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Original Article

Studies on parasitic prevalence in pet birds from Punjab, Pakistan

Estudos de prevalência parasítica em pássaros de estimação de Punjab, Paquistão

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Abstract

During this one year study, blood and fecal samples of doves (*Zenaida asiatica*), ducks (*Anas platyrhynchos*), pigeons (*Columba livia*), partridges (*Alectoris chukar*), turkeys (*Meleagris gallopavo*) and goose (*Chen caerulescens*) were collected to assess the parasitic prevalence in these birds. The birds were kept at Avian Conservation and Research Center, Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore. All these avian species were kept in separate cages and their entire body was inspected on regularly basis to record external parasites. For internal parasites, 100 blood and 100 fecal samples for each species were analyzed. During present study, two species of ectoparasites i.e. fowl ticks (*Args persicus*) and mite (*Dermanyssus gallinae*) while 17 species of endoparasites; three from blood and 14 from fecal samples were identified. Prevalence of blood parasites was *Plasmodium juxtanucleare* 29.3%, *Aegyptinella pullorum* 15% and *Leucoctoyzoon simond* 13%. Parasitic species recorded from fecal samples included 6 species of nematodes viz. *Syngamus trachea* with parasitic prevalence of 50%, *Capillaria anatis* 40%, *Capillaria annulata* 37.5%, *Heterakis gallinarum* 28.3%, *Ascardia galli* 24% and *Allodpa suctoria* 2%. Similarly, two species of trematodes viz. *Prosthogonimus ovatus* having parasitic prevalence of 12.1% and *Prosthogonimus macrorchis* 9.1% were also recorded from fecal samples of the birds. Single cestode species *Raillietina echinobothrida* having parasitic prevalence of 27% and 3 protozoan species i.e. *Eimeria maxima* having prevalence 20.1%, *Histomonas meleagridis* 8% and *Giardia lamblia* 5.3% were recorded. In our recommendation, proper medication and sanitation of the bird's houses and cages is recommended to avoid parasites.

Keywords: Plasmodium, blood parasites, domestic birds, *Haemoproteus, Leucocytozoon*.

Resumo

Durante este estudo de um ano, amostras de sangue e fezes de pombos (Zenaida asiatica), patos (Anas platyrhynchos), pombos (Columba livia), perdizes (Alectoris chukar), perus (Meleagris gallopavo) e ganso (Chen caerulescens) foram coletados para avaliar a prevalência de parasitas nessas aves. As aves foram mantidas no Centro de Conservação e Pesquisa de Aves, Departamento de Vida Selvagem e Ecologia, Universidade de Veterinária e Ciências Animais, Lahore. Todas essas espécies de aves foram mantidas em gaiolas separadas e todo o seu corpo foi inspecionado regularmente para registrar parasitas externos. Para parasitas internos, foram analisadas 100 amostras de sangue e 100 amostras fecais de cada espécie. Durante o presente estudo, duas espécies de ectoparasitas, ou seja, carrapatos de aves (Args persicus) e ácaros (Dermanyssus gallinae), enquanto 17 espécies de endoparasitas, três de sangue e 14 de amostras fecais, foram identificadas. Os parasitas sanguíneos prevalentes foram Plasmodium juxtanucleare, 29,3%, Aegyptinella pullorum, 15%, e Leucoctoyzoon simond, 13%. As espécies parasitas registradas em amostras fecais incluíram 6 espécies de nematoides viz. Syngamus traqueia com prevalência parasitária de 50%, Capillaria anatis, 40%, Capillaria annulata, 37,5%, Heterakis gallinarum, 28,3%, Ascardia galli, 24% e Allodpa suctoria, 2%. Da mesma forma, duas espécies de trematódeos viz. Prosthogonimus ovatus com prevalência parasitária de 12,1% e Prosthogonimus macrorchis, 9,1%, também foram registrados nas amostras fecais das aves. Espécies de cestoide único Raillietina echinobothrida com prevalência parasitária de 27% e 3 espécies de protozoários, ou seja, Eimeria maxima tendo prevalência de 20,1%, Histomonas meleagridis, 8%, e Giardia lamblia, 5,3%, foram registradas. Em nossa recomendação, são indicados medicação adequada e saneamento das casas e gaiolas dos pássaros para evitar parasitas.

Palavras-chave: Plasmodium, parasitas sanguíneos, aves domésticas, Haemoproteus, Leucocytozoon.

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1. Introduction

Commercial farmers prefer confined facilities for birds as density of the birds is higher and these facilities aid to boost their populations. However, higher densities of the birds result in transmission of parasitic agents (Krystianiak et al., 2007) and pathogenic microbes that hinder growth and egg production (Dranzoa et al., 1999). In birds, disease causing species like roundworms reduce breeding success and species like *Syngamus trachea*, *Ascaridia* spp, *Heterakis isolonche, Capillaria* spp. and *Eimeria* spp. cause coccidiosis (Goldova et al., 1993). Blood parasites viz. *Plasmodium* spp. and *Leukocytozoon* spp. are common in feral as well as domestic birds which result in higher mortalities (Aguirre et al., 1986).

In many countries, birds are reared on ground in aviaries where they remain in permanent contact with soil. The soil serves as reservoir for larval insects and helminthes. These factors clearly reflect the presence of wide range of parasites in birds kept in free-range rearing facilities and in turn result in low production (Permin et al., 1997). Amongst parasitic diseases, protozoan diseases especially coccidiosis is top of the list of parasites affecting birds worldwide and result in diarrhea, poor growth, and higher mortalities especially in young birds. Moreover, in confined facilities, birds are more susceptible to parasites and pathogenic microorganisms (Krystianiak et al., 2007).

Poor families keep many avian species as domestic poultry and use these birds as source of food and recreation. However, due to apparent less importance of these birds, little attention in terms of research has been dedicated towards these species and there is paucity of knowledge on health, socio-economic aspects, importance and management strategies of these birds. Understanding parasitic prevalence in poultry birds will aid in developing strategies to manage avian population (Sol and Lefebvre, 2000; Adriano and Cordeiro, 2001). Present study was therefore planned to study the parasitic prevalence in some captive avian species.

2. Materials and Methods

2.1. Sampling

Present one year study was conducted to check the parasitic prevalence in doves (*Zenaida asiatica*), ducks (*Anas platyrhynchos*), pigeons (*Columba livia*), partridges (*Alectoris chukar*), turkeys (*Meleagris gallopavo*) and goose (*Chen caerulescens*) was conducted at Avian Conservation and Research Center, Department of Wildlife and Ecology, C-Block, Ravi Campus, University of Veterinary and Animal Sciences, Lahore.

2.2. Identification of ectoparasites

To determine ectoparasites, the whole body of the birds was fully examined visually on weekly basis and the parasites were collected with the help of forceps and observed and identified under A.KRÜSS Optronic MSL4000-10/30-IL-TL stereo microscope.

2.3. Fecal sampling and parasites identification

Fresh fecal samples (n = 100) for each of the captive species were collected and brought to the laboratory for analysis through Smear method. Simple floatation and sedimentation techniques were used to detect parasitic oocytes or eggs. Later on, quantitative fecal sample examination, in term of oocysts per gram of feces was conducted using Macmaster's egg counting technique. The oocytes were repeatedly examined for micrometery. The species were identified through microscopic examination of oocysts and eggs (Atkinson CT et al. 2009).

2.4. Blood sampling and parasites analysis

Blood samples (n = 100) from brachial vein of each of the avian species including were collected for endoparasites identification. A drop of fresh blood was placed on a clean glass slide and smear was prepared. Methyl alcohol was used for smear fixation and staining was carried out through Giemsa stain for 5 to 10 minutes. The stained slides were washed with distilled water, dried out and observed under light microscope. Taxonomic keys were used to precisely identify the parasitic species.

3. Results and Discussion

Temporal and spatial variations in parasitic prevalence are well documented and these variations are attributed with intermediate hosts (Cooper, 2005). Helminth species are highly diverse and are greatly distributed in Asia (Pandey et al. 1992; Bagust, 1994). During present study, a total of nine species of helminthes were recorded including six species of nematodes *Syngamus trachea, Capillaria annulata, C. anatis, Ascardia galli, Heterakis gallinarum and Allodopa suctoria*, two species of trematodes *Prosthogonimus ovatus, P. macrorchis* and one species of cestode *Raillietina echinobothrida. Ascardia galli*, *Heterakis gallinarum*, and *Capillaria annulata* (Table 1) are common parasitic species of commercial poultry (Permin et al. 1997). Important helminthic diseases of poultry are ascariodiosis and cestodiosis (Fatihu et al. 1991). One hundred helminth species have been identified from wild and domesticated avian species. Parasitic infections in poultry may result in reduction in growth and egg laying (Van Hemert et al., 2019). Nematodes have been recorded from poultry and other domestic avian species and their presence in birds results in serious infection of digestive tract (Gylstorff and Grimm, 1998).

During present study, *Syngamous trachea* was recorded from gut content of geese and turkeys and its prevalence was 50%. Glystorff and Grimm (1998) reported *Syngamus trachea* is responsible for respiratory disorder in chicken, quail, gees peafowl, guinea fowl and turkey. During present study, *Ascardia galli* was recorded from fecal samples of ducks, dove, turkeys and geese and its prevalence was 24%. Greiner (1997) reported that ascardial roundworm is present in different avian fauna. Most common helminth disease of poultry is Ascariodiosis (Fatihu et al. 1991). Prevalence of *Cappillaria annulata* was 37.5% while that

Table 1. List of parasites identified in different avian species during study period.

Parasites	Turkey	Pigeon	Duck	Dove	Partridge	Geese	Diagnosis	Total Samples Collected	Samples positive for Parasite	Percent Prevalence
Nematodes										
Syngamus trachea	●	●●	●●	●●	●●	●	Faecal smears analysis	600	300	50%
Capillaria annulata	●	●	●●	●●	●	●●	Faecal smears analysis	600	225	37.5%
Capillaria anatis	●●	●●	●	●●	●●	●	Faecal smears analysis	600	240	40%
Ascardia galli	●	●●	●	●	●●	●	Faecal smears analysis	600	144	24%
Heterakis gallinarum	●	●●	●	●●	●	●	Faecal smears analysis	600	170	28.3%
Allodapa suctoria	●	●	●	●	●	●●	Faecal smears analysis	600	12	2%
Cestode										
Raillietina echinobothrida	●	●	●●	●●	●●	●●	Faecal smears analysis	600	162	27%
Trmatode										
Prosthogonimus ovatus	●●	●●	●	●●	●●	●	Faecal smears analysis blood, analysis is also performed	600	73	12.1%
Prosthogonimus macrorchis	●●	●●	●	●	●	●●	Faecal smears analysis,blood analysis also performed	600	55	9.1%
Protozoa										
Giardia lamblia	●	●	●●	●	●●	●	Faecal analysis or necroscopy	600	32	5.3%
Eimeria maxima	●	●●	●	●●	●●	●●	Faecal analysis or necroscopy	600	121	20.1
Histomonas meleagridis	●	●●	●●	●●	●●	●●	Faecal analysis or necroscopy	600	48	8%
Haemoparasite										
leucoctoyzoon simond	●	●●	●	●●	●●	●●	Blood smear method	600	78	13%
Plasmodium juxtanucleare	●	●●	●●	●●	●●	●●	Blood smear method	600	176	29.3%
Aegyptinella pullorum	●	●	●	●	●	●	Blood smear method	600	90	15%
Ectoparasite										
Fowl tick Args persicus	●	●●	●	●	●	●●	Physical observation	Observation made on weekly basis	56	
Mite Dermanyssus gallinae	●	●●	●	●●	●●	●●	Physical observation	Observation made on weekly basis	31	

Present = ●, Absent = ●●.

of *C. anatis* was 40%. Capillarian species are thread like nematodea present in the upper area of gastrointestinal tract particularly in esophagous and crop but also found in small intestine (Greiner and Ritchie, 1994; Zucca, 2000) Capillarial species can cause infection in domestic birds where deep litter contains number of eggs in soil or litter (Permin and Hansen, 1998). *Heterakis gallinarum* is also a nematodal worm and its prevalence was 28.3%. According to Goldova et al. (2006) pheasants and partridges were infected by hetarakis. Menezes et al. (2003) documented that *H. gallinarum* is responsible for chronic typhilitis and haemosiderosis. *H. gallinarum* is also capable of transferring protozoan *Histomonas meleagridis* to birds (Dimitrov D et al. 2015).

Some protozoan parasites have zoonotic potential, and their interaction with infected specimen can cause disease in humans (Slifko et al. 2000). The probability of transmission of zoonotic disease is influenced by so many factors, such as agent stability, population density, animal handling, virulence, route and latent period (Slifko et al. 2000; Marietto-Gonçalves et al. 2008). During present study, three protozoan parasitic species were detected and their prevalence was *Eimeria maxima* 20.1%, *Histomonas meleagridis* 8%, *Giardia lamblia* 5.3% and *Eimaria* is host specific (Table 2) and mainly found in Galliformes, Columbiformes and poultry (Greiner and Ritchie 1994). Giardia is present in motile trophozoite and cyst stage (Burr et al. 2012). Up to 50% mortality is caused by giardia and it can also lead to poor plumage and can reduce growth (Greiner and Ritchie, 1994). *Histomonas* is mostly transmitted in embryonated eggs of the cecal nematode *Heterakis gallinarum*. *H. meleagridis* is a protozoan parasite which lives in caeca and liver and causes disease in turkeys however it is less fetal in chicken (Dimitrov D et al. 2015).

Three species of parasites viz. *Leucoctoyzoon simond*, *Plasmodium juxtanucleare* and *Aegyptinella moshkovskii* were recorded from blood samples and their prevalence was 13%, 29.3% and 15%, respectively. Haemoparasite are responsible of avian malaria and acute anemia (Vander Heyden, 1996). Avian haemoparasites are pathogenic to their hosts and result in high mortalities, retardation of growth, reproductive failure, reduced productivity and have negative impacts on behavior (Sørci and Møller, 1997; Merilae et al. 1999; Merino et al. 2000; Cardona et al. 2002; Sol et al. 2003; Dunn et al. 2011).

Infections with *Plasmodium* have been identified in all avian orders except Struthioniformes, the Coliiformes and the Trogoniformes (Valkiūnas et al. 2005). The highest diversity of *Plasmodium* has been recorded form the Columbiformes, Galliformes, and Passeriformes (Valkiūnas et al. 2005; Martinsen et al. 2008). *Leucocytozoon* has been reported from many avian orders but only some species are pathogenic to their host. Susceptible groups of avian hosts consist of poultry, pigeons, raptors, waterfowl and ostriches (Bennett et al., 1993). Haemoprotozoa are mostly transmitted by blackflies (Atkinson and Riper, 1991). In domestic poultry, only two species of *Leucocytozoo* i.e. *L. sabrazesi* and *L. caulleryi* have been reported (Colley et al. 1971). *Leucocytozoon simondi* was also recorded during present study. *L. simondi* is a blood parasite that can cause mortality in domestic geese and ducks and is transmitted by vector black flea (Atkinson and Riper, 1991; Desser and Bennett, 1993). *Haemoproteus* geneus is equally distributed in birds in all continents except Antarctica because there is no vector for the transmission (Valkiūnas et al., 2005).

Dimitrov D et al. (2015) documented that ectoparasites play important role in transmission of diseases and result in great loss to poultry. The fowl tick *Argas persicus* was also observed during present study. The fowl tick has origination in central Asia (Buczek et al., 2006). Basically, it was an old world parasite but it also exists in new world along with other species viz. *Argas miniatus*, *A. radiates* and *A. sanchezi*. In birds, *A. persicus* reduces growth and egg yield, also causes weakness and anemia that may lead to death (Khan et al., 2001). Furthermore, in chickens it causes paralysis. One species of chicken mite *Dermanyssus gallinae* was also observed during present investigation. *D. gallinae* is continuous blood feeder of chicken, pigeon, turkey and many other avian species. During day time, they live in crevices near host nest, leaving these crevices at night to feed blood of birds. Heavy infection of this mite can decrease egg production in poultry. It also causes anemia, and act as host for secondary infection.

Table 2. Parasites, their prediction sites, morphology, life cycle, clinical diagnosis and control measures.

Parasites	Prediction site	Morphology	Life cycle	Clinical diagnosis	Control measures
Nematodes (Round worm)					
Syngamus trachea	Lungs and trachea	Worms are medium sized and red in colour. Females are greater than male measuring 5 to 20 mm, and male is 2 to 6 mm and egg size is 70 to 100 um	Direct or indirect	Coughing, sneezing and respiratory disorder. Death occurs when mucus block the trachea.	Keep the bird's bedding as dry as possible and frequently change it. Broad spectrum anthelmintics are used for treatment.

Table 2. Continued...

Parasites	Prediction site	Morphology	Life cycle	Clinical diagnosis	Control measures
Capillaria annulata	Mucosa of crop and Esophagous	Males are 15 to 25 mm, females are 37 to 80 mm,and eggs are ~30x70 um	Direct or indirect	Seriously harm the lining of crop and oesophagus.	Restrict their access to humid area. Strict hygiene of feeder and drinker. Tablets and injections are used for single animal treatment but for flock anthelmintics are used.
Capillaria anatis	Cecum	Males are 15 to 25 mm, females are 37 to 80 mm,and eggs are ~30x70 micrometer	Direct or indirect	Diarrhoea	Anthelmintics are used.
Ascardia galli	Small intestine	Worms are semitransparent, female length is 72 to 160mm, and male length is 51 to 61mm. eggs are 72 to 93 um.	Direct	Enteritis, loss of appetite, unthriftiness, pale combs and wattles, droopy wings	Pasture rotation, Avoid to moisture content, anthelmintics are used.
Heterakis gallinarum	Caeca	Male is 7 to 13 mm female is 10 to 15 mm long, eggs are ovoid, about 45x75 um.	Direct	Nodules and small bleeding in cecal wall. Causative agent for black head disease.	Anthelmintics are used.
Allodapa suctoria	Caeca	Male is 7 to 10 mm, female is 9 to 18 mm long and egg size is 52 to 64 um.	Indirect	Vomiting, nausea	Control intermediate host.
Cestode (Tape worm)					
Raillietina echinobothrida	Small intestine	10 to 25 cm. size of egg is 74 to 93 um.	Indirect	Reduce growth, abdominal disturbance	Control intermediate host.
Trematodes (flukes)					
Prosthogonimus ovatus	Cloaca and rectum	8 to 9mm and egg is 22 to 24 um	Indirect	Milky discharge from cloaca, lay soft shell egg.	Control of secondary host.
Prosthogonimus macrorchis	Intestine	7 to 9 mm and egg is 20 um	Indirect	Reduce growth, thriftiness, abdominal discomfort.	Sanitary practices, avoid from moisture area
Protozoa (single cell)					
Giardia lamblia	Intestinal tract	11 to 14 µm in length and 7 to 10 µm in width. Two forms trophozoite and cyst: trophozoite is active form and cyst is dormant.	Direct.	Weight loss, Diarrhoea is foul smelling, scratching and preening.	Keep drinking bottle clean.Use cool boiled water. Metronidazole is used for common treatment.

Table 2. Continued...

Parasites	Prediction site	Morphology	Life cycle	Clinical diagnosis	Control measures
Eimeria maxima	Small intestine	Three developmental stages: schizonts, gamonts and oocysts.	Direct	Cause catarrhalic or haemorrhagic enteritis, bloody diarrhoea,	Continuous medication is given in food and and water. sulfonamides drug is most common
Histomonas meleagridis	Caeca and liver	It has two forms: a tissue-dwelling (amoebic) form and a caecal lumen (has single flagellum) form	Direct	Infection occur only when they penetrate from blood streams to liver.	Dimetridazole is very effective for treating histomonosis.
Blood parasites:					
Leucocyzoon n *simond*	Leucocyte and erythrocyte	Oval in shape. Mature gametocyte is 14-22 um. gametocyte is elongated when found in leukocytes and round when found in erythrocytes.	Indirect	The animals are listless, anorectic, anaemic and have a laboured breathing. CNS symptoms.	Treatment mostly is not effective and medication is used in combination form pyrimethamine (1 ppm) nd sulfadimethoxine (10 ppm) in the feed
Plasmodium juxtanucleare	Erythrocyte	Round oval or irregular in shape mature gametocyte is 15.5 um	Indirect	Anaemia, diarrhoea and weight loss that may lead to death.	Treatment is difficult in birds. Because duration of disease is 2-3 days.
Aegyptinella pullorum	Erythrocyte	Small 5 to 10 um, round to oval bodies.	Indirect	Ruffled feather birds may become anorectic, droopy and may suffer from diarrhoea	Duration is very small. biosecurity measures should be taken to reduce the introduction
Ectoparasites:					
Fowl tick: *Args persicus*	Skin	Soft bodied tick and the size of female is 10 x 6 mm	Direct	Anaemia, weight loss, depression, toxaemia, and paralysis	Houses should be cleaned,walls, ceilings, cracks, and crevices should be highly sprayed with carbaryl or coumaphos
Mite: *Dermanyssus gallinae*	Skin	The adult female mites size is 1 mm in length. The colour may be grey to deep red	Direct	Reduction in egg production, anaemia and itching effect may change bird behaviour.	Cracks and crevices should be filled in-house should be clean and spray should be used.

4. Conclusions and Recommendation

During present investigation, two species of ectoparasites and 17 species of endoparasites; three from blood and 14 from fecal samples were identified. In our recommendation, proper medication and sanitation of the birds houses and cages is recommended to avoid parasites.

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