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Prevalence of Ectoparasites in Wild and Domesticated Grey *(Francolinus pondicerianus)* and Black Partridges *(Francolinus francolinus)* from Khyber Pakhtoonkhwa Province of Pakistan

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Abstract.- Ectoparasites increase birds' morbidity by sucking blood and causing irritation to them hence affect their economic production. In the current study comparative prevalence of ectoparasites was studied in domesticated and wild black (*Francolinus francolinus)* and grey partridges *(Francolinus pondicerianus)* from Khyber Pakhtoonkhwa province of Pakistan. Sixteen species of ectoparasites, including eight lice, four mite, three tick and one flea species, were collected from 88 out of 110 (80%) wild/domesticated black and grey partridges by using standard methods and identified by using taxonomic keys. 53 grey partridges (33 domesticated and 20 wild) were infested by seven lice species (*Menopon gallinae, Goniocotes gall, Menacanthus stramineus, Genero columbicola, Lipeurus caponis, Brueelia coquimbana, Coculogaster heterographus*)**,** three species of ticks (*Haemaphysalis leporispalustris, Ixodes pacificus, Amblyomma maculatum)* 2 species of mites (*Ornithonyssus syliarum, Dermanyssus gallinae*) and a flea species (*Pulex irritans).* While 57 black partridges (35 domesticated and 22 wild) were infested by 7 species of lices (*Coculogaster heterographus, Brueelia coquimbana, Menacanthus stramineus, Genero columbicola, Menopon gallinae, Lipeurus caponis, Goniodes gigas),* four species of mites (*Tyroglyphus* spp., *Dermanyssus gallinae, Ornithonyssus syliarum, Sternostoma tracheacolum)***,** two species of ticks (*Ixodes pacificus, Amblyomma americanum)* and a flea specie (*Pullex irritans).*

Key words: Ectoparasites, grey partridge, black partridge.

INTRODUCTION

Birds are economic and effective source of animal proteins produced within the shortest possible time and play a vital role in narrowing down the animal supply protein gap (Pearson, 1995; Khan *et al.*, 2003). Black and grey francolins (*Francolinus francolinus* and *F. pondicerianus*) belong to Perdicinae sub family (francolins, partridges and old world quails) of the family Phasianidae. Francolins are different from partridges (Snow partridge *Lerwa lerwa*, Chakor partridge (*Alectoris chukar*, Seesee partridge *Ammoperdix griseogularis* occurring in Pakistan). The two francolins occurring in Pakistan are however known as partridges probably because of their resemblances with partridges especially with European grey partridge (*Perdix perdix*). Genus Francolinus is represented by five species *viz*., black francolin *Francolinus francolinus*, painted francolin *F. pictus*, Chinese francolin *F. pintadeanus*, Grey francolin *F. pondicerianus* and swamp francolin *F. gularis.*

Both grey and black francolin are distributed widely throughout Pakistan; they are found in the Indus plains, plentiful in undisturbed tropical thorn forests and occur throughout lower hills of Makran and Lasbela in Balochistan Province. They can be encountered in sand dune deserts like Cholistan in Bahawalpur district. They also occur on the Potohar Plateau and in the Salt Range in Punjab Province. In the Khyber Pakhtunkhwa (KPK) province, they are found in lower protected hills (part of Manglot Wildlife Park) around Cherat and in some parts of Kohat (Johnsgard, 1988). In Asia populations of both these francolin species are declining for which various factors have been speculated such as the loss of food, excessive predation, hunting and habitat destruction as well as too much use of guns for hunting (Mahmood *et al.*, 2010).

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Birds, like all other animals, too suffer from a wide range of maladies. In semi-scavenging system, birds are found to be infested with various types of ectoparasites including different species of lice, mites, ticks and fleas (Abedin and Huq, 1977; Rahman *et al.*, 1989). Birds having access to outdoor areas have a greater diversity of ecto and endoparasites (Pandey *et al.*, 1992). Ectoparasites of birds live or penetrate within the skin or even into the air sacs and some live under feathers. The ectoparasites do lower the reproductive success of the birds and during periods of heavy infestation, lower their resistance by weakening them (Panday and Ahluwalia, 1983). They suck blood, interfere with the feed consumption by giving continuous irritation and thus they are associated with emaciation, anemia, allergies, dermatitis and eventually loss of meat and egg production and in worst cases leading to death of the bird (Soulsby, 1982). There is evidence that infestation of ectoparasites causes nestling mortality and nest desertion by birds (Wheelwright and Boersma, 1979). In general the increased mortality due to ectoparasites is caused by the loss of blood, which weakens the host, by viral disease or by diseases caused by noxious endoparasites for which arthropods are vectors that act as mechanical or biological agents transmitting a number of pathogens (Mir *et al.*, 1993; Pearson, 1995).

The aim of this study was to report the comparative prevalence of various types of ectoparasites in domesticated and wild black and grey partridges from KPK province of Pakistan.

MATERIALS AND METHODS

Ectoparasite samples were collected from 110 black and grey partridges from various regions of KPK. These birds include 57 black partridges (35 domesticated and 22 wild) and 53 grey partridges (33 domesticated and 20 wild). Age, sex and size of these birds were also noted.

Visual examination

Visual examination of birds, for the detection of parasites, was done following Walther and Clayton (1997). Briefly, birds were immobilized with the help of surgical tape. The feathers of the head, the neck, under the wings, body and legs were raised and thoroughly examined for ectoparasites. Magnifying glass was used to observe ectoparasites having less than 1mm body size. The ectoparasites were counted and transferred to the labeled bottles containing 50% ethanol and later on identified by using taxonomic keys (Shanta *et al.*, 2006).

Dust ruffling

For the collection and quantification of ectoparasites load from live birds, method of Walther and Clayton (1997) was followed. Live birds were held in one hand over the colored, smooth collecting surface and were dusted with an insecticidal powder (0.1% Permethrin) followed by feather ruffling. To prevent irritation, eyes of the birds were protected. After each bout of ruffle ectoparasites were collected, counted, transferred to 50% ethanol containing viols and identified by using taxonomic keys.

Microscopic examination

The collected ectoparasites were microscopically analyzed for identification. Later on ectoparasites were dehydrated each in 50, 70, 90% and absolute ethanol for 5 to 10 minutes and stained with Borax carmine and mounted on slides with Canada balsam for long term preservation following Sayed and Saleem (2000). Parasitic prevalence and mean intensity of all ectoparasites was determined.

RESULTS

Result of this study indicated that both wild/ domesticated Grey as well as black partridges (88 out of 110) were highly infested by various type of ectoparasites. Grey partridges were comparatively more infested (84.4% in domesticated vs 80% parasitic prevalence in wild birds) as compared to black partridges (80% in domesticated vs. 77.3% parasitic prevalence in wild birds) (Table I).

Twenty seven out of 33 domesticated grey partridges were infested by five species of lice including *Genero columbicola, Lipeurus caponis, Menacanthus stramineus, Menopon gallinae* and

Table I.- Comparison of mean prevalence of ectoparasites in grey and black partridges studied (n=110).

Type of birds	Total No. of birds	No of birds infested	Prevalence (%)
Domesticated grey partridges	33	27	84.4
Wild grey partridges	20	16	80
Domesticated black partridges	35	28	80
Wild black partridges	22	17	77.3

Goniocotes gall. *Lipeurus caponis* was the most prevalent (72.7%) as 102 lice were collected from 24 birds. *Pulex irritans* was the only flea (15.15%) collected from six domesticated grey partridges (Table II).

Sixteen out of 20 wild grey partridges were infested with two species of lice (*Brueelia coquimbana* and *Coculogaster heterographus)*, two species of mites (*Dermanyssus gallinae* and *Ornithonyssus sylviarum)* and three species of ticks (*Haemaphysalis leporispalustris, Ixodes pacificus* and *Amblyomma maculatum)*. *Ornithonyssus sylviarum* was the most prevalent mite (65%), while *Amblyomma maculatum* was the most abundant tick (75%) among wild grey partridges (Table II).

Twenty eight of 35 domesticated black partridges were infested by seven lice species including *Coculogaster heterographus, Brueelia coquimbana, Menacanthus stramineus, Genero columbicola, Menopon gallinae, Lipeurus caponis, Goniodes gigas* and one tick species (*Ixodes pacificus)*. the most prevalent lice as 26 birds were infested with 29 of these lice (Table III).

Seventeen of 22 wild black partridges were infested with three mite species (*Tyroglyphus* spp, *Dermanyssus gallinae* and *Ornithonyssus sylviarum*), two tick species (*Amblyomma americanum* and *Ixodes pacificus*) and one flea species (*Pullex irritans*). *Ornithonyssus sylviarum* (68.8%) and *Amblyomma americanum* (63.3%) were the most prevalent mite and tick in wild black partridges, respectively (Table III).

DISCUSSION

The aim of the present study was to find the comparative prevalence of ectoparasites in wild and domesticated grey partridges *(Francolinus pondicerianus)* and black partridges *(Francolinus francolinus*) as to our knowledge, there is no reported study on the ectoparasites in Black and Grey francolins/partridges. Similar studies studies have however been conducted on chukor partridge *(Alectoris chukar)* (Sychra, 2005), red legged partridge *(Alectoris rufa)* (Calvate *et al.*, 2003) and in poultry (Shantha *et al.*, 2006).

Prevalence and parasitic intensity are normally calculated for each species of parasite observed. The prevalence and intensity of parasitic infection may be influenced by a number of epidemiological factors such as age, sex, breed etc. and climatic environmental factors such as free living management system and climatic conditions (Clayton and Moore, 1997; Nadeem *et al*., 2007). Mean parasitic intensity is more important parameter than the overall parasitic prevalence as it gives actual idea about the load of a particular parasite on a specific bird while prevalence provides us an idea about overall affected birds among the population (Wiles *et al.*, 2000). This factor was also evident from the present study where ectoparasitic prevalence and intensity values were never in agreement but both were providing useful information regarding the number of birds infested among domesticated/wild grey and black partridges as well as indicating the most abundant ectoparasites on birds (Tables II-III).

Sychra (2005) reported high lice infestation in chukor *(Alectoris chukar)*. The lice infestation included *Amyrsidea perdicis, Menacanthus pallidulus, Menopon gallinae, Goniodes colchici, Lipeurus maculosus, Goniocotes microthorax* and *Cuclotogaster heterographus.* All these lice except *Amyrsidea perdicis* are also reported in the present study. Transmission of lice may be vertical when it is from parents to offsprings during parental care or horizontal when it is through direct contact of adult birds or through birds using the same resting place (Darolova *et al*., 2001). The mode of lice transmission was horizontal in this study. Hillgarth (1996) and Darolova *et al.* (2001) reported similar

Table II.- Prevalence and mean intensity of ectoparasites in domesticated and wild grey partridges. Mean intensity is expressed along with standard error of mean (SEM).

Ectoparasites	Site of recovery	No of birds infested	Prevalence (%)	Total No. of ectoparasies	Mean Intensity ±SEM (Total No. of ectoparasites/ No. of infected birds)
Domesticated grey partridge (n=33)					
Lice					
Menopon gallinae	Feathers, tail wings, neck	21	63.63	49	2.3±0.65
Goniocotes gall	Feathers, tail wings, neck	19	57.57	36	1.8±0.05
Menacanthus stramineus	Feathers, tail wings, neck	13	39.39	78	6.0±1.32
Lipeurus caponis	Feathers, tail wings, neck	24	72.72	102	4.2±1.2
Genero columbicola	Feathers, tail wings, neck	09	27.27	35	3.8±0.67
Fleas					
Pulex irritans	Legs and body	06	15.15	23	4.8±0.53
Wild grey partridge (n=20)					
Lice					
Brueelia coquimbana	Feathers, tail wings, neck	10	50	41	4.1±0.75
Coculogaster heterographus	Feathers, tail wings, neck	09	45	36	4.8±0.68
Mites					
Ornithonyssus sylviarum	Feathers, tail wings, neck	13	65	55	4.2±0.91
Dermanyssus gallinae	Feathers, tail wings, neck	11	55	48	4.3±0.84
Fleas					
Ixodes pacificus	Feathers, tail wings, neck	14	70	38	2.7±0.6
Amblyomma maculatum	Feathers, tail wings, neck	15	75	61	4.0±0.94
Haemaphysalis leporispalustris	Feathers, tail wings, neck	08	40	25	3.1±0.5

results and demonstrated that horizontal transfer was the main route for the spread of lice from one adult bird to another within the same species. Most species of lice depend on the warm, humid conditions near the skin of the host and are unable to survive off the host for more than a few days or hours.

Calvate *et al*. (2003) found three species of ticks (*Haemaphysalis punctata, Hyalomma lusitanicum*, and *Ixodes frontalis)* and six species of chewing lice (*Goniodes dispar, Cuclotogaster obscurior, Goniocotes obscurus, Menopon pallens, Menacanthus lyali* and *Columbicola columbae columbae*) on wild red legged partridges. We also detected all the three reported tick species and two of the lice species in grey and black partridges in the present study indicating that birds belonging to similar taxonomic lineage are infested by similar type of ectoparasites. They also reported an overall higher ectoparasitic load in males as compared to females. Similar results were obtained in the present study. This is because males display greater territorial and competitive behaviour as compared to the females, therefore devote less time to self maintenance and are parasitized to a greater extent.

The study concludes that Grey and Black francolins/partridges are infested by many ectoparasites which affect their health status. Symptoms, causative agents, and pathology have no doubt received the most attention, but from the standpoint of possible control measures, the manner of transference from an infected to a non-infected bird is probably the most important consideration. More field studies are needed to better understand the correlations between ectoparasites and various diseases associated with

Table III.- Prevalence of ectoparasites in domesticated and wild black partridges. Mean intensity is expressed along with Standard Error of Mean (SEM).

Ectoparasites	Site of recovery	No of birds infested	Prevalence (%)	Total No. of ectoparasies	Mean Intensity ±SEM (Total No. of ectoparasites/ No. of infected birds)
Domesticated grey partridge (n=33)					
Lice					
Lipeurus caponis	Feathers, tail wings, neck	22	64.85	68	4.4±1.28
Goniodes gigas	Feathers, tail wings, neck	19	54.28	72	3.7±1.01
Menopon gallinae	Feathers, tail wings, neck	20	57.14	33	1.6±0.45
Genero columbicola	Feathers, tail wings, neck	17	48.57	51	2.4±0.63
Menacanthus stramineus	Feathers, tail wings, neck	21	60	32	1.2±0.39
Brueelia coquimbana	Feathers, tail wings, neck	26	74.28	29	1.3±0.38
Coculogaster heterographus	Feathers, tail wings, neck	15	42.85	25	1.4±0.36
Ticks					
Ixodes pacificus	Feathers, tail wings, neck	3	8.5	14	4.6±0.35
Wild grey partridge (n=22)					
Mites					
Sternostoma tracheacolum	Feathers, tail wings, neck	8	36.36	25	3.1±0.5
Ornithonyssus sylviarum	Feathers, tail wings, neck	15	68.81	45	3±0.07
Dermanyssus gallinae	Feathers, tail wings, neck	4	18.18	19	2.4±0.52
Tyroglyphus spp.	Feathers, tail wings, neck	13	5.41	32	2.7±0.45
Ticks					
Amblyomma americanum	Feathers, tail wings, neck	14	63.63	44	3.1±0.7
Ixodes pacificus	Feathers, tail wings, neck	12	54.54	26	2.1±0.4
Fleas					
Pulex irritans	Feathers, tail wings, neck	3	13.63	17	5.6±0.42

them in partridge populations. Also, more strict sanitary controls are necessary in rearing facilities in order to avoid the release of undesirable pathogens through ectoparasites. A close monitoring of partridge populations, through periodical surveys and analyses of dead-found partridges, is necessary to maintain healthy populations.

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