

Full Length Research Paper

Prevalence and intensity of phthirapteran ectoparasites infesting Eurasian Collared-Dove (*Streptopelia decaocto*) (Phthiraptera: Insecta)

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One hundred Eurasian Collared-Doves were mist netted in district Rampur (India) from 2010 to 2011 and subjected to delousing by fumigation method. Only three phthirapteran species e.g. *Columbicola bacillus* Giebel, 1866, *Coloceras* Taschenberg, 1882 and *Hohorestiella rampurensis* Bansal were recovered. The population characteristics, that is, prevalence, mean intensity, sample mean abundance, and ranges of infestation were recorded. Frequency distribution patterns of all the species were aggregated but conformed to binomial model in case of *C. bacillus*. Sex ratios were skewed in favour of females in case of all the three lice. The prevalence and intensity of phthiraptera were comparative higher in summer months than winter months. The prevalences of three phthirapteran species (e.g. *C. bacillus*, *Coloceras* species and *H. rampurensis*) on the Eurasian Collared-Dove were 71, 13 and 16%, respectively, in district Rampur, from 2010 to 2011. The sample mean abundances remained 8.1, 1.3 and 1.6, respectively. The frequency distribution patterns of all the species were skewed but conformed to the negative binomial model in case of only one species. Sex ratios were skewed in favour of females while nymphal population exceeded over adults in case of all the three species.

Key words: Phthiraptera, Eurasian Collared-Dove lice, prevalence, ischnocera, amblycera, mallophaga

INTRODUCTION

As many as six phthirapteran species are known to infest the Eurasian Collared-Dove, *Streptopelia decaocto* (e.g. *Bonomiella concii* Eiculer, 1947; *Coloceras hilli* Bedford, 1920; *Coloceras piagati* Johnston and Harrison, 1912; *Columbicola bacillus* Giebel, 1866; *Hohorestiella modesta* Ansari, 1951; *Turturicola salimallii* Clay and Meinertzhogen, 1937). The prevalence of an amblyceran louse, *Hohorestiella rampurensis* on 45 *S. decaocto* has been noticed by Singh et al. (2012).

Reports on the population characteristics of phthiraptera infesting selected Indian birds, namely, domestic pigeons (Singh et al., 1998; Khan et al., 2009), common mynas (Chandra et al., 1990; Saxena et al., 2007), house crows (Beg et al., 2008), red avadavats (Gupta et al., 2007), bank mynas (Rajput et al., 2009), house sparrows, Indian parakeets, white breast kingfishers (Saxena et al., 2007), domestic fowls (Trivedi and Saxena, 1991; Trivedi et al., 1992; Saxena et al.,

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2004; Kumat et al., 2004), red whiskered bulbuls (Arya et al., 2010), common bayas (Arya et al., 2011) and certain other poultry (Khan et al., 2008) have appeared for the last 25 years. A scrutiny of literature reveals that the population characteristics of phthirapterans occurring in Eurasian Collared-Doves deserved investigation. The present report furnishes information on the prevalence, intensity of infestation and population composition of phthirapteran species parasitizing the Eurasian Collared-Doves, *S. decaocto*.

MATERIALS AND METHODS

One hundred Eurasian Collared-Doves (*S. decaocto*) were mist netted at 32 locations from January 2010 to December 2011, in district Rampur (28° 48' 79° 00' E) (India). Each bird was examined visually (with the help of magnifying torch), after tying the legs. The uninfested birds were released in wild and the lousy hosts were deloused by the modified fair Isle method (Gupta et al., 2007). Fumigation method reportedly does not yield complete louse load (Clayton and Drown, 2001) but secures the life of bird. After tying the legs, birds was placed in a transparent plastic bag containing a wad of cotton wool soaked in chloroform in such a way that head protruded out (allowed to breathe). After 10 min, the body feathers of fumigated birds were ruffled manually over a plastic sheet, to take out the louse load. The head was separately examined after delousing. The deloused birds were released in wild. Entire louse load so obtained was transferred to 70% alcohol and separated species wise, sex wise and stage wise. Common measures of population characteristics (namely, prevalence, mean intensity, sample mean abundance), and indices of aggregation (namely, variance to mean ratio, exponent [k] of the negative binomial distribution and index of discrepancy [D] were compared with the help of software offered by Rozsa et al. (2000). The goodness of fit between the observed and the expected frequencies (negative binomial) was determined by the χ^2 test (Gupta et al., 2007).

RESULTS

During the present studies specimens belonging to only three genera e.g. *Columbicola*, *Coloceras* and *Hohorestellia* were recovered. Adams et al. (2005) have revised the genus *Columbicola*. The specimens of *Columbicola* collected in the present studies resembled that of *C. bacillus* (in morphological characteristics and measurements) to a greater extent (Figure 1A and B). Tendeiro (1973) made valuable contribution on the taxonomic status of the genus *Coloceras*. Two species of the genus *Coloceras* (e.g. *C. piagati* and *C. hilli*) have been listed from *S. decaocta*. The specimens of the genus *Coloceras* collected in the present studies exhibited some differences in chaetotaxy and measurement from the aforesaid two species (Figure 1C and D). Exact taxonomic identity (species level) presented some confusion. Hence, for the present description, the specimens are being referred as *Coloceras* species. The specimens of amblyceran lice collected in the present studies belong to genus *Hohorestiella*. The specimens differed from *H. modesta* in several characteristics and

resembled that of the new species *H. rampurensis* described by Bansal et al. (2010) in morphological characteristics and measurements (Figure 1E and F).

Seventy seven percent of the Eurasian Collared-Doves examined from January 2010 to December 2011 in district Rampur (UP) were found infested with one or other species of phthiraptera. Thus, the sample mean abundance of phthiraptera remained 11.03 per bird, as a total of 1103 lice were collected (n=100). Likewise, the mean intensity of infestation was recorded as 14.32 per bird. Maximum number of lice counted on any bird was 75 (range of infestation, 1 to 75).

Out of the hundred birds examined from January 2010 to December 2011, 23 birds were louse free. Maximum number of birds (57) carried single species. Two species infestation was encountered on 17 Eurasian Collared-Doves. Simultaneous occurrence of all the three species was observed on only 3 birds. In other words, single species infestation was the most common on the Eurasian Collared-Doves.

As far as, seasonal variations in the prevalence of phthiraptera infesting Eurasian Collared-Doves is concerned, the sample size (7 to 11 per month) was too small and moreover the study period lasted two years. It would not be worthwhile to perform correlation analysis between the mean monthly temperature and the eco factors (mean monthly temperature, relative humidity and photoperiod). Nevertheless, the data provides primary clues as the prevalence remained 60% in January (n=10). It increased in February (67%, n=9). It further increased to 87.5 in March (n=8) and remained similar in April (n=8). The prevalence rate was 100% in May and June (n=8 and 7, respectively). The prevalence decreased to 86% in July and remained similar in August (n=7, each). The prevalence decreased to 75% (n=8) in September and further reduced in October (62.5%; n=8). The prevalence exhibited slight increase in November (67%, n=9) but decreased in December (64%, n=11). The overall data shows that the prevalence remained low (60 to 67%) in winter months (November to February) (Figure 5), and became high in summer month (March to June; 87.5 to 100%) and were moderate during the other months (62.5 to 86%; July to October).

More or less similar trend was observed in the mean monthly infestation intensities. For instance mean monthly intensity exhibited continuous increase from January to May (5.0, 8.6, 11.1, 19.0 and 27.4, respectively). Intensity of infestation exhibited slight reduction in June (24.3) but decreased abruptly in July (14.8). It showed slight increase in August (17.7) but again reduced to 11.7 in September. The mean monthly intensity increased to 12.6 in October but again reduced to 6.3 level in November and remained nearly similar (6.4) in December. Thus, the data indicates that intensities of infestation were comparatively higher during summer months but exhibited fluctuations during winter and rainy months (Figure 5).

Table 1. Population characteristics of three phthirapteran species on 100 Eurasian Collared-Dove lice in district Rampur from 2010 to 2011

Population parameter	<i>C. bacillus</i>	<i>Coloceros</i> spp.	<i>H. rampurensis</i>
Prevalence	71	13	16
Sample mean abundance	8.1	1.3	1.6
Mean intensity	11.5	9.7	10.3
Range of infestation	1-75	5-15	3-24
Variance/mean ratio	19.38	9.4	12.19
Total no. recorded	813	126	164
D of Poulin	0.654	0.884	0.881
Exponent of -ve binomial (k)	0.446	0.042	0.052
Whether conformation -ve binomial	Conformed	Not conformed	Not conformed
Male:Female	1:1.3	1:1.2	1:1.3
Adult:Nymph	1:1.4	1:13	1:1.3
I:II:III Nymphal instars	1:0.9:0.7	1:1.3:1.5	1:0.9:1.6

The population characteristics of three phthirapteran species infesting Eurasian Collared-Dove, *S. decoccto* have been indicated as shown in Table 1. However, the frequency distribution pattern of three species is being described.

Frequency distribution pattern of *C. bacillus*

A closer look on the data reveals that no lice occurred on 23 birds. A single louse was present upon 6 birds. Likewise, 2 lice on 9 birds, 3 lice on 1 bird, 4 lice on 8 birds, 5 lice on 5 birds, 6 lice on 3 birds, 7 lice on 6 birds, 8 lice on 2 birds, 9 lice on 2 birds, 10 lice on 2 birds, 11 lice on 1 bird, 12 lice on 1 bird, 13 lice on 4 birds, 14 lice on 4 birds, 15 lice on 2 birds, 16 lice on 1 bird, 17 lice on 1 bird, 19 lice on 2 birds, 20 lice on 2 birds, 23 lice on 1 bird, 24 lice on 2 birds, 26 lice on 1 bird, 31 lice on 1 bird, 32 lice on 1 bird, 55 lice on 1 bird, 63 lice on 1 bird and finally 75 lice on single bird. The aforesaid data has been depicted as shown in Figure 2 against the frequencies expected by the negative binomial model. The shape of frequency distribution curve was clearly aggregated/clumped/skewed. The variance to mean ratio was computed as 19.38. The value of D of Poulin was determined as 0.654. The value of k (the exponent of negative binomial distribution) was recorded as 0.446. The frequency distribution pattern of *C. bacillus* on Eurasian Collared-Doves conformed to negative binomial distribution ($\chi^2 = 21.56$, $P < 0.05$) (Table 1).

Frequency distribution pattern of *Coloceros* species

A closure look on the data reveals that 5 lice occurred on 2 birds, 7 lice on 1 bird, 8 lice on 2 birds, 9 on 1 bird, 10 on 1 bird, 11 on 3 birds, 12 on 1 bird, 14 on 1 bird and 15 lice on single bird. The aforementioned observed

frequency distribution was plotted against the frequencies expected by the negative binomial. The pattern of frequency distribution remained skewed/clumped. The variance to mean ratio was computed as 9.4. The value of 'D' of Poulin appeared to be 0.884. The value of the exponent of negative binomial (k) was computed as 0.042. However, the negative binomial distribution was not found to be a good fit in case of *Coloceros* spp. ($\chi^2 = 17.29$; $P > 0.05$) (Figure 3).

Frequency distribution pattern of *H. rampurensis*

The data indicates that 84 birds were found louse free. Three lice occurred on 2 birds, 6 lice on 4 birds, 8 lice on 2 birds, 9 lice on 1 bird, 10 lice on 1 bird, 11 lice on 1 bird, 12 lice on 1 bird, 14 lice on 1 bird, 16 lice on 1 bird, 22 lice on 1 bird and 24 lice on single bird. The aforementioned observed frequency distribution pattern has been plotted against the frequencies estimated by the negative binomial. The shape of frequency distribution pattern remained clumped/aggregated (hollow curve) and the variance to mean ratio exceeded unity (12.19) (Figure 4). The value of index of discrepancy (D of Poulin) was estimated as 0.881. The value of exponent of negative binomial (k) was determined as 0.052. The distribution of *H. rampurensis* on Eurasian Collared-Dove lice was skewed but somehow it failed to conform to negative binomial model ($\chi^2 = 18.16$, $P > 0.05$) (Table 1).

DISCUSSION

Studies revealed that prevalence of *C. bacillus* on Eurasian Collared-Doves was higher, than two other species (e.g. *Coloceros* spp. and *H. rampurensis*). The prevalences of phthirapteran species on the other Indian birds reportedly varies from 6.9 to 51.3% on domestic

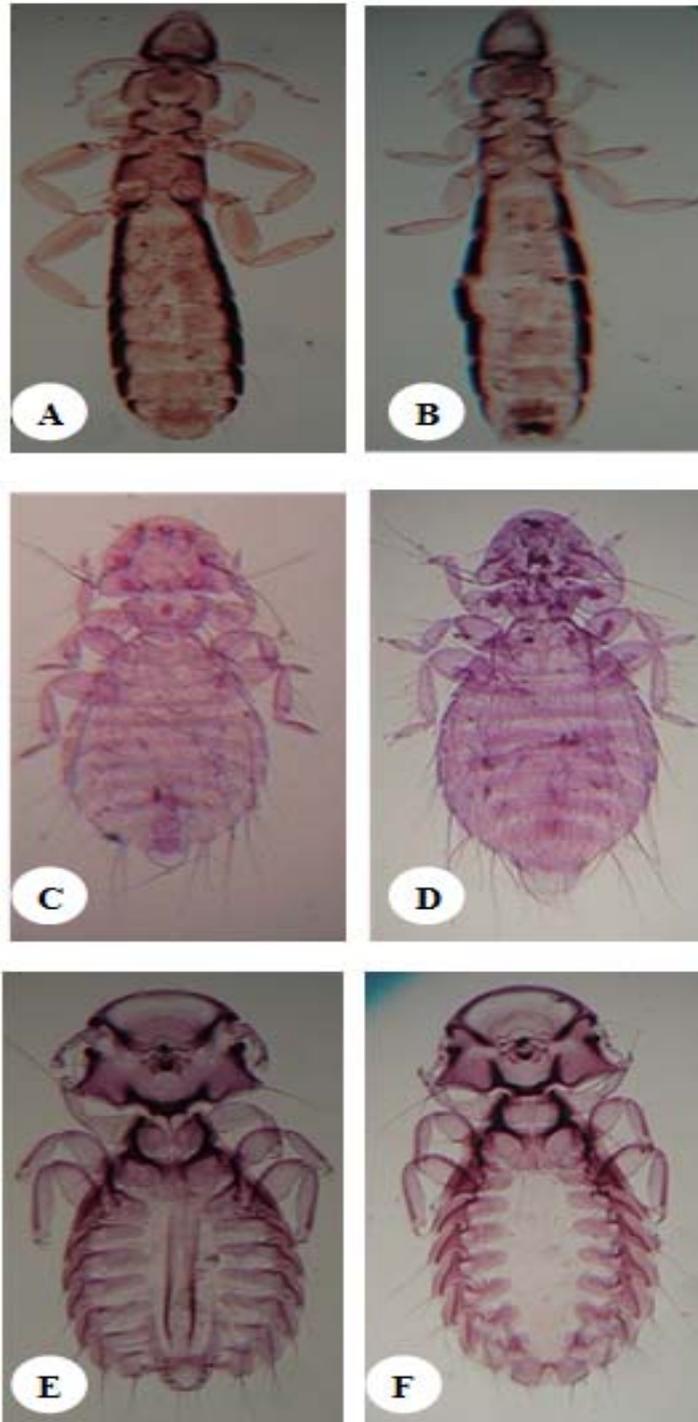


Figure 1. LM photograph of adult Eurasian Collared-Dove lice *Columbicola bacillus* (A-male, x43, B-female x40), *Coloceras* spp. (C-male x60, D-female x48) and *Hohorstiella rampurensis* (E-male x59 D-female x46).

fowls, 28.8 to 61.0% on pigeons, 13.0 to 42.0% on common myna, 14.0 to 31.0% on house sparrows, 17.0 to 34.0% on Indian parakeets, 40.0% on kingfishers, 3.0

to 36.2% on house crows, 20.8 to 36.2% on red avadavat, 58% on red whiskered bulbuls and 74% on common bayas (Singh et al., 1998; Saxena et al., 2004,

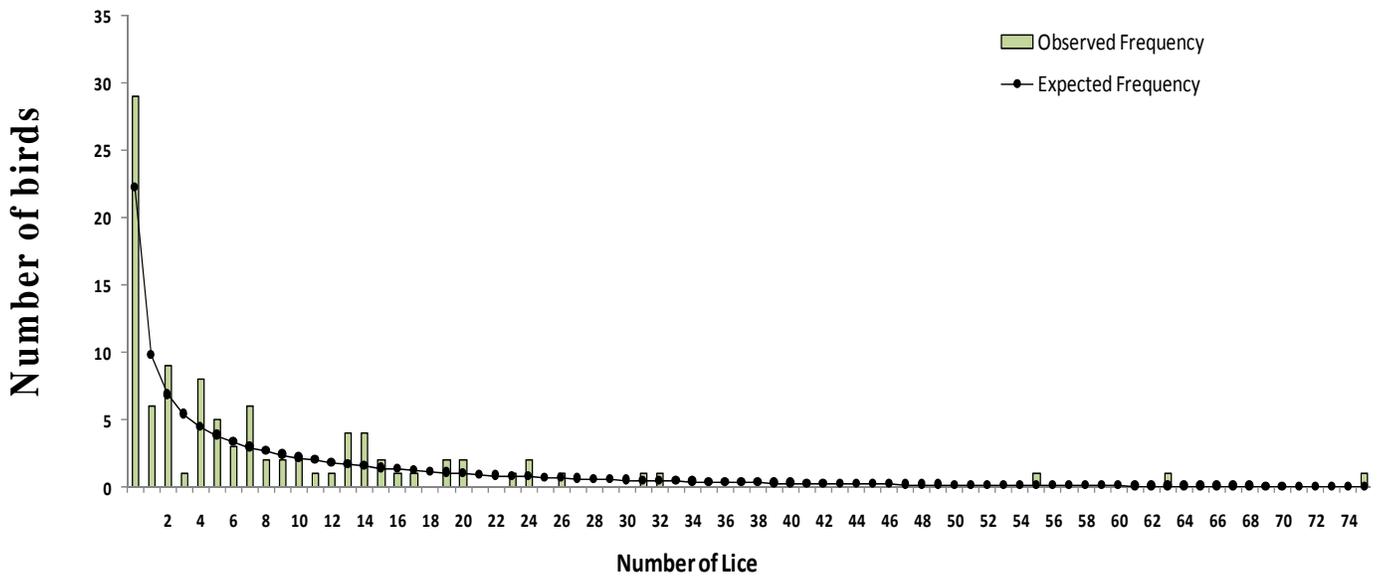


Figure 2. The frequency distribution pattern of *Columbicola bacillus* on 100 Eurasian Collared-Dove lice in district Rampur, from 2010-2011.

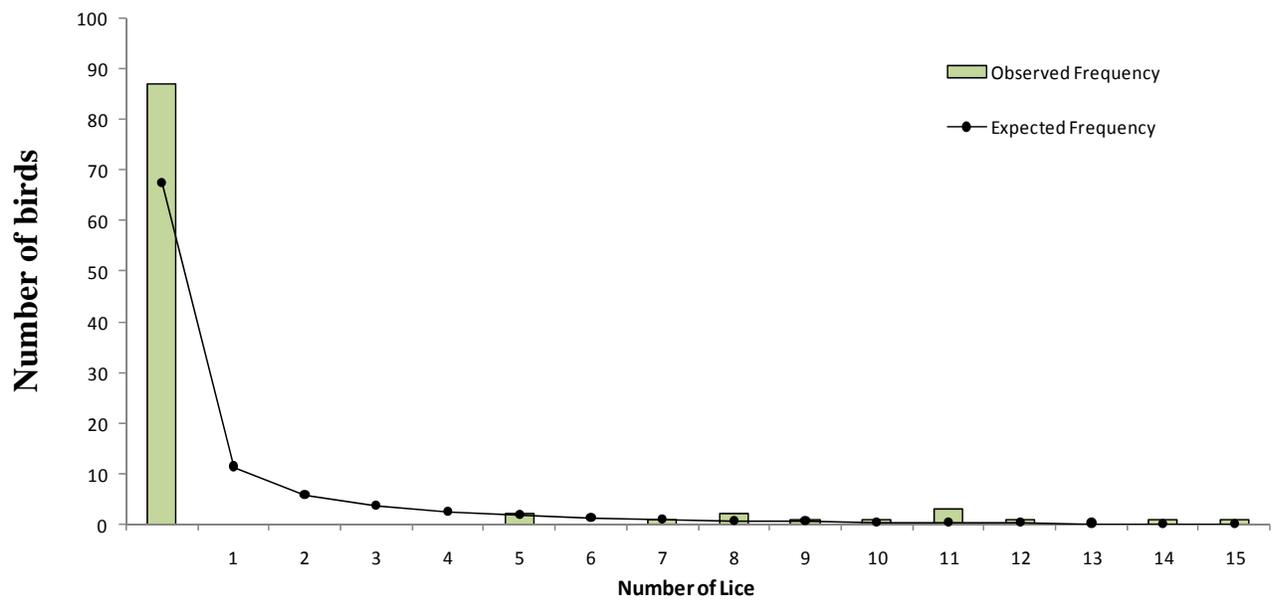


Figure 3. The frequency distribution pattern of *Coloceros* spp. on 100 Collared-Dove lice in district Rampur from 2010 to 2011.

2007; Gupta et al., 2007; Beg et al., 2008, Arya et al., 2010, 2011).

As far as intensity of infestation of phthiraptera on Indian birds is concerned, it has been reported to be 80.15 per bird on common myna (Chandra et al., 1990). It varied from 18.4 to 182.5 per host on domestic pigeons (Singh et al., 1998), from 37.4 to 40.21 per bird on domestic fowls (Kumar et al., 2004), from 59.3 to 103.0

per bird on house crows (Beg et al., 2008), from 1.5 to 3.4 per bird on red avadavats (Gupta et al., 2007), from 7.6 to 13.3 per bird on house sparrows, from 13.8 to 21.8 per host on parakeets and 17.7 per bird on kingfishers (Saxena et al., 2007), 30.6 to 48.3 per host on bank myna (Rajput et al., 2009), 15.6 on red whiskered bulbuls and 13.97 on common bayas (Arya et al., 2010, 2011). Thus, the sample mean abundance of three phthirapteran

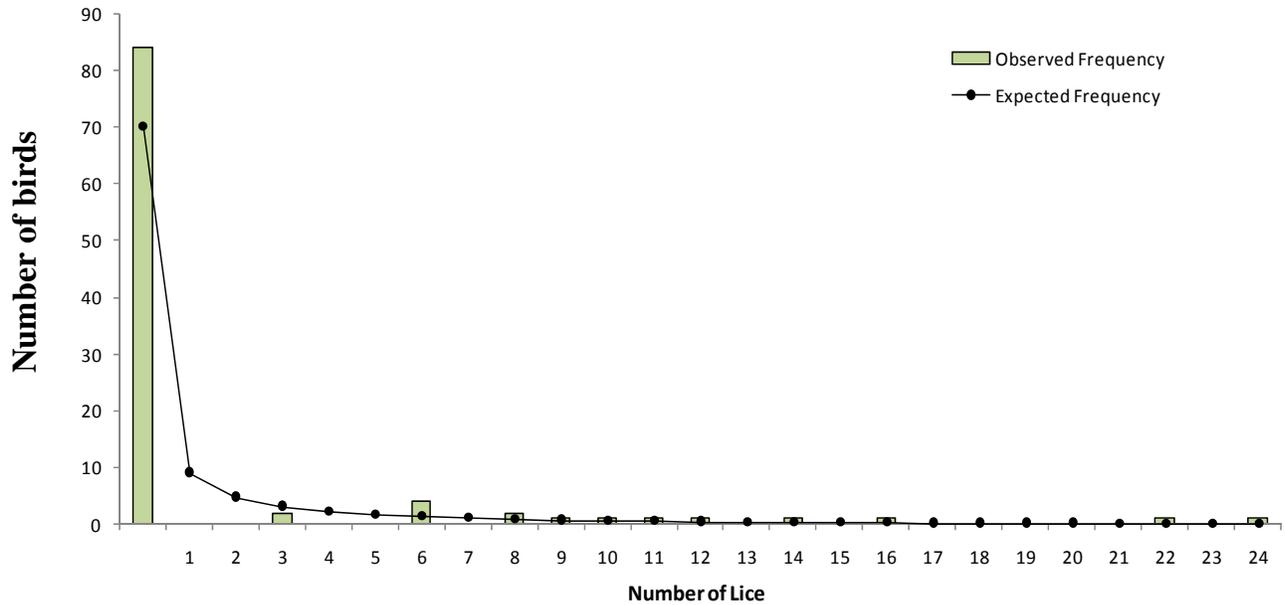


Figure 4. The frequency distribution pattern of *Hohorstiella rampurensis* on 100 Eurasian Collared-Doves in district Rampur from 2010-2011.

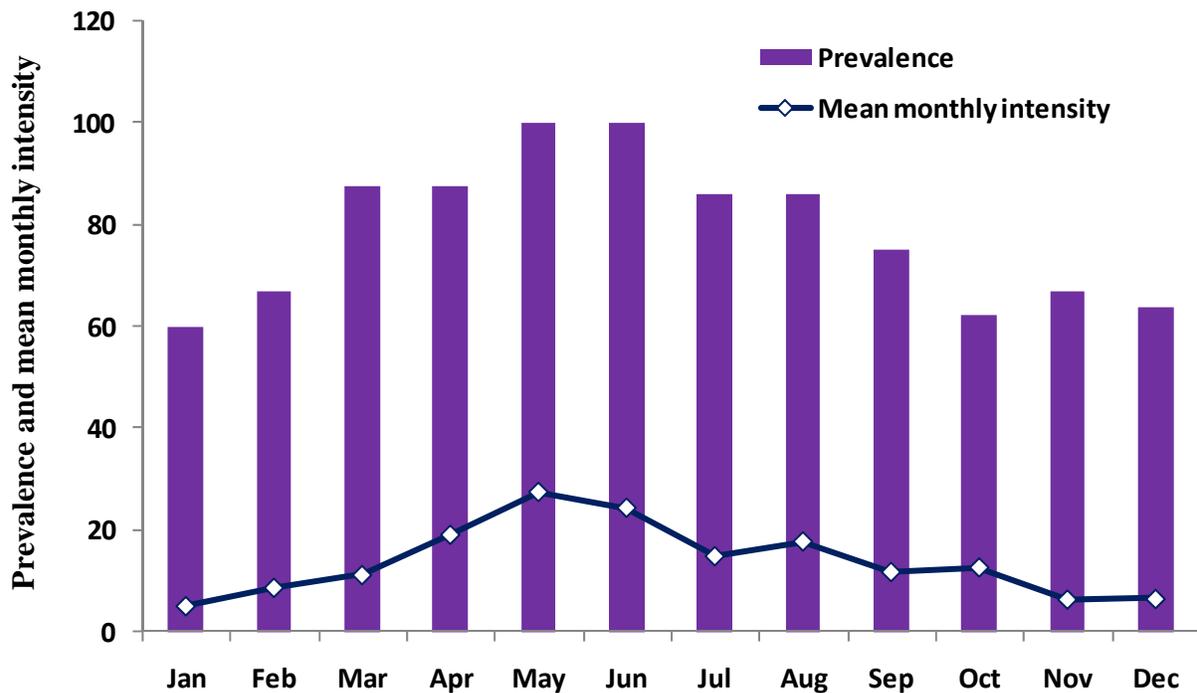


Figure 5. The prevalence and mean monthly intensity of phthirapteran species on 100 Eurasian Collared-Dove lice s in district Rampur from 2010 to 2011.

species was not high on Eurasian Collared-Doves that remained (8.15, 1.26 and 1.64/bird).

Avian lice generally exhibit clumped/aggregated distribution on the host birds (Rekasi et al., 1997). The

latter studied the distribution of 12 avian lice and also analyzed 15 distribution recorded by earlier workers and found that the distribution of 21 (out of 27) species occurring on 13 birds conformed to the negative binomial

model. However, Saxena et al. (2007), Gupta et al. (2007), Beg et al. (2008), Rajput et al. (2009) and Arya et al. (2010, 2011) found that the distribution of only 2 species (out of 23) occurring on nine avian hosts conformed with negative binomial model. In case of Eurasian Collared-Doves, the negative binomial model was found to be a good fit in case of *C. bacillus* but not in case of *Coloceras* spp. and *H. rampurensis*.

Sex ratio of the population of three phthirapteran species occurring on Eurasian Collared-Doves conformed to the general trend observed in most of the phthirapteran species. In phthirapterans, the females usually outnumber the males in natural population (Marshall, 1981). Reasons responsible for skewed sex ratios have been discussed elsewhere (Marshall, 1981; Gupta et al., 2007). The adult nymph ratio of any population provides some clues regarding the temporal stability of the population. The occurrence of few nymphs and more adults indicates declining population while the presence of more nymphs and few adults points out that the population is expanding (Marshall, 1981). In case of Eurasian Collared-Dove lice, *C. bacillus*, *Coloceras* spp. and *H. rampurensis*, the adult nymph ratio remained nearly similar. However, it may be noted that lice population on avian hosts fluctuates seasonally, so the population ratio of the aforementioned species is bound to vary with time.

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Conflict of interest

The authors declare that they have no conflict of interest to disclose.

REFERENCES

- Adams RJ, Price RD, Clayton DH (2005). Taxonomic revision of old world members of feather louse genus *Columbicola* (Phthiraptera: Ischnocera), including descriptions of eight new species. *J. Nat. Hist.* 39:3545-3618.
- Arya G, Bansal N, Khan V, Ahmad A, Saxena AK (2010). Population characteristics of Phthiraptera occurring on Red Whiskered Bulbul (*Pycnonotus jocosus*). *J. Appl. Nat. Sci.* 2(2):263-265.
- Arya G, Bansal N, Ahmad A, Gupta N, Saxena AK (2011). Population ecology of Phthirapteran ectoparasites infesting common Baya (*Ploceus philippinus*) (Phthiraptera: Insecta). *Turk. J. Vet. Anim. Sci.* 35(1):183-185.
- Bansal N, Singh P, Ahmad A, Arya G, Saxena AK (2010). A new species of *Hohorstiella* (Menoponidae: Amblycera: Phthiraptera) from Indian Ring Dove, *Streptopelia decaocto decaocto* (Columbiformes). *Entomon* 35:183-190.
- Beg S, Gupta N, Kumar S, Khan V, Bhatnagar S, Saxena AK (2008). Occurrence of Phthiraptera on the house crow, *Corvus splendens* (Passereiformes: Corvidae). *Entomon* 33:75-78.
- Chandra S, Agarwal GP, Singh SPN, Saxena AK (1990). Seasonal changes in a population of *Menacanthus eurysternus* (Mallophaga: Amblycera) on the common Myna, *Acridotheres tristis*. *Int. J. Parasitol.* 20:1063-1065.
- Clayton DH, Drown DM (2001). Critical evaluation of five methods for quantifying chewing lice (Insecta: Phthiraptera). *J. Parasitol.* 87:1291-1300.
- Gupta N, Kumar S, Saxena AK (2007). Prevalence and population structure of lice (Phthiraptera) on the Indian Red Avadavat. *Zool. Sci.* 24:381-383.
- Khan V, Kumar S, Gupta N, Ahmad A, Saxena AK (2008). Prevalence of phthirapteran ectoparasites on selected poultry in the district, Rampur (U.P.). *Indian Vet. J.* 85:447-448.
- Khan V, Kumar S, Gupta N, Ahmad A, Saxena AK (2009). Prevalence of lice in pigeons. *Indian Vet. J.* 86:531-532.
- Kumar S, Gupta N, Saxena AK (2004). Population composition of selected poultry lice (Phthiraptera). *Res. Rev. Parasitol.* 64:49-54.
- Marshall AG (1981). The ecology of ectoparasitic insects. Academic Press, London.
- Rajput S, Joshi VD, Gupta N, Khan V, Saxena AK (2009). Population dynamics of Phthiraptera on Indian Bank Myna, *Acridotheres ginginianus*. *Entomon* 34(2):99-102.
- Rozsa L, Reiczigel J, Majoros G (2000). Quantifying parasites in sample of hosts. *J. Parasitol.* 86:228-232.
- Rekasi J, Rozsa L, Kiss BJ (1997). Patterns in the distribution of avian lice (Phthiraptera: Amblycera, Ischnocera). *J. Avian Biol.* 28:150-156.
- Saxena AK, Kumar S, Gupta N, Singh SK (2004). Prevalence of phthirapteran ectoparasitic insects on domestic hens of Rampur. *J. Parasit. Dis.* 28(1): 57-60.
- Saxena AK, Kumar S, Gupta N, Mitra JD, Ali SA, Srivastava R (2007). Distribution pattern of phthirapterans infesting certain common Indian birds. *J. Parasitol.* 93(4):957-958.
- Singh SK, Surman S, Kumar A, Saxena AK (1998). Population composition of four phthirapteran ectoparasites infesting blue rock pigeon *Columba livia*. *J. Parasit. Dis.* 22(2):144-147.
- Singh P, Ahmad A, Arya G, Bansal N, Saxena AK (2012). Prevalence of *Hohorstiella rampurensis* on Indian Ring Dove (*Streptopelia decaocto*) (Columbiformes: Columbidae). *Indian Vet. J.* 89:118-119.
- Tendeiro J (1973). Estudos sobre os Goniódideos (Mallophaga: Ischnocera) dos Columbiformes, XIV- Genero Coloceras Taschenberg, 1882. Universidade De Lourenco Marques.
- Trivedi MC, Saxena AK (1991). Population dynamics of chicken body louse, *Menacanthus stramineus* (Phthiraptera: Amblycera). *J. Zool. Res.* 4(1&2):37-42.
- Trivedi MC, Saxena AK, Rawat BS (1992). Incidence of Mallophaga on poultry in Dehradun (India). *Angew Parasitol.* 33:69-78.