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BLOOD PARASITISM IN WILD INDIAN BIRDS

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INTRODUCTION

During the course of different surveys conducted over the period of 1973-1988, data pertaining to parasitism of avian haematozoa from various parts of India were gathered (Nandi, 1976; 1986a, 1989; Nandi and Bennett, 1994; Nandi and Mandal, 1977, 1978, 1980, 1984, 1985; Nandi, Mandal and Choudhury, 1984; Nandi, Ray and Banerjee, 1984). The present paper analyses these mass of information about the levels of blood parasitism in wild avian populations in India as a whole and also at the State level.

Though there are a number of papers on blood parasites of Indian avifauna (Nandi, 1984; Nandi and Bennett, 1997), these are either limited to a localised region or deal with taxonomic aspects of one or a few parasites. The single largest survey carried out so far is the Haematozoa in the birds of eastern and southern Asia including India, conducted under the Migratory Animal Pathological Survey (MAPS) by Mc Clure *et al.* (1978). The result of the above paper is discussed in relevance to the present report.

MATERIALS AND METHODS

A total of 1242 wild birds comprising 342 species representing 66 families and subfamilies and 15 orders were examined for the blood parasites. These birds were collected from 11 States of India. The distribution and the relative frequencies of the different parasitic genera have been analysed from State to State, as well as from avian family to family, especially in case where more than 10 birds were sampled. Thin smears were prepared from the peripheral blood, air dried, fixed in 100% menthanol, stained with Giemsa's or Wright's stain and examined under microscope (100 X, 400 X and 1000 X) for about 15 minutes before declaring them negative or otherwise for the parasites.

RESULT AND DISCUSSION

The data about the prevalence and distribution of avian blood parasites, those observed in 1242 wild birds belonging to 342 species of 66 avian families/subfamilies collected during the year 1973-1988 from 11 States *viz.*, West Bengal, Orissa, Goa, Maharashtra, Andhra Pradesh, Jammu and Kashmir, Tripura, Assam, Arunachal Pradesh, Himachal Pradesh and Andaman & Nicobar Islands, indicate the presence of parasites in 304 birds of 122 species

TABLE-1

Blood parasitism in wild birds from different parts of India.

States	Total birds		Number of birds infected with					
	Examined	Infected	Tryp.	Leuc.	Haem.	Plasm.	Lank.	Micro.
West Bengal	426	130	6	2	116	15	4	24
Per cent		30.5	1.4	0.46	27.2	3.5	0.93	5.6
Orissa	171	18	—	—	15	3	—	—
Per cent		10.5	—	—	8.7	1.7	—	—
Assam	41	13	—	1	11	1	—	3
Per cent		31.7	—	2.4	26.8	2.4	—	7.3
Himachal Pradesh	6	1	—	—	1	—	—	—
Per cent		16.1	—	—	16.1	—	—	—
Arunachal Pradesh	61	19	—	—	5	—	—	14
Per cent		31.1	—	—	8.1	—	—	22.9
Tripura	18	0	—	—	—	—	—	—
Per cent		—	—	—	—	—	—	—
Andaman & Nicobar Is.	8	2	—	—	1	—	—	1
Per cent		25.0	—	—	25.5	—	—	12.5
Goa	156	50	6	11	30	—	—	24
Per cent		32.0	3.8	7.0	19.2	—	—	15.3
Andhra Pradesh	146	30	1	3	14	—	—	14
Per cent		20.5	0.68	2.0	9.5	—	—	9.5
Maharashtra	142	23	—	—	23	2	—	—
Per cent		16.1	—	—	16.1	1.4	—	—
Jammu & Kashmir	67	18	1	6	10	1	—	7
Per cent		26.8	1.4	8.9	14.9	1.4	—	10.4
Total	1242	304	14	23	226	22	4	87
Per cent		24.9	1.1	1.8	18.1	1.7	0.32	7.0

Abbreviation : Tryp. = *Trypanosoma;* Leuc. = *Leucocytozoon;*
Haem. = *Haemoproteus;* Plasm. = *Plasmodium;*
Lank. = *Lankestrella;* Micro = Microfilaria

TABLE-2

Blood parasitism in different species of wild Indian birds

Family and species	Total birds		Number of birds infected with					
	Exam.	Inf.	Leuc.	Haem.	Plasm.	Tryp.	Micro	Lank
1	2	3	4	5	6	7	8	9
ACCIPITRIDAE (11 species)	27	5	3	2	—	—	2	—
Accipiter badius	7	1	1	—	—	—	1	—
Accipiter trivirgatus	1	1	—	—	—	—	1	—
Buteo vulpinus	1	1	—	1	—	—	—	—
Elanus caeruleus	3	1	1	—	—	—	—	—
Spizaetus cirrhatus	4	1	1	1	—	—	—	—
ALAUDIDAE (5 species)	13	1	—	—	—	—	1	—
Gallerida malabarica	5	1	—	—	—	—	1	—
ALCEDINIDAE (4 species)	25	1	—	1	—	—	—	—
Halcyon smyrnensis	16	1	—	1	—	—	—	—
ANATIDAE (7 species)	24	1	—	1	—	—	—	—
Nettapus coromandelianus	2	1	—	1	—	—	—	—
ANHINGIDAE (1 species)	1	0	—	—	—	—	—	—
APODIDAE (1 species)	9	0	—	—	—	—	—	—
ARDEIDAE (5 species)	28	0	—	—	—	—	—	—
ARTAMIDAE (1 species)	1	0	—	—	—	—	—	—
BUCEROTIDAE (5 species)	16	4	3	—	—	1	4	—
Ptilolaemus tickelli	2	1	—	—	—	—	1	—
Tockus griseus	6	3	3	—	—	1	3	—
BURHINIDAE (1 species)	1	0	—	—	—	—	—	—
CAMPEPHAGIDAE (4 species)	16	1	—	1	—	—	—	—
Coracina novaehollandiae	6	1	—	1	—	—	—	—
CAPITONIDAE (7 species)	27	10	—	10	1	—	1	—
Megalaima asiatica	4	4	—	4	—	—	—	—
Megalaima haemacephala	8	1	—	1	1	—	1	—
Megalaima viridis	1	1	—	1	—	—	—	—
Megalaima zeylanica	9	4	—	4	—	—	—	—
CAPRIMULGIDAE (3 species)	8	0	—	—	—	—	—	—
CHARADRIIDAE (5 species)	26	0	—	—	—	—	—	—
CINCONIDAE (1 species)	2	0	—	—	—	—	—	—
CINCLIDAE (1 species)	1	0	—	—	—	—	—	—

Table-2 contd.

1	2	3	4	5	6	7	8	9
COLUMBIDAE (13 species)	112	32	—	27	1	1	5	—
Columba livia	25	21	—	21	1	—	—	—
Stretopelia chinensis	29	6	—	5	—	1	1	—
Chalcophaps indica	5	2	—	—	—	—	2	—
Treron phoenicoptera	37	1	—	—	—	—	1	—
Treron pompadora	1	1	—	—	—	—	1	—
Treron bicincta	1	1	—	1	—	—	—	—
CORACIIDAE (1 species)	15	6	—	6	—	—	—	—
Coracias bengalensis	15	6	—	6	—	—	—	—
CORVIDAE (8 species)	61	15	3	8	4	2	10	—
Cissa chinensis	4	3	—	—	—	—	3	—
Corvus splendens	14	1	—	1	1	—	—	—
Dendrocitta frontalis	3	2	—	—	—	—	2	—
Dendrocitta vagabunda	24	7	3	6	3	2	4	—
Corvus macrorhynchos	13	1	—	—	—	—	1	—
Garrulus lanceolatus	1	1	—	1	—	—	—	—
CUCULIDAE (8 species)	21	3	—	2	—	—	1	—
Centropus sinensis	7	1	—	1	—	—	—	—
Cuculus varius	1	1	—	—	—	—	1	—
Centropus toulou	1	1	—	1	—	—	—	—
DICAEIDAE (1 species)	1	0	—	—	—	—	—	—
DICRURIDAE (6 species)	41	10	—	6	—	2	5	—
Dicrurus adsimilis	24	7	—	6	—	2	2	—
Dicrurus paradiseus	7	3	—	—	—	—	3	—
ESTRILDIDAE (3 species)	31	9	—	9	—	3	—	—
POEPHILINAE (3 species)	31	9	—	9	—	3	—	—
Lonchura malabarica	25	6	—	6	—	3	—	—
Lonchura punctulata	4	3	—	3	—	—	—	—
EMBERIZIDAE (1 species)	1	0	—	—	—	—	—	—
EURYLAIMIDAE (1 species)	3	1	—	1	—	—	—	—
Serilophus lunatus	3	1	—	1	—	—	—	—
FALCONIDAE (1 species)	1	1	—	1	—	—	—	—
Falco tinnunculus	1	1	—	1	—	—	—	—
FRINGILLIDAE (4 species)	5	3	3	—	—	—	3	—
CARDUELINAE (4 species)	5	3	3	—	—	—	3	—
Carpodacus erythrinus	2	2	2	—	—	—	2	—
Mycerobas affinis	1	1	1	—	—	—	1	—

Table-2 contd.

1	2	3	4	5	6	7	8	9
GLAREOLIDAE (2 species)	2	0	—	—	—	—	—	—
HIRUNDINIDAE (2 species)	16	0	—	—	—	—	—	—
IRENIDAE (4 species)	13	5	—	3	—	—	2	—
Aegithina tiphia	5	4	—	2	—	—	2	—
Chloropsis aurifrons	5	1	—	1	—	—	—	—
LANIIDAE (4 species)	17	2	—	1	—	—	1	—
Lanius schach	10	2	—	1	—	—	1	—
LARIDAE (5 species)	6	0	—	—	—	—	—	—
MEGAPODIDAE (1 species)	1	1	—	1	—	—	—	—
Megapodius freycinet	1	1	—	1	—	—	—	—
MEROPIDAE (4 species)	39	7	1	6	—	—	1	—
Merops orientalis	31	6	—	6	—	—	1	—
Nyctyornis athertoni	3	1	1	—	—	—	—	—
MOTACILLIDAE (6 species)	14	3	—	2	—	—	1	—
Anthus hodgsoni	2	1	—	—	—	—	1	—
Dendronanthus indicus	1	1	—	1	—	—	—	—
Motacilla alba	1	1	—	1	—	—	—	—
MUSCICAPIDAE	174	33	1	21	2	3	13	—
MONARCHINAE (2 species)	10	2	—	1	1	—	1	—
Terpsiphone paradisi	5	2	—	1	1	—	1	—
MUSCICAPINAE (5 species)	24	4	—	3	1	—	—	—
Myiophoneus caeruleus	2	2	—	2	—	—	—	—
Muscicapa parva	16	1	—	1	—	—	—	—
Muscicapa thalassina	2	1	—	—	1	—	—	—
RHIPIDURINAE (1 species)	1	1	—	—	—	—	1	—
Rhipidura aureola	1	1	—	—	—	—	1	—
SYLVIINAE (10 species)	42	5	—	3	—	2	2	—
Acrocephalus dumetorum	9	3	—	3	—	2	—	—
Seicercus affinis	2	1	—	—	—	—	1	—
TIMALIINAE (14 speceis)	32	7	1	4	—	—	5	—
Garrulax lineatus	2	1	—	—	—	—	1	—
Garrulax squamatus	3	1	—	—	—	—	1	—
Turdoides striatus	13	4	1	4	—	—	2	—
Yuhina bakeri	2	1	—	—	—	—	1	—

Table-2 contd.

1	2	3	4	5	6	7	8	9
TURDINAE (15 species)	65	14	—	10	—	1	4	—
Copsychus saularis	22	11	—	9	—	1	2	—
Enicurus immaculatus	1	1	—	1	—	—	—	—
Erithacus svecicus	16	1	—	—	—	—	1	—
Saxicoloides fulicata	1	1	—	—	—	—	1	—
NECTARINIDAE (3 species)	5	0	—	—	—	—	—	—
ORIOLIDAE (2 species)	14	4	—	—	—	—	4	—
Oriolus xanthornus	10	4	—	—	—	—	4	—
PARADOXORNITHIDAE (12species)	2	0	—	—	—	—	—	—
PARIDAE (1 species)	3	0	—	—	—	—	—	—
PASSERIDAE (1 species)	36	7	—	3	—	—	5	2
Passer domesticus	36	7	—	3	—	—	5	2
PHASIANIDAE (8 species)	18	3	2	1	—	—	—	—
PHASIANINAE (7 species)	17	3	2	1	—	—	—	—
Arborophila rufogularis	1	1	—	1	—	—	—	—
Gallus gallus	9	2	2	—	—	—	—	—
TETRAONINAE (1 species)	1	0	—	—	—	—	—	—
Bonasa umbellus	1	0	—	—	—	—	—	—
PICIDAE (16 species)	33	9	1	6	2	—	4	—
Jynx torquilla	1	1	—	1	—	—	1	—
Dendrocopos mahrattenhsis	7	2	—	2	1	—	—	—
Dinopium benghalense	5	1	—	—	—	—	1	—
Picus canus	1	1	—	1	—	—	—	—
Picus chlorophus	1	1	—	1	1	—	1	—
Picus flavinucha	3	2	—	2	—	—	1	—
Picus squamatus	4	1	1	—	—	—	—	—
PITIIDAE (1 species)	2	1	—	—	—	—	1	—
Pitta nipanensis	2	1	—	—	—	—	1	—
PLOCEIDAE (3 species)	87	70	—	67	7	—	9	—
Ploceus philippinus	82	70	—	67	7	—	9	—
PSITTACIDAE (7 species)	44	0	—	—	—	—	—	—
PTEROCLIDAE (1 species)	1	0	—	—	—	—	—	—
PYCNONOTIDAE (8 species)	30	9	4	5	—	1	1	—
Criniger flaveolus	1	1	—	1	—	—	—	—
Pycnonotus cafer	13	3	2	1	—	—	1	—

Table-2 contd.

1	2	3	4	5	6	7	8	9
Pycnonotus leucogenys	2	1	1	—	—	—	—	—
Pycnonotus jocosus	3	1	1	—	—	1	—	—
Hypsipetes indicus	5	3	—	3	—	—	—	—
RALLIDAE (3 species)	11	0	—	—	—	—	—	—
RECURVIROSTRIDAE (7 species)	1	0	—	—	—	—	—	—
ROSTRATULIDAE (1 species)	1	0	—	—	—	—	—	—
SCOLOPACIDAE (10 species)	27	2	—	1	—	—	1	—
Philomachus pugnux	3	1	—	1	—	—	—	—
Scolopax rusticola	1	1	—	—	—	—	1	—
SITTIDAE (1 species)	3	0	—	—	—	—	—	—
STRIGIDAE (species)	27	13	2	11	1	1	2	—
Athene brama	10	3	1	1	—	—	1	—
Bubo zeylonensis	1	1	—	1	—	—	—	—
Glaucidium cuculoides	3	2	1	2	—	1	1	—
Glaucidium radiatum	2	1	—	1	—	—	—	—
Otus scops	1	1	—	1	1	—	—	—
Strix aluco	3	1	—	1	—	—	—	—
Otus bakkamoena	5	4	—	4	—	—	—	—
STURNIDAE (8 species)	80	29	—	20	4	—	9	1
Acridotheres fuscus	8	3	—	1	—	—	2	—
Acridotheres tristis	21	4	—	3	1	—	1	—
Gracula religiosa	3	1	—	—	—	—	1	—
Sturnus contra	22	12	—	8	2	—	4	—
Sturnus pagodarum	13	3	—	3	—	—	—	—
Sturnus malabaricus	11	6	—	5	1	—	1	1
THRESKIORNITHIDAE (1 species)	1	1	—	1	—	—	—	—
Pseudibis papillosa	1	1	—	1	—	—	—	—
TROGONIDAE (1 species)	1	1	—	1	—	—	—	—
Harpactes fasciatus	1	1	—	1	—	—	—	—
TURNICIDAE (1 species)	8	0	—	—	—	—	—	—
UPUPIDAE (1 species)	4	1	—	—	—	—	1	—
Upupa epops	4	1	—	—	—	—	1	—
ZOSTEROPIDAE (1 species)	3	0	—	—	—	—	—	—
Total -	1242	304	23	226	22	14	87	4

Abbreviations : As in Table 1

Negative birds (numbers examined in parantheses) :

ACCIPITRIDAE- *Accipiter nisus* (1), *Butastur teesa* (2), *Haliastur indus* (2), *Milvas migrans* (2), *Neophron perenopterus* (3), *Spilornis cheela* (1).

ALAUDIDAE-*Ammomanes phoenicurus* (3), *Mirafra assamica* (1), *M. erythroptera* (2), *Alauda gulgula* (2).

ALCEDINIDAE- *Alcedo atthis* (7), *Pelargopsis capensis* (1), *A. hercules* (1).

ANADIDAE - *Anas poecilorhyncha* (12), *Dendrocygna javanica* (3), *Tadorna ferruginea* (2), *Anas acuta* (2), *Aythya fuligula* (2), *Mergus mergenser* (1).

ANHINGIDAE- *Anhinga rufa* (1)

APODIDAE-*Apus affinis* (9)

ARDEIDAE-*Ardeola grayi* (21), *Ardeola bacchus* (1), *Bubulcus ibis* (2), *Butorides striatus* (1), *Egretta intermedia* (3)

ARTAMIDAE- *Artamus fuscus* (1)

BUCEROTIDAE- *Anthraceros malabaricus* (1), *Buceros bicornis* (1) *Tockus birostris* (6)

BURHINIDAE-*Burhinus oedicnemus* (1)

CAMPEPHAGIDAE-*Coracina melanoptera* (1), *Pericrocotus cinnamomeus* (5), *P. flameus* (4)

CAPITONIDAE-*Blythipicus pyrrhotis* (1), *Megalaima lineatus* (3), *M. virens* (1).

CAPRIMULGIDAE-*Caprimulgus asiaticus* (3), *C. indicus* (3), *C. macrurus* (2)

CHARADRIIDAE-*Charadrius alexandrirus* (1), *C. mongolus* (1), *Pluvialis dominica* (3), *Vanellus indicus* (18), *V. malabaricus* (3)

CICONIDAE-*Anastomus oscitans* (2)

CINCLIDAE-*Cinclus palasii* (1)

COLUMBIDAE-*Columba hodgsonii* (1), *Ducula aenea* (7), *Macropygia rufipennis* (1), *M. unchall* (1), *Streptopelia decaocto* (2), *S. senegalensis* (1), *Treron curvirostris* (1)

CORVIDAE- *Cissa flavirostris* (1), *Dendrocitta formosae* (1)

CUCULIDAE-*Cacomantis marulinus* (1), *Cuculus poliocephalus* (1), *Eudynamys scolopacea* (7), *Rhopodytes tristis* (2), *Chalcites maculatus* (1)

DICAEIDAE-*Dicaeum cruentalum* (1)

DICRURIDAE- *Dicrurus aeneus* (4), *D. caerulescens* (4), *D. hottentottus* (1), *D. remifer* (1)

EMBERIZIDAE-*Emberiza cia* (1)

ESTGRILDIDAE :POEPHILINAE-*Lonchura striata* (2)

FRINGILLIDAE-CARDUELINAE-*Carpodacus pulcherrinus* (1), *Leucosticte, nemoricola* (1)

GLAREOLIDAE-*Cursorius coromandelicus* (1), *Glareola lactea* (1)

HIRUNDINIDAE-*Hirundo daurica* (15), *H. smithi* (1)

IRENIDAE-*Chloropsis cochinchinensis* (2), *C. hardwickii* (1)

LANIIDAE-*Lanius cristatus* (2), *L. tephronotus* (2), *L. vittatus* (3)

LARIDAE-*Geochelidon nilotica* (1), *Sterna albifrons* (1), *S. aurantia* (1), *S. bengalensis* (1), *S. hirundo* (2)

MEROPIDAE- *Merops leschenaulti* (4), *M. philippinus* (1)

MOTACILLIDAE- *Anthus novaeseelandiae* (7), *A. trivialis* (1), *Motacila indica* (2)

MUSCICAPIDAE: MONARCHINAE-*Monarcha azurea* (5); MUSCICAPINAE-*Muscicapa latirostris* (1), *Niltava tickelliae* (3), SYLVIINAE-*Acrocephalus agericola* (5), *A. stentoreus* (8), *Megalurus palustris* (1), *Orthotomus sutorius* (1), *Phylloscopus collybita* (6), *P. subaffinis* (1), *Prinia flaviventris* (1), TIMALINAE-*Actinodura egertoni* (2), *Chrysomma sinense* (2), *Garrulax striatus* (1), *G. pectoralis* (1), *Pomatorhninus erythrogenys* (1), *P. ochraceiceps* (1), *Sphenocichla humei* (1), *Stachyris nigriceps* (1), *S. ruficeps* (1), *Turdoides caudatus* (1); TURDINAE-*Erithacus calliope* (8), *Monticola cinclorhynchus* (1), *M. solitorius* (1), *Phoenicurus ochruros* (1), *Saxicola caprata* (1), *S. ferrea* (1), *S. torquata* (4), *Turdus dissimilis* (1), *T unicolor* (3), *Zoothera citrina* (3), *Z. dauma* (1).

NECTARINIDAE-*Arachnothera longirostris* (1), *Nectarina asiatica* (3), *N. zeylanica* (1)

ORIOLIDAE-*Oriolus oriolus* (4)

PARADOXORNITHIDAE-*Paradoxornis atrosuperciliaris* (2)

PARIDAE-*Parus major* (3)

PHASIANIDAE :PHASIANINAE-*Arborophila atrogularis* (1), *A. torqueola* (1), *Gallus sonneratii* (2), *Perdicula asiatica* (2), *Polypectron bicalcaratum* (1); TETRAONINAE-*Bonasa umbellus* (1).

PICIDAE-*Chrysocolaptes festivus* (1), *C. lucidas* (2), *Dendrocopos nanus* (1), *Hemicircus canente* (1), *Micropternus brachyurus* (1), *Picoides himalayensis* (2), *P. macei* (1), *Picumnus innominatus* (1), *Sasia ochracea* (1).

PLOCEIDAE-*Ploceus benghalensis* (2), *P. megarhynchus* (3)

PSITTACIDAE-*Psittacula alexandri* (2), *Psittacula columboides* (2), *P. cyanocephala* (12), *P. eupatria* (8), *P. krameri* (18), *P. longicauda* (1), *Loriculus vernalis* (1)

PTEROCLIDAE-*Pterocles indicus* (1)

PYCNONOTIDAE-*P. melanichterus* (2), *P. striatus* (1), *Hypsipetes flavalus* (3)

RALLIDAE-*Amaurornis phoenicurus* (6), *Fulica atra* (3), *Gallinula chloropus* (2)

RECURVIROSTRIDAE-*Himantopus himantopus* (1)

ROSTRATULIDAE-*Rostratula benghalensis* (1)

SCOLOPACIDAE-*Arenaria interpres* (3), *Calidris testacea* (1), *Tringa glareola* (3), *T. hypoleucos* (2), *T. nebularia* (4), *T. stagnatilis* (1), *Capella gallinago* (6), *C. stenura* (3).

SITTIDAE-*Salpornis spilonotus* (3)

STRIGIDAE-*Asio flameus* (1), *Glaucidium brodiei* (1)

STURNIDAE-*Aplonis panayensis* (1), *Mino coronatus* (1)

TURNICIDAE-*Turnix suscitator* (8)

ZOSTEROPIDAE-*Zosterops palpebrosa* (3)

TABLE-3

Blood parasitism in wild birds from different avian families/subfamilies in India

Family and species	Total birds		Number of birds infected with					
	Exam.	Inf.	Leuc.	Haem.	Plasm.	Tryp.	Micro	Lank
ACCIPITRIDAE (11 Species)	27	5 (18.5%)	3	2	—	—	2	—
ALAUDIDAE (5 Species)	13	1 (17.6%)	—	—	—	—	1	—
ALCEDINIDAE (4 Species)	25	1 (4.0%)	—	1	—	—	—	—
ANATIDAE (7 Species)	24	1 (4.1%).	—	1	—	—	—	—
ANHINGIDAE (1 Species)	1	0	—	—	—	—	—	—
APODIDAE (1 Species)	9	0	—	—	—	—	—	—
ARDEIDAE (5 Species)	28	0	—	—	—	—	—	—
ARTAMIDAE (1 Species)	1	0	—	—	—	—	—	—
BUCEROTIDAE (5 Species)	16	4 (25.0%)	3	—	—	1	4	—
BURHINIDAE (1 Species)	1	0	—	—	—	—	—	—
CAMPEPHAGIDAE (4 Species)	16	1 (6.2%)	—	1	—	—	—	—
CAPITONIDAE (7 Species)	17	10 (37.0%)	—	10	1	—	1	—
CAPRIMULGIDAE (3 Species)	8	0	—	—	—	—	—	—
CHARADRIIDAE (5 Species)	26	0	—	—	—	—	—	—
CICONIDAE (1 Species)	2	0	—	—	—	—	—	—
CINCLIDAE (1 Species)	1	0	—	—	—	—	—	—
COLUMBIDAE (13 Species)	112	32 (28.5%)	—	27	1	1	5	—
CORACIIDAE (1 Species)	15	6 (40.0%)	—	6	—	—	—	—
CORVIDAE (8 Species)	61	15 (24.5%)	3	8	4	2	10	—
CUCULIDAE (8 Species)	21	3 (14.2%)	—	2	—	—	1	—
DICAEIDAE (1 Species)	1	0	—	—	—	—	—	—
DICRURIDAE (6 Species)	41	10 (24.3%)	—	6	—	2	5	—
ESTRILDIDAE (3 Species)	31	9 (29.0%)	—	9	—	3	—	—
POEPHILINAE (3 Species)	31	9 (29.0%)	—	9	—	3	—	—
EMBERIZIDAE (1 Species)	1	0	—	—	—	—	—	—
EURYLAIMIDAE (1 Species)	3	1	—	1	—	—	—	—
FALCONIDAE (1 Species)	1	1	—	1	—	—	—	—
FRINGILLIDAE (4 Species)	5	3	3	—	—	—	3	—
CARDUELINAE (4 Species)	5	3	3	—	—	—	3	—
GLAREOLIDAE (2 Species)	2	0	—	—	—	—	—	—
HIRUNDINIDAE (2 Species)	16	0	—	—	—	—	—	—
IRENIDAE (4 Species)	13	5 (38.4%)	—	3	—	—	—	—
LANIIDAE (4 Species)	17	2 (11.7%)	—	1	—	—	—	—
LARIDAE (5 Species)	6	0	—	—	—	—	—	—
MEGAPODIDAE (1 Species)	1	1	—	1	—	—	—	—
MEROPIDAE (4 Species)	39	7 (17.9%)	1	6	—	—	—	—
MOTACILLIDAE (6 Species)	14	3 (21.4%)	—	2	—	—	—	—

Table-3 contd.

Family and species	Total birds		Number of birds infected with					
	Exam.	Inf.	Leuc.	Haem.	Plasm.	Tryp.	Micro	Lank
MUSCICAPIDAE	174	33 (18.9%)	1	21	2	3	13	—
MONARCHINAE (2 Species)	10	2 (20.0%)	—	1	1	—	1	—
MUSCICAPINAE (5 Species)	24	4 (16.6%)	—	3	1	—	—	—
RHIPIDURINAE (1 Species)	1	1	—	—	—	—	1	—
SYLVIINAE (10 Species)	42	5 (11.9%)	—	3	—	2	2	—
TIMALIINAE (14 Species)	32	7 (21.8%)	1	4	—	—	5	—
TURDINAE (15 Species)	65	14 (21.5%)	—	10	—	1	4	—
NECTARINIDAE (3 Species)	5	0	—	—	–	—	—	—
ORIOLIDAE (2 Species)	14	4 (28.5%)	—	—	–	—	4	—
PARADOXORNITHIDAE (1 Species)	2	0	—	—	–	—	—	—
PARIDAE (1 Species)	3	0	—	—	—	—	—	—
PASSERIDAE (1 Species)	36	7 (19.4%)	—	3	—	—	5	2
PHASIANIDAE (7 Species)	18	3 (16.6%)	2	1	—	—	—	—
PHASIANINAE (7 Species)	17	3 (17.6%)	2	1	—	—	—	—
TETRAONINAE (1 Species)	1	0	—	—	—	—	—	—
PICIDAE (16 Species)	33	9 (27.2%)	1	6	2	—	4	—
PITTIDAE (1 Species)	2	1	—	—	—	—	1	—
PLOCEIDAE (3 Species)	87	70 (80.4%)	—	67	7	—	9	—
PSITTACIDAE (7 Species)	44	0	—	—	—	—	—	—
PTEROCLIDAE (1 Species)	1	0	—	—	—	—	—	—
PYCNONOTIDAE (8 Species)	30	9 (30.0%)	4	5	—	1	1	—
RALLIDAE (3 Species)	11	0	—	—	—	—	—	—
RECURVIROSTRIDAE (7 Species)	1	0	—	—	—	—	—	—
ROSTRATULIDAE (1 Species)	1	0	—	—	—	—	—	—
SCOLOPACIDAE (10 Species)	27	2 (7.4%)	—	1	—	—	1	—
SITTIDAE (1 Species)	3	0	—	—	—	—	—	—
STRIGIDAE (9 Species)	27	13 (48.1%)	2	11	1	1	2	—
STURNIDAE (8 Species)	80	29 (36.2%)	—	20	4	—	9	1
THRESKIORNITHIDAE (1 Species)	1	1	—	1	—	—	—	—
TROGONIDAE (1 Species)	1	1	—	1	—	—	—	—
TURNICIDAE (1 Species)	8	0	—	—	—	—	—	—
UPUPIDAE (1 Species)	4	1	—	—	—	—	1	—
ZOSTEROPIDAE (1 Species)	3	0	—	—	—	—	—	—

Abbreviation : Tryp. = *Trypanosoma;* Leuc. = *Leucocytozoon;*
Haem. = *Haemoproteus;* Plasm. = *Plasmodium;*
Lank. = *Lankestrella;* Micro = Microfilaria

under 40 families/subfamilies (Tables 1-3). Infections with species of *Trypanosoma* (1.1% in 14 birds of 9 species), *Leucocytozoon* (1.8%, in 23 birds of 16 species), *Haemoproteus* (18.1%, in 226 birds of 63 species), *Plasmodium* (1.7%, in 22 birds of 13 species), *Lankesterella* (0.32%, in 4 birds of 3 species), and *Microfileria* (7.0%, in 87 birds of 52 species) were encountered. Double and multiple infections were recorded in 64 birds of 31 species i.e., in 21.0% of the infected birds (Table-2). Two species of *Trypanosoma viz., T avium* and *T corvi* (see Nandi and Bennett, 1994); ten species of *Leucocytozoon viz., L. brimonti, L. dubreuli, L. cambournaci, L. majoris, L. nyctyornis, L. macleani, L. sakharoffi, L. squamatus, L. toddi* and *L. ziemanni*; 28 species of *Haemoproteus* viz., *H. aegithinae, H. bennetti, H. borgesi, H. certropi, H. columbae, H. coraciae, H. cornuata, H. danilewskyi, H. dicruri, H. fallisi, H. fringillae, H. halcyonis, H. lanii, H. megapodius, H. meropis, H. noctuae, H. orizivorae. H. passeris, H. pastoris, H.plataleae, H. sacharovi, H. sanguinis, H. syrnii, H. tephrodornis, H. thereicerycis, H. tinnunculi, H. velans, and H. xantholaemae* and 4 species of *Plasmodium viz., P. circumflexum, P. nucleophilum, P. relictum* and *P. vaughani* were observed. Five species of *Haemoproteus viz., H. celli, H. garnhami, H. glaucidii, H. morneti* and *H. sturni* reported earlier (Nandi and Mandal, 1977, 1978, 1985; Nandi *et al.*, 1984) are considered herein synonymous with *H. noctuae* in partim/*H. syrnii* in partim, *H. orizivorae*, again *H. noctuae* in partim/*H. syrnii* in partim, *H. pastoris* and again *H. pastoris* respectively (see Bishop and Bennett, 1992). Similarly *Leucocytozoon danilewskyi* in *Glaucidium cuculoides* from Jammu and Kashmir (Nandi and Mandal, 1978), *L. fringillinarum* in *Carpodacus erythrinus* (see Nandi and Mandal, 1978) and *L. sabrazesi* from the Jungle fowl, *Gallus gallus* (see Nandi *et al.*, 1984), are considered as synonyms of *L. ziemanii, L. cambournaci* and *L. macleani* respectively (Bishop and Bennett, loc. cit., Bennett *et al.*, 1991). However, some haemoprotozoan parasites and larval nematodes could not be specifically identified.

An analysis of the results reveals that there exists a marked variation in the prevalence of blood parasites from state to state, as well as in relative frequencies of the different parasite-genera (Table-1). A comparision of this prevalence of blood parasites from various states of India is not conclusive since the avian population in each state studied differs in diversity of species and in the number of birds sampled. Thus, the differences are likely to be the result of host difference rather than of geography or habitat diversity.

The overall prevalence of the various parasitic genera also varied markedly from family to family (Table-2), as reported by Nandi and Bennett (1997) in the birds of India and adjacent countries. However, this variation is very much reduced in the families *viz.*, Columbidae and Muscicapidae in which more than 100 birds are sampled. It is worth mentioning that Nandi and Bennett's study (loc. cit.) covers all survey reports including specific and fragmentary study programmes carried out by various investigators. While the present paper analyses the survey reports made by the present author and his co-workers only and that too considering all the blood parasites. Thus, it reasonably reflects the true prevalence of parasites especially for those families in which the sample size was 100 or more comparable to the study of McClure *et al.* (1978) from eastern and southern Asia.

Of the 11 States surveyed from India, the overall prevalence of haematozoa was found to be void in Tripura, lowest (10.5%) in Orissa and highest in Goa (32.0%). It has been observed that all the haemoprotozoan genera and the microfilariae have not been represented from all the States in India so far surveyed. Only the species of *Haemoproteus* are represented from all the States except Tripura from where a small sample of 18 birds was examined. Among the haematozoa the species of *Haemoproteus* and *Plasmodium* only were recorded from Orissa and Maharashtra. Infections with *Haemoproteus* were predominant over others in all these regions and the prevalences were more or less similar in all the States except in West Bengal. The highest prevalence of *Haemoproteus* in West Bengal was due to 100% infection in *Columba livia intermedia* and for 88% infection in *Ploceus philippinus* (cf Nandi *et al.*, 1984). The greater portion of the total infection was due to *Haemoproteus*. This suggests a greater ceratopogonid and hippoboscid vector potential for haemoproteids in this subcontinent.

The overall prevalences of *Plasmodium* (1.7%), *Leucocytozoon* (1.8%), *Trypanosoma* (1.1%) and Microfilaria (7.8%) were considerably low in comparison to *Haemoproteus* (18.1%). The infection with species of *Leucocytozoon* is appreciable from Goa (7.0%) and Jammu and Kashmir (8.9%) (Nandi and Mandal, 1978, 1985). The species of *Leucocytozoon* are transmitted by simuliid vectors having narrow breeding requirements i.e. fast flowing hill streams. While the parasites belonging to *Trypanosoma, Plasmodium* and microfiloria require improved method of diagnosis and are not readily detectable by thin film technique. These parasites are transmitted by a variety of dipteran vectors, including simuliids, ceratopogonids and culicids (Greiner *et al.*, 1975), and probably for this reason the prevalences of these parasites varied from State to State. The relatively high prevalence of infection with *Haemoproteus* and low prevalences with other parasites have also been reported from eastern and southern Asia (Mc Clure *et al.*, 1978.).

The distribution and frequency of occurrence of different blood parasites for avian families in which the sample size was 10 individuals or more (Table-2), indicate that the prevalence of haemoparasites differs markedly from family to family, as did the relative frequencies of the different parasite genera. Of the 36 families and subfamilies represented by more than 10 birds, 5 families *viz.*, Ardeidae, Charadriidae, Hirundinidae, Psittacidae and Rallidae were found to be negative for the haematozoan infection. Among the rest 31 families and subfamilies, 2 families *viz.*, Columbidae and Muscicapidae were represented by more than 100 birds, while 3 families *viz.*, Corvidae, Ploceidae and Sturnidae were represented by more than 50 but less than 100 birds. The highest prevalence, however, was recorded in Ploceidae (80.4%) and lowest in family Alcedinidae (4%). The highest prevalence of parasitism in ploceids is due to occurrence of infection in 70 (85.3%) out of 82 *Ploceus philippinus* sampled (see Nandi, 1989; Nandi and Mandal, 1977, 1984; Nandi et al., 1984). It is apparent that many families have limited number of parasite representative (Table-3) and certain families *viz.*, Alcedinidae, Anatidae and Coraciidae showed only infection with *Haemaproteus*. The absence of haemoparasites from certain families may not suggest that there is physiological block to infection (Nandi, 1984; Bishop and Bennett, 1992). The

variation in the prevalence and distribution of haematozoa from family to family may be due to host-parasite-vector-environment interactions.

SUMMARY

1 Out of a total of 1242 wild birds representing 342 species of 66 families/subfamilies from 11 States of India examined; only 304 (24.7%) birds of 122 species belonging to 40 families and subfamilies harboured blood parasites.

2. Infections of *Haemoproteus* (18.1%) were the most commonly encountered parasites, followed by microfilariae (7.0%),*Leucocytozoon* (1.8%),*Plasmodium*(1 7%),*Trypanosoma* (1 1%) and *Lankesterella* (0.32%).

3. The relatively high prevalence of infections with *Haemoproteus* and the marked variation in the prevalence of blood parasitism in brids obtained from different States as well as in the relative frequencies of the different parasites have been discussed.

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