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Insect ectoparasites on wild migratory birds: A review

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This review emphasize that the avian host are strongly affected by ectoparasites and these ectoparasites causes serious threats to birds. These ectoparasites might be a serious threat for growth, reproduction and long term survival of birds. Moreover, these parasites may affect the host behavior in different ways like they can provoke their locomotors performance. By close observation it can be seen that these ectoparasites damage the bird's feathers. Over all, the avian host was undeniably connected with species heterogeneity, species abundance and behavior. Different populations have close relations between epidemiological theory and ecosystem management. Among environmental factors that lead the prevalence of ectoparasites are temperature and seasonal variations. Migratory birds may also face extra risks to an already risky journey and also can got infected. Greater number of ectoparasites abundance for some migratory birds suggests that more research and observation are need particularly with reference to emerging diseases. The lice species are mostly present on passerine birds. The avifauna play critical role in the ecosystem and are implicated in the transmission of zoonotic diseases. Study of ectoparasites movement with migratory birds is not only important with economical point of view but also have import role in public health. The visual observation and survey of ectoparasites on migratory birds is very important for control and prevention of parasites responsible for zoonotic disease.

Keywords: Migratory birds, Ectoparasites, Prevalence, Zoonotic disease, Avifauna.

In general avian hosts are strongly affected by ectoparasites and these ectoparasites causes serious threats to birds. These might be so serious for growth, reproduction and long term survival. Rosy starlings were considered to be susceptible for mites and some others ectoparasites which are still not known fully.

Effect of ectoparasites on the host behavior

The parasites may affect the host behavior in different ways. Such parasites may also provoke on their locomotors performance. After many observations it could be seen that these ectoparasites were damage the birds feathers. Such species of ectoparasites ware impacted on

the Barn Swallows flight during reduction and level of journey. These results recommended that the accidental effects of feather lice on host performance. The effect of thermoregulation and feather ruptured is cause by feather lice. Such study was firstly reported that the parasite may also effected on behavior.(Barbosa et al. 2002).

Ecto- parasites biodiversity

The major fact of biodiversity is a large amount population and adequately of substitute parasitism. A variety of parasites successively use different host species with difficult life pattern. The richness number of hosts which causes the increase number of ectoparasites and amount of

avian host. Suddenly the reasonable supposition has tiny experimental support, particularly regarding these parasites. The straightforward examinations of this impression and mostly required the suitable rules for analysis. Observations show that, quantify spatial scales present on birds by time-lapse videography. At the same time the small spatial scales are used to determine the related communities between birds and premature stages of trematode ecto-parasitic communities of snail. Over all the avian host were undeniably connected with species heterogeneity, species abundance, and large amount of trematodes in host snails. Different populations have close relations between epidemiological theory and ecosystem management.(Hechinger et al.2005).

Environmental factors leading prevalence of ectoparasites

The temperature is main ecological effect that contributes diapause in the regulatory ways. But the no more influence of temperature on the free-living parasites and a way that affect host-parasite communications. The experimental study showed that the high temperature has greater effect on hibernating cocoons of *Carnus hemapterus* an ecto-parasitic fly of various bird species. Alarming condition is a precondition to achievement of species diapause. According to these studies the winter seasons investigate unprotected ecto-parasitic pupae in the shells of avian species to favor able temperature. Without frightening and noted the appearance experimental bases and regulator sets. These observations showed the group's progressive appearance time, consequently, a prolonged advent period. The alarming condition would not clear consequence on the begging of appearance but the mean appearance day was condensed and a span of the appearance date. The control action and increased the appearance rate was compared during the spring conditions. Such study classifies an ecological indication, namely hotness during the life stage due to disturbing of extensive fly and indications malleability of parasite diapause (Amat-Valero et al. 2013)

Effect of ecto-parasites on passerines birds

The development and survival of offspring is effected by many parasites. Because parasites may have permanent effects on phenotypes of passerines birds' growth, such study provides experimental evidence for parasite effects during

the survival of growth. The progress of offspring that shows the significances of phenotypic amendment on the life time of reproductive achievement. Such study shows that during growth the parasitic effects are important for sympathetic optimum resource distribution and life-history evaluate under parasitism effect (Fitze et al. 2004).

Passerines bird was affected by tick's parasite. These birds can be infested with tick-borne pathogens i.e. *Anaplasma sp.*, *Babesia sp.*, *Coxiella sp.*, *Borrelia sp.*, and tick which create virus. Frequency of parasites on birds which changes season, above years, area and variety of avian species. The occurrence of ecto-parasitic species of ticks on variety of birds influenced the degree of nourishing on the earth. The ecto-parasitic species like *Turdus sp.*, mostly present on the blackbird in Europe, It has the power of birds which will simply cross barriers, like glaciers, hurdles, marine, mountains and deserts. It should additionally halt animals and these ticks will transfer a lot of quicker than the wing less hosts. Birds will presumably transport tick-borne infectious agents as a result of tick's pathogen and presumably as hosts for transfer of pathogens between ticks through co-feeding. Study of bird migration routes and of the spatial distribution of tick species and tick-borne pathogens is crucial impact of birds. Winning formation of recent tick species can rely upon appropriate climate, vegetation and hosts. It's never been confirmed that a brand new tick species, really has been established during new vicinity once being seeded there by birds (Hasle, 2013).

Effect on resident and migratory birds

The parasites and infectious diseases are major problems that affect the resident's growth and life style, inspiring ability to their hosts and generating the normal inhabitants. Results showed the diversity of wild lesser kestrel population may also threat by feather lice. At least the function of individual characteristic variety of wild population may also affected by ectoparasites (Ortego et al. 2007).

The *Ornithonyssus bursa* is a blood sucking species but its impact is not significant to cause a large quantity of blood loss even the mortality of chick. Numerous bird species are parasitized by *O. bursa* in New Zealand. The consequence of *O. bursa* mite on the host ability is not clear. During three-year study of robin on tertiary Matangi in the

North Island. The occurrence of such parasites on robin nests and their effect on robin chick. In such cases the growth and survival rate of ectoparasites were determined. Occurrences of parasites were interrelated with different time of the year and moistness of the territory. While the invasion are being positively correlated with humid microclimates and nesting efforts. Robin chicks were significantly smaller in infested nests and fledged at an earlier age in nests were not detected mites. In spite of this effect at one month, there was no significant difference in body size or survival rate between the two groups. This situation was not more alarming because chicks compensated of infected nests. In New Zealand, where parasites of ground-dwelling mammalian are present, these parasites enforced the chick to leave their territory starting age with fewer advanced airborne abilities (Berggren 2005).

The birds' parasitism's not well recognized that is found in a tropical region. Migratory birds may also face extra risks to an already risky journey and also infected. Such study discovers the ecology of an ecto-parasite invasion in Chiapas, Mexico. A mist-netting project take place in 2 different coffee organization systems. Chigger mites (*Acarinatrom biculidae*) ectoparasites during the larval stage, were found on both types of birds like resident and migratory birds. It was observed that 17 out of 26 species for long distance travelers and 33 out of 71 native species had been at least 1 infested individual. Some long-distance migrants the infestation pre valences were high as 0.73 on Swanson's thrush (*Catharusus tulatus*), these ecto-parasitic value on infested resident species were heavily. Greater amount of ecto-parasitic abundance for some migratory birds suggests that more research and observing particularly in light of emerging diseases (Dietsch, 2005).

Ecto-parasitic status in Pakistan

Studied comparative prevalence of ectoparasites was studied in domesticated and wild black (*Francolinus francolinus*) and grey partridges (*Francolinus pondicerianus*) from Khyber Pakhtoonkhwa province of Pakistan. The ectoparasites increase birds' morbidity by sucking blood and causing irritation to them hence affects their economic production. A total of 57 grey partridges (33 domesticated and 20 wild) were infested by seven lice species (*Menopon gallinae*, *Gonicotes gallinae*, *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 sylvium*, *Dermanyssus gallinae*) and a flea species (*Pulex irritans*). While 57 black partridges (35 domesticated and 22 wild) were infested by 7 species of lice (*Coculogaster heterographus*, *Brueelia coquimbana*, *Menacanthus tramineus*, *Genero columbicola*, *Menopon gallinae*, *Lipeurus caponis*, *Gonicodes gigas*), four species of mites (*Tyroglyphus sp.*, *Dermanyssus gallinae*, *Ornithonyssus sylvium*, *Sternostoma tracheacolum*), two species of ticks (*Ixodes pacificus*, *Amblyomma americanum*) and a flea species (*Pulex irritans*) (Khattak et al. 2012).

The habitat preference of ectoparasites (*Myrsidea invadens* and *Brueelia chayanh*) on Common Myna (*Acridotheres tristis*) was 144 were examined round the year (2009-2010) for the collection of two ecto-parasitic species *Myrsidea invadens* and *Brueelia chayanh* belongs to the order Phthiraptera from the host *Acridotheris tristis* from Faisalabad City. It was observed that *Myrsidea invadens* (54.7%) was found to be as most common ecto-parasite round the year on Common Myna (*Acridotheris tristis*) of Faisalabad city and *Brueelia chayanh* (45.2%) was second most numerous species found on *Acridotheris tristis*. Ectoparasites of different species when found on same host are usually negatively correlated in terms of their habitat preferences. It was observed during the study that *Myrsidea invadens* has rounded body with bigger legs so it prefers dorsal part of its host body and *Brueelia chayanh* has elongated body shape so it prefers the ventral side of the host (Aslam et al. 2015).

Ecto-parasite categories on the bases of species

Lice species effect on birds and mammals

The lice (*Insecta Phthiraptera*) are permanent ectoparasites of birds and mammals. Despite having a rich avifauna in Iran, limited number of studies have been conducted on lice fauna of wild birds in this region. In east of Iran the ecto-parasitic study was carried out to identify lice species in passerine birds. Total 37 bird species were captured. During examination birds bodies were infested by lice. Infested birds were fifty two (49.05%) out of 106 birds. 11 lice species were identified out of 465 lice collected. Along other birds and their specific ectoparasites

species, one species of lice *Brueelia chayanh* was reported on Common Starling (*Sturnus vulgaris*), this was first time recorded in Iran (Moodi et al. 2013).

The predominant feather lice belong to endemic passerine birds of New Zealand. New species *Melibrueeliano vaeseelandia* are described and their hosts were Passeriformes; Meliphagidae. *Brueelia callaeincola* is also recorded (Michel and Palma 2015)

Lice community parasite on great gray shrike in North, East Slovakia the community of lice parasite were collected that is present on great grey shrike during 1962-1974. Lice fauna comprised of three species. All these species were before specified as distinguishing for that host. The abundance of lice was high and it may also recover about 96.3% on the host specimens. Scattering of lice on regional birds indicating considerable variations in abundance of lice ectoparasites. Sex ratios of lice were unfair towards females and could not associated with the subpopulation size of lice on avian hosts (Szczykutowicz et al. 2006).

The most widespread chewing lice ectoparasites are active in the plumage of birds. These lice may also be thriving with unusual mechanical effects during ringing, and these ectoparasites could decline off their hosts. The feather holes may consist the number of louse loads. Such feather holes were counted after a month. Suggestively more new holes appeared in the reduced ringing procedure group, representing that the usual ringing procedures effectively decrease louse loads. This is the first evidence that bird ringing affects ecto-parasite invasions (Vas and Fuisz 2010)

The ectoparasites and other invertebrates are well-known to play important role in bird manners and in the evolutionary adaptations such as preening and foraging strategies. To conducted an exploratory study by macro- and microscopically evaluating the nests of Hair-crested Drongos (*D. hottentottus*) at Dongzhai National Nature Reserve, Henan Province, China in 2011 to determine if there was a presence of invertebrates. To developed a modified funneling technique to collect invertebrate sample and reduce contamination from outside source in a field setting. Several species of ectoparasites (lice and ticks) and other invertebrates (springtails and rove beetles) was present within the nests. Our finding warrant further investigation as to whether or not the presence of invertebrates in the nests of

Hair-crested Drongos plays a role in the adaptation of the unique nest dismantling behavior exhibited by this species (Lyakhova and Kotti 2011).

The population characteristics of *Brueelia* sp. on certain Indian finches during 2004 to 2006. Total five different kinds of finches were study. In this case two kinds of finches were infected with lice parasites. The occurrence dispersal pattern of parasites on *T. guttata* adapted to the undesirable model. Gender ratio was favor able for females and adults in normal residents (Saxena et al. 2011).

There is an association between the chewing lice and feather mites on birds in Brazil. About 1,479 chewing lice fifteen taxa were identified on species level, eighteen on genera level belonging to three families. About sixteen genera of feather mites 10 were identified on species level. Prevalence rate was high on Passeriformes (chewing lice, 57.8 and feather mites, 75.6%) birds. Similarly, non- Passeriformes prevalence rate of lice and mites was 66.7 and 50.0% respect (Enout et al. 2012).

Wild passerine affected by ectoparasites during developing period. The two parasitic species of fleas and 23 lice species were originate on 108 avian hosts. There was an important difference in total frequency but there was an equal mean intensity of chewing lice on both such as local and travelling birds (Sychra et al. 2008).

Feather-chewing lice were commonly attacks on Tree Swallows and their effect on bird's survival and reproduction rate from the duration of 1993 to 2005. Several patches were present in feathers that caused by lice species. Over all, these data propose that feather chewing lice has damage effect on bird's body. These parasites have little effect on bird ability (Lombardo et al. 2015).

Study showed that 310 birds that are infested by order Mallophaga (chewing lice). Eleven exotic species individuals and wild life Brazilian birds were constructive for these ectoparasites. Ten species of chewing lice were identified. In these species, three were predictable as poisoners and belong to family Menoponidae. While seven species belong to Philopteridae was found. In Brazil for the first time two species were identified (Marietto and Goncalves 2012).

The lice (Insecta: Phthiraptera) are long-lasting ectoparasites of birds and mammals. Although having a rich avifauna in Iran. Lice fauna

of wild birds in this region have been studied in inadequate number. About 106 passerine birds of 37 types were captured. Their different parts of body were observed for the lice invasion. About 52 birds (49.05%) from 106 caught birds were infected. Overall 465 lice were collected from infested birds and 11 lice species were identified (Moodi et al. 2013).

Effect of fire ants on different species of birds

The fire ants on the investigate nestling of avian host. In United States from 1966-2005, the Northern Bobwhite accomplished normal deterioration rate was 3% on yearly bases. Factors were involved to the decline of alteration of farm practices, habitat destruction due to red imported fire ant (*Solenopsis invicta*). The chief objective of these observations was to investigate the effect of fire ant on the nestling of avian host. The consequence of fire ant and non-target ant species was studied. In 2005 eight plots were selected, in each plot with one breeding bobwhites from Louisiana captive stock were present. In these eight plots, the four plots were wide range that treated with Amdro (0.73%). Adhesive tricks showed effective scattering of bait, while the composition of traps size varied from that predictable value. Baits were used to determine the achievement of RIFA invasion and to investigate the effect of bait on non-fire ants. In 2006, 8 plots were reduced in to six plots but number of fire ants was increase in number. In these situations two birdcages per plot were taken that contained captive-bred bobwhites from Arkansas and other two restricted in Louisiana hostages. In accumulation the fire ant which was effectively repressed on these plots, a *phaenogaster fulvarudis* was undesirably affected by action. The *Prenolepis imparis* displayed a potential inexpensive that was discharge from parasites. In 2005, the study showed that if reduced the number of nestling that automatically reduced number of parasites. One nest shaded effectively because there was no effect of fire ants. While on the other case the nest were infected by such ectoparasites. In 2006, the number of eggs, nests and baby bird was not different meaningfully condition and unprocessed plots were not present between the two different populations of bobwhites birds. A meaningfully greater ratio of nests was criticized by fire ants on unprocessed plots. RIFA were seemed during the opening of bobwhite eggshells. The ranges of fire

ants were attacking eggs during preceding to hatch bobwhite (Seymour 2007).

Effect of feather mites

The presence of mites on birds during 1973 to 75. The distributions of mites showed that 26 species out of 225 birds were discovered in India. Total 269 mites were present on bird species. There were 7 families and 5 genera of mite's were discovered. Different types of mite's species were presented on different hosts. The *Bakericheyla* sp were discovered on *Passer domesticus*. While the species also present on *corvus spenders*, *Acridotheres tristis*, and *Acridotheres ginginianus*. On house sparrow, house crow and common myna the *Gabucinia* sp. was determined. The Gaud species were also discovering from *Strelko viacarus* species (Vijay and Patwant 2009).

The parasitic mites in turkey's bird in Oaxaca's Coast region, Mexico, the mites were obtained from 30 backyard turkeys. These mites were stand in adhesive paper and seen with the 200X lens in a computer optical microscopy. The pictures of parasites size was determine by the microscopy software. To increase the size of image using specialist software, which relate the number of pixels in the pictures. The species identified were *Dermanyssus gallinae*, and *Ornithonyssus sylviarum*, for first time in backyard turkeys in Mexico (Camacho-Escobar et al. 2010)

The fitness significances of the ectoparasitism were conveyed over the life history in their host's species with relation to difference in plenty of total ecto-parasitic public and composition through the life history of host. The most experimental work on ecto-parasite species was during their development period. In south-western Arizona an extensive survey of ectoparasite community on *Carpodacus mexicanus* was take place. They studied that different ectoparasite species of mites' belong to genera *Strelkoviacarus* and *Dermoglyphus* was present. The nests mite *Pellonyssus reedi*, lice *Menacanthus alaudae* and *Ricinus microcephalus* were identified. Mite *P. reedi* and louse *Mena canthus alaudae* was plenty highest value during host developing period. Particularly in elder birds on which *P. reedi* abundance form of shelter. The mostly study showed that the breeding birds have greater mites. The shedding male feather mites have plenty of *P. reedi*. The study showed that the combination of ectoparasites is less studying. These

ectoparasites capacity that recommending of harmonize in their life cycles in their hosts. The relative abundance of ecto-parasite species depends upon the host life stages and how the make adaptation against parasite (Hamstra and Badyaev 2009).

Birds are afflicted by an extra ordinary diversity of ectoparasites, extending from feather degrading bacteria to feather feeding lice. Several of these ectoparasites have simple harmful effects on the host fitness. It is hence not unexpected that the collection on birds has preferred a range of possible variation for dealing with the ectoparasites. In this study they reviewed the evidence of the unsupported tools birds have for allocating with ectoparasites (Clayton et al. 2010).

The ectoparasites occur in the lining of bird nests. Their detrimental effects on nestlings have been reported, but little is known about their patterns of abundance in relation to urbanization. I compared the abundance of haematophagous parasites in Wood Thrush nests in suburban and contiguous forests and measured nestling size in relation to parasite abundance. Nests from suburban forests had fewer mites, though the abundance of blowflies did not differ between suburban and contiguous forests. There was no relationship between the abundance of mites and nest site characteristics, though blowfly abundance may be related to nesting substrate species. Lack of a relationship between mites and nest site characteristics suggests that differences in parasite life histories can result in certain groups of parasites being more sensitive than others to changes in Wood Thrush nesting sites mediated by changing urban environments. Parasites had little effect on nestling condition, and the only negative effects detected were in suburban habitats, where parasite abundances were lower. Larger nestlings came from contiguous forest nests with higher parasite diversities (Dalton et al. 2014).

Flies effect on birds

The first defense is training behavior, includes preparing with the bill and biting with their feet. Grooming also showed to be exact operational beside ectoparasites. The studies show that the feather lice are relatively slow moving ectoparasites. The efficiency of grooming and defense against more mobile and indirect ectoparasite flies. Hippoboscidae has ability to feed host blood and causes blood diseases such as anemia. Such parasites have secondary effects

that lead the vectors of pathogens. The actual defense against ectoparasites is very significant. The captive Rock Pigeons have a grooming behavior that makes a defense against ectoparasites. Flies killed the birds double with reduced their grooming. However, grooming did not kill all of the flies. The function of the bill adding, which is serious for operative grooming beside feather lice. Birds do not frosted by controlling flies. At least, grooming is operative against moveable ectoparasites, but such condition does not eliminate them. Possible effect of grooming on the communication of changing aspects of blood sucking parasites such as *Hippoboscidae* flies (Waite et al. 2012).

Ticks effect

The bird-facilitated pathogens and ticks are assumed to inspire attack of ticks-borne zoonotic infection into urban areas on wild birds by capturing mist net. Results effect about proliferate density due to infectious of tick-borne and point out the large sample size that is necessary to the valuation of this force (Sarah et al. 2012).

Method used for capturing ectoparasites

The two methods for quantifying lice parasites which are commonly used on live birds. Visual examination provides us information about an estimation of ectoparasite richness based on various body regions of a bird during observer examination. The visual examination showed that the variation may also occur in lice species of their whole richness. The lot of lice parasites was collected by using a dust-ruffling method. Over all such method showed that these parasites were mostly present on passerine birds.(Koop and Clayton 2013)

The lice parasites from aquatic birds during hibernating seasons in searching grounds of coastal Ecuador these species were collected on structural bases. The result shows that the scattering of these chewing lice species was enclosed the regions around the world. It includes the Arctic region of the north, but the entire winter season is the scattering area of the host species. The Ecuador's mainland coastal area is the first studying area of chewing lice. To determine the host-parasite ecology, further research is required and discontinuing the ecto-parasitic infection in shorebirds over the region.(Haase and Alava 2014)

The parasites prevalent among wild bird

species in southern Nigeria the avifauna play critical role in the ecosystem and are implicated in the transmission of zoonotic diseases. These parasites economically and public health are importance. Ectoparasites were collected from captured birds from two sites Awba dam and International Institute of Tropical Agriculture IITA in Ibadan. The dust- ruffling technique method was used for ectoparasites collection. Floation method and direct smear were used for fecal and blood analysis respectively. Ticks were identified under light microscope. Differential leucocyte counts and Packed Cell Volume were also estimated. A total of 123 birds were sampled, 29 and 94 species around Awba dam. The bird family with the highest frequency of isolated parasite is the Pycnonotidae. This information is important to the control and prevention of parasites of zoonotic disease (Omonona et al. 2014).

CONCLUSION

Avian host are strongly affected by ectoparasites, these ectoparasites causes serious threats to birds for growth, reproduction and long term survival of birds. These infected birds are also responsible for the spreading of zoonotic diseases. Environmental factors that lead the prevalence of ectoparasites are temperature and seasonal variations. Migratory birds face extra risks of ectoparasite prevalence during journey because they come in contact with other birds which are already infected by ectoparasites.

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