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ORIGINAL ARTICLE

Population levels of Phthiraptera on domestic ducks (*Anas platyrhynchos*) (Anseriformes: Anatidae)

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Abstract Three phthirapteran species (two Ischnocera and one Amblycera) were recovered from hundred ducks in district Bareilly and Rampur during 2011–2012. Prevalence of *Anaticola crassicornis* was comparatively higher (31 %) than that of *Anatoecus dentatus* (16 %) and *Holomenpon leucoxanthum* (28 %). However, the intensity of infestation of *H. leucoxanthum* (22.89) remained higher than the other two species. Distribution pattern of all lice were skewed but negative binomial model was not found to be a good fit. Sex ratios of all three species were skewed in favour of females (*A. crassicornis*—1:1.23, *H. leucoxanthum*—1:1.19, *A. dentatus*—1:1.72) and nymphal population exceeded the adult population (*A. crassicornis*—1:1.26, *H. leucoxanthum*—1:1.12, *A. dentatus*—1:1.61).

Keywords Phthiraptera · Lice · Ischnocera · Amblycera · Prevalence

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Introduction

Information regarding the population characteristics of phthirapteran ectoparasites of certain common Indian birds viz. common myna (Chandra et al. 1990), pigeons (Singh et al. 1998; Khan et al. 2009), red avadavats (Gupta et al. 2007), Indian parakeets, house sparrows, common myna and white breasted king fishers (Saxena et al. 2007), house crows (Beg et al. 2008), poultry (Khan et al. 2008), bank myna (Rajput et al. 2009), cattle egret, striated babblers, snipe, green pigeon (Ahmad et al. 2010, 2011, Ahmad Arya et al. 2012; Ahmad Saxena et al. 2012), common hoopae (Agarwal et al. 2011), common baya (Arya et al. 2011), and finches (Saxena et al. 2011) have been provided by workers during the past two decades. Marshall (1981) reviewed the work done on the population ecology of the ectoparasitic insect. The patterns of abundance of biting lice on the host birds have been discussed by Rekasi et al. (1997), Rozsa (1997) and Reiczigel et al. (2005).

A survey of literature revealed that population levels of Phthiraptera on common Indian ducks deserve investigation. The present report furnishes information on the prevalence, intensity of infestation, nature of frequency distribution pattern and population composition of two ischnoceran lice, *A. crassicornis* and *Anatoecus dentatus* and one amblyceran louse, *Holomenopon leucoxanthum* on common ducks.

Materials and methods

One hundred ducks were examined during 2011–2012, in district Bareilly (28.35°N; 79.42°E) and Rampur (28°49′12″N 79°1′11″E) Uttar Pradesh, India. After tying the legs, each bird was examined with the help of

Table 1 Population characteristics of phthirapteran ectoparasites on domestic ducks

S. no.	Population characteristics	*Anaticola crassicornis*	*Anatoecus dentatus*	*Holomenopon leucoxanthum*
1.	Sample size	31	16	28
2.	Prevalence	31.00 %	16 %	28 %
3.	Mean intensity	18.10	12.38	22.89
4.	Median intensity	12.00	6.50	15.50
5.	Sample mean abundance	5.61	1.98	6.41
6.	Variance/mean ratio	27.84	19.26	33.32
7.	Index of discrepancy	0.833	0.902	0.831
8.	K of negative binomial	0.09	0.05	0.08
9.	Male : Female	1:1.23	1:1.72	1:1.19
10.	Adult : Nymph	1:1.26	1:1.61	1:1.12
11.	Ist: IInd : IIIrd instars	1:0.52:0.61	1:0.62:0.97	1:0.80:0.96

magnifying lens equipped with light source. Uninfested birds were released and infested hosts were subjected to delousing by the modified Fair lsle method (Gupta et al. 2007). Life of the bird is safe by fumigation method, however, it does not yield complete louse load (Clayton and Drown 2001). The head and body feathers of deloused ducks were further examined to take out the remaining louse load. Entire louse load was transferred to 70 % alcohol and the lice were separated species -wise, sex -wise and stage-wise.

The data obtained as above were used for recording the prevalence, mean intensity, sample mean abundance, index of discrepancy and variance to mean ratio of the louse population. The exponent of the negative binomial distribution (k) and index of discrepancy (D) were computed with the help of software offered by Rozsa et al. (2000). The goodness of fit between the observed and the expected frequencies by negative binomial was tested by the χ^2 test.

Results

Two ischnoceran lice, *A. crassicornis* and *Anatoecus dentatus* and one amblyceran louse, *H. leucoxanthum* were recovered from 100 domestic ducks, *Anas platyrhynchos* examined for the presence of lice, during 2011–2012, from Bareilly and Rampur districts of Uttar Pradesh India. The prevalence of *A. crassicornis* was 31 %. As many as, 561 specimens (all stages) were collected from the infested birds (mean intensity, 18.10; median intensity, 12.0). The sample mean abundance was 5.61(range 1–60, $n = 100$). The variance to mean ratio (27.84) was significantly greater than unity, indicating over dispersion. The calculated value of binomial exponent (k) was 0.09. The observed frequencies did not conform to the expected frequencies for a negative binomial distribution ($\chi^2 = 87.5$; $P = 0.03$). The value of index of discrepency (D) was 0.833. The overall male, female ratio remained 1:1.23. The adult nymph ratio was 1:1.26, while the ratio of first, second and third instars of nymph remained 1:0.52:0.61 (Table 1; Fig. 1).

The prevalence of *Anatoecus dentatus* was 16 %. As many as, 198 specimens (all stages) were collected from the infested birds (mean intensity, 12.4; median intensity, 6.5). The sample mean abundance was 1.98 (range 2–36, $n = 100$). The variance to mean ratio (19.26) was significantly greater than unity, indicating over dispersion. The calculated value of binomial exponent ($k = 0.05$) gave expected frequencies for a negative binomial distribution which differed significantly from the observed frequencies ($\chi^2 = 105.12$; $P = 0.04$). The value of index of discrepency (D) was 0.902. The overall male, female ratio remained 1:1.72. The adult nymph ratio was 1:1.61, while the ratio of first, second and third nymphal instars remained 1:0.62:0.97 (Table 1; Fig. 2).

The prevalence of *Holomenopon leucoxanthum* was 28 %. As many as 641 specimens (all the stages) were collected from the infested birds (mean intensity, 22.9; median intensity, 15.5). The sample mean abundance was 6.41 (range 2–75, $n = 100$). The variance to mean ratio (33.32) was significantly greater than unity, indicating over dispersion. The calculated value of binomial exponent ($k = 0.08$) gave expected frequencies for a negative binomial distribution which differed significantly from the observed frequencies ($\chi^2 = 75.66$; $P = 0.03$). The value of index of discrepancy (D) was 0.831. The overall male, female ratio remained 1:1.19. The adult nymph ratio was 1:1.12, while the ratio of first, second and third instars of nymph were recorded as 1:0.80:0.96 (Table 1; Fig. 3).

Discussion

A review of literature reveals that prevalence of different species of Phthiraptera on Indian common birds exhibit

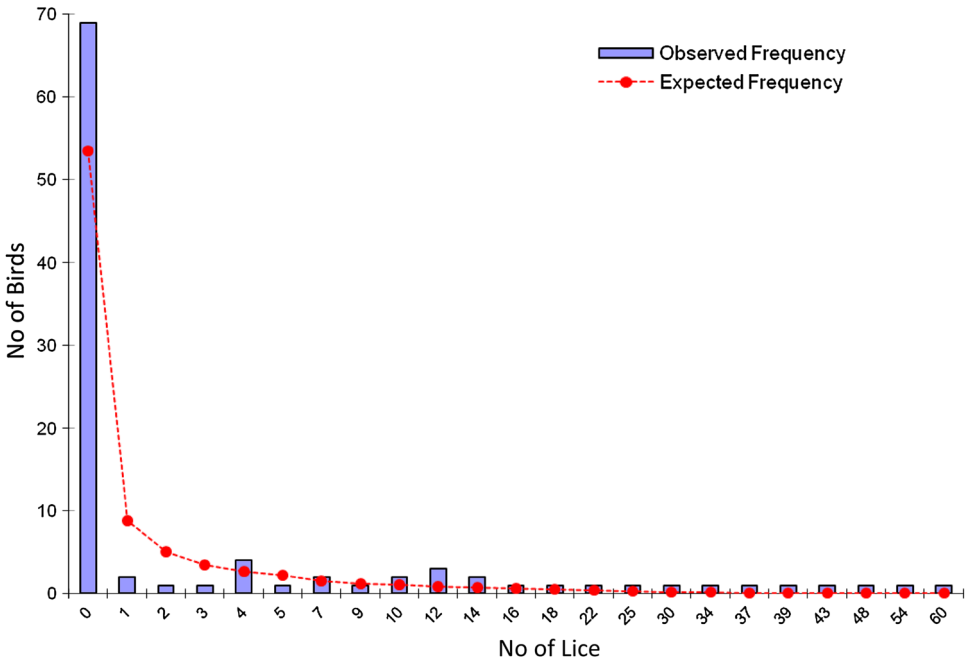

Fig. 1 Frequency distribution pattern of *A. crassicornis* on duck, joined closed circles indicate, the expected frequency for a negative binomial distribution

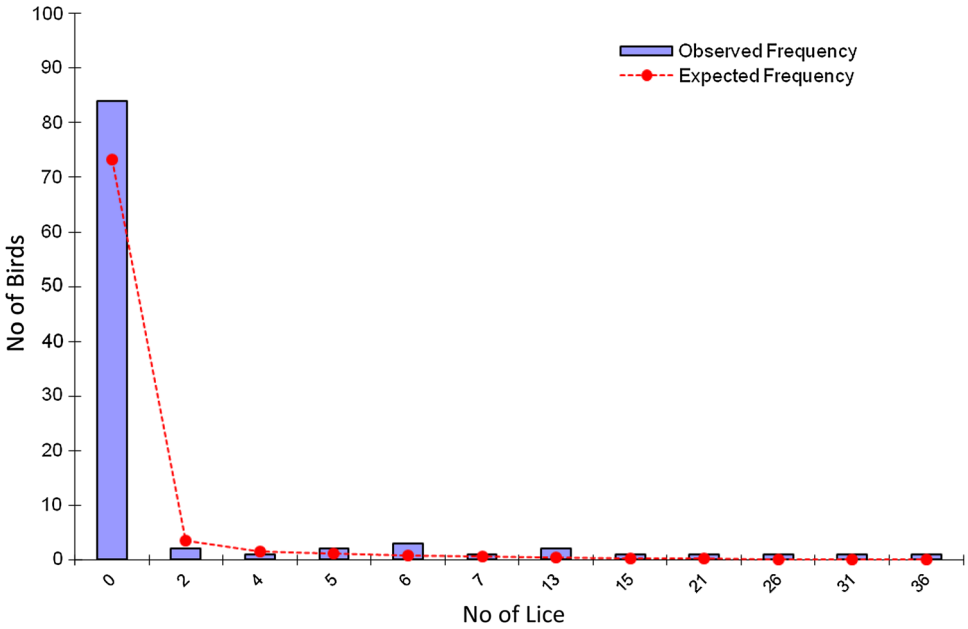

Fig. 2 Frequency distribution pattern of *Anatoecus dentatus* on duck; joined closed circles indicate, the expected frequency for a negative binomial distribution

considerable variations viz. 29–61 %, on blue rock pigeons, 13–68 % on common mynas, 14–31 % on house sparrows, 17–34 % on Indian parakeets, 40 % on white breasted kingfishers, 21–36 % on red avadavats, 11–52 % on house crows, 31–48 % on bank myna, 17–41 % on cattle egret, 74 % on common baya, 40 % on common hoopae, 20 % on finches, 40 % on babblers 50–75 % on green pigeons, 62 % on snipes (Chandra et al. 1990; Singh et al. 1998; Gupta et al. 2007; Saxena et al. 2007; Beg et al. 2008; Khan et al. 2009; Rajput et al. 2009; Ahmad et al. 2010, 2011; Agarwal et al. 2011, Arya et al. 2011; Saxena et al. 2011; Ahmad Arya et al. 2012a, b; Ahmad Saxena et al. 2012). Thus, the prevalence of Phthiraptera on ducks examined during the present investigation (16–31 %) was lower than the other birds examined so far.

Survey of literature further indicates that intensity of infestation of different species of Phthiraptera on other Indian birds is reported to be 80.2 per bird on common Myna (Chandra et al. 1990), 18.4–182.5 per bird on domestic pigeons (Singh et al. 1998), 1.5–3.4 per bird on red avadavats (Gupta et al. 2007), 7.6–13.3 per bird on house sparrows, 13.8–21.8 per host on parakeets, 17.7 per

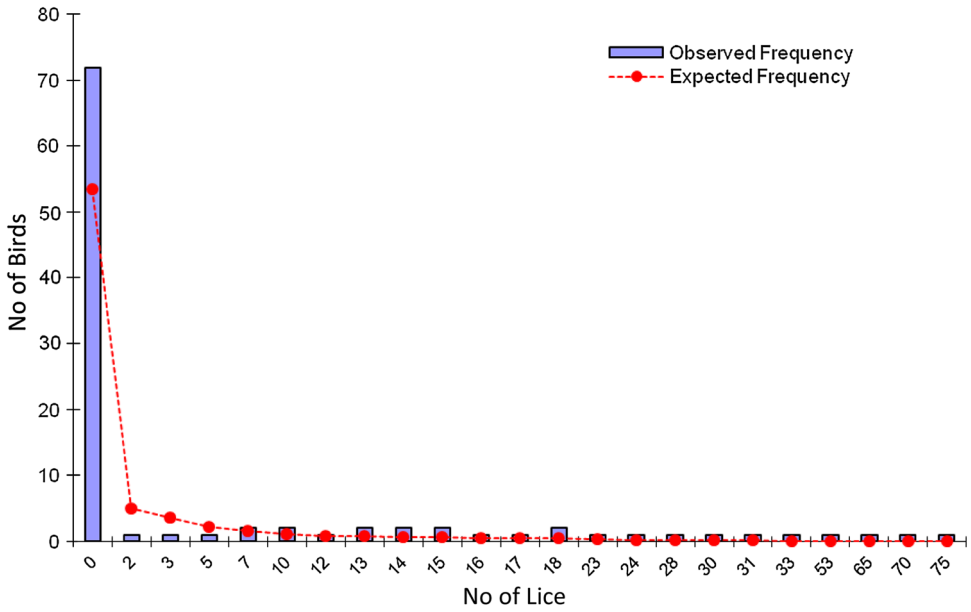

Fig. 3 Frequency distribution pattern of *Holomenopon leucoxanthum* on duck; joined closed circles indicate, the expected frequency for a negative binomial distribution

bird on kingfishers (Saxena et al. 2007), 11.0–27.0 per bird on house crows (Beg et al. 2008), 6.8–16.6 per host on bank myna (Rajput et al. 2009), 52.8–103.2 per host on cattle egret, 13.2–16.4 per host on green pigeon,13.4 per host on babblers, 220.2 per host on snipes (Ahmad et al. 2010, 2011; Ahmad Arya et al. 2012; Ahmad Saxena et al. 2012) and 13.97 per host on common baya (Arya et al. 2011). The mean number of lice on 100 domestic ducks (*A. platyrhynchos*) was 18.10 (*A. crassicorniss*), 12.38 (*A. dentatus*) and 22.89 (*H. leucoxanthum*). Maximum number of lice collected on any bird remained 60 for *A. crassicorniss,* 36 for *A. dentatus* and 75 for *H. leucoxanthum.*

Further survey of literature indicates that in case of avian lice nymphal population generally outnumbers the adults in natural population (Eveleigh and Threlfall 1976; Chandra et al. 1990; Trivedi et al. 1991 ; Kristofik et al. 1996; Saxena et al. 1996; Singh et al. 1998). Avian lice exhibit seasonal variations in population and the proportion of juveniles is bound to vary with time. Moreover, many more factors may influence the population structure of avian lice. During the present studies, the nymphal population dominated over adults in overall ratio in all the three lice.

In case of avian lice, females usually outnumber the males in natural population (Eveleigh and Threlfall 1976; Chandra et al. 1990; Trivedi and Saxena 1991; Kristofik et al. 1996; Singh et al. 1998). However, in case of mammalian lice, the ratio is more skewed and in certain species, males are rare in natural population (Marshall 1981). The present observations indicate that the male and female ratio remained skewed in favour of female for all the three lice species.

The negative binomial distribution is generally defined by two parameters, the arithmetic mean (X) and the binomials exponent (k) (Bliss and Fisher 1953). The value of binomial exponent (k) gives some indication regarding the de-establishing effect of parasites on the host population and is also related to reproductive rates of parasites and hosts (Fowler and Miller 1984).

Selected workers have tested the applicability of negative binomial in the pattern of frequency distribution of certain avian lice (Fowler et al. 1984; Fowler and Williams 1985; Fowler and Hodson 1988; Clark et al. 1994; Lee and Clayton, 1995; Rekasi et al. 1997; Ahmad et al. 2010, 2011; Agarwal et al. 2011; Saxena et al. 2011). In the present case, the distribution patterns of lice on duck were clearly skewed but somehow the frequency distribution pattern failed to conform the negative binomial distribution.

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