	H	E	11
	<i>Leucocytozoon sturni</i> Bennett, Earlé and Peirce, 1992	RM		
	<i>Leucocytozoon underhilli</i> Bennett, Earlé and Squires-Parsons, 1995	RM		
Sulidae	<i>Babesia poelea</i> Work and Ramayer, 1997			
Threskiornithidae	<i>Haemoproteus pelouroi</i> Tendeiro, 1947	M	A	7–13
	<i>Haemoproteus plataleae</i> de Mello, 1936	H	E	45
	<i>Leucocytozoon ibisi</i> Adlard, Peirce and Lederer, 2002	RM		
Trochilidae	<i>Haemoproteus archilochus</i> Coatney and West, 1938	C	E	16
	<i>Haemoproteus trochili</i> White, Bennett and Williams, 1979	H	E	11
	<i>Haemoproteus witti</i> White, Bennett and Williams, 1979	H	E	24
	<i>Haemoproteus trogonis</i> Bennett and Peirce, 1990	H	E	11
Trogonidae	<i>Haemoproteus circumnuclearis</i> Bennett, Caines and Whiteway, 1986	C	E	20
Tyrannidae	<i>Haemoproteus souzalopesi</i> Bennett, Caines and Whiteway, 1989	D	E	13
	<i>Haemoproteus tyranni</i> Bennett, Caines and Whiteway, 1989	H	E	17
	<i>Haemoproteus phodili</i> Bishop and Bennett, 1989	H	E	14
Tytonidae	<i>Haemoproteus tytoni</i> Bishop and Bennett, 1989	C	A/E	21
Upupidae	<i>Babesia krylovi</i> (Yakunin and Krivkova, 1971) Peirce, 1975			
	<i>Haemoproteus upupae</i> de Mello, 1936	H	E	?
	<i>Leucocytozoon communis</i> Valkiunas, 1989	RM		
Vangidae	<i>Haemoproteus madagascariensis</i> Savage, Arie and Greiner, 2004	H	E	3
	<i>Haemoproteus vangii</i> Savage, Arie and Greiner, 2004	M/H	A/E	7
	<i>Leucocytozoon lairdi</i> Savage, Arie and Greiner, 2004	RM		
	<i>Leucocytozoon vangis</i> (Savage, Arie and Greiner, 2004) emend Peirce	RM		
Vireonidae	<i>Haemoproteus vireonis</i> Bennett, Caines and Woodworth-Lynas, 1987	H	E	12
Zosteropidae	<i>Haemoproteus killangoi</i> Bennett and Peirce, 1981	H	A	9
	<i>Haemoproteus zosteropsis</i> Chakravarty and Kar, 1945	H	E	15
	<i>Leucocytozoon zosteropsis</i> Peirce, Cheke and Cheke, 1977	RM		

Haemoproteus. Shape: C, circumnuclear; D, discoid; H, halteridial; M, microhalteridial; R, rod-like. Outline: A, amoeboid; E, entire; I, immature; M, mature. Terminology derived from Bennett and Peirce (1988).

Leucocytozoon. Shape: RM, round morph; FM, fusiform morph. Terminology from Bennett et al. (1991).

Table II. Species of *Haemoproteus* and *Leucocytozoon* requiring review.

Species	Authority	Type host species	Type host family
<i>Haemoproteus</i>			
<i>H. hartmanni</i>	Babudieri, 1931	<i>Nycticorax nycticorax</i>	Ardeidae
<i>H. herodiadis</i>	de Mello, 1935	<i>Egretta intermedia</i>	Ardeidae
<i>H. hirundinis</i>	Sergent and Sergent, 1905	"hirundelle"	Hirundinidae
<i>H. krylovi</i>	Subkhanov, 1980	<i>Pterocles orientalis</i>	Pteroclididae
<i>H. mathislegeri</i>	Mohammed, 1958	<i>Ixobrychus minutus</i>	Ardeidae
<i>H. megapodus</i>	Nandi and Mandal, 1980	<i>Megapodus freycinet</i>	Megapodiidae
<i>H. nascimentoi</i>	Tendeiro, 1947	<i>Hoplopterus tectus</i>	Charadriidae
<i>H. tephrodornis</i>	de Mello, 1936	<i>Tephrodornis pondicerianus</i>	Campephagidae
<i>H. upupae</i>	de Mello, 1936	<i>Upupa epops</i>	Upupidae
<i>Leucocytozoon</i>			
<i>L. cheissini</i>	Krylov and Tryapitsina, 1965	<i>Tetragallus himalayensis</i>	Phasianidae
<i>L. leboeufi</i>	Mathis and Leger, 1911	<i>Ixobrychus sinensis</i>	Ardeidae
<i>L. legeri</i>	França, 1912	<i>Scolopax rusticola</i>	Scolopacidae
<i>L. sanarellii</i>	Babudieri, 1931	<i>Nycticorax nycticorax</i>	Ardeidae
<i>L. sousadiasi</i>	Tendeiro, 1947	<i>Hoplopterus tectus</i>	Charadriidae
<i>L. vandenbrandeni</i>	Rodhain, 1931	<i>Anhinga rufa</i>	Anhingidae

Taxonomic issues

One of the parasites listed in the previous checklist was *Hepatozoon ploceus* of the Ploceidae attributed to Bennett et al. (1992). In fact these authors described *Hepatozoon estrildus* from the Poephilinae which was omitted from the checklist. No parasite under the name of *Hp. ploceus* has ever been described, so Bennett et al. (1994) inadvertently created a *nomen nudum*. There is no slide in the International Reference Centre for Avian Haematozoa (IRCAH) labelled with this parasite.

One family group which specifically requires review is the Ardeidae. Recent DNA–DNA hybridization studies (Martínez-Vilalta and Motis 1992) have split the family into four subfamilies. Historically, at least three of these subfamilies have each had species of *Haemoproteus* and *Leucocytozoon* described from them, but as can be seen from Table II all require review. Studies are currently under way to obtain fresh material in an effort to resolve these issues. Whether all species of *Haemoproteus* and *Leucocytozoon* described are valid remains to be determined. Most species in the past have been described from dead birds so the morphometric data are not acceptable by current standards. It is perhaps worth noting that the parasite described from the Nycticoracinae as *Leucocytozoon nycticoraxi* by Shamsuddin and Mohammad (1980) is almost certainly a synonym of *L. sanarellii* Babudieri, 1931. Babudieri (1931) based his description on his own material and that previously illustrated and described, but not named, by Franchini (1924). Shamsuddin and Mohammad (1980) made no reference to the paper by Babudieri (1931) and only one figure from their description appeared as several pages were missing from the published issue of the journal including all the remaining figures for *L. nycticoraxi*. Making allowance for the usual post mortem changes and distortion caused during smear making, there is no obvious difference between the descriptions.

Of more recent occurrence has been the description of *Leucocytozoon bennetti* by Savage et al. (2004) from the Vangidae. Unfortunately these authors have created a homonym as the species name is preoccupied for the parasite described by Valkiunas (1993) from the Coraciidae. It is therefore proposed that *Leucocytozoon bennetti* Savage, Arie and Greiner, 2004 be emended to *Leucocytozoon vangis*.

However, the status of *L. bennetti* of the Coraciidae is also in doubt. Bennett et al. (1993) reviewed the leucocytozoids of the Coraciidae and concluded that only one species was valid, *Leucocytozoon eurystomae* Kerandel, 1913 which has both round and fusiform morphs. This was based on the assumption that round morphs usually develop first. Therefore those slides with only round morphs were early infections. Concurrently with the paper published by Bennett et al. (1993), Valkiunas also published a description of a new species from the same family which he named *Leucocytozoon bennetti* (Valkiunas, 1993) on the basis that only round morphs occurred and that the parasite differed morphologically from *Akiba caulleryi* (Mathis and Leger, 1909). Unfortunately, Valkiunas (1993) did not compare his material with that of Bhatia (1938) in particular. Bhatia (1938) described *L. melloi* which only had round morphs and his figures correspond to figure 3 in the description by Valkiunas (1993) for *L. bennetti*. Furthermore, Bhatia (1938) made the point that many of the parasites were enucleated, a significant point noted also by Valkiunas (1993). In recent correspondence G. A. Valkiunas (personal communication) states that he has about 100 slides of the parasite all with round morphs only. Therefore it seems reasonable to accept there is a leucocytozoid in the Coraciidae with only round morphs. Valkiunas (1993) was apparently describing the same parasite as Bhatia (1938) and therefore *L. bennetti* should be considered a synonym of *L. melloi*.

Discussion

The host specificity of avian haematozoa was discussed in detail by Bennett and Peirce (1988) and reinforced by Bennett et al. (1994) who concluded that most species included in the checklist were host family and subfamily specific. There are a few exceptions, most notably among small passerines where some species may occur in more than one subfamily, i.e. *Haemoproteus balmorali* Peirce, 1984 of the Muscipapinae also occurs in the Turdinae and therefore may be specific only to the family level. Although there may be other examples, on present knowledge this is a rare occurrence. The expanding use of molecular techniques in the study of avian haematozoa should eventually clarify the status of many species which have a similar morphology but occur in different host families or subfamilies. However, molecular studies should only be considered as a useful adjunct in taxonomy; morphology and life cycles will remain the core attributes in defining new species.

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