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Population level of phthirapteran ectoparasites infesting domestic pigeons, *Columba livia domestica* Gmelin, 1789

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ABSTRACT: Four species of phthirapterans, namely *Colpocephalum turbinatum* Denny, 1842; *Columbicola columbae* Linnaeus, 1758; *Campanulotes compar* Burmeister, 1838; and *Hohorstiella lata* Piaget, 1880, were identified from thirty domestic pigeons, *Columba livia domestica* Gmelin, 1789. The prevalence of *C. turbinatum* Denny, 1842 was notably higher (63.3%) compared to *C. columbae* Linnaeus, 1758 (50%), *C. compar* Burmeister, 1838 (46.7%) and *H. lata* Piaget, 1880 (23.3%). Furthermore, the intensity of infestation for *C. turbinatum* Denny, 1842 was recorded-144.89, which is greater than that of the other three species: *C. columbae* Linnaeus, 1758-108.33, *C. compar* Burmeister, 1838-117.79, and *H. lata* Piaget, 1880-24.71. The sex ratios for all four species exhibited a bias towards females, with *C. turbinatum* Denny, 1842-1:1.20, C. columbae Linnaeus, 1758-1:1.17, *C. compar* Burmeister, 1838-1:1.22, and *H. lata* Piaget, 1880-1:1.65. Additionally, the nymphal populations surpassed the adult populations, with *C. turbinatum* Denny, 1842-1:1.29, *C. columbae* Linnaeus, 1758-1:1.30, *C. compar* Burmeister, 1838 at-1:1.36, and *H. lata* Piaget, 1880-1:1.84.

Keywords: Domestic pigeons, Mean intensity, Median intensity, Phthiraptera, Prevalence, Range, Ratio.

INTRODUCTION

Reports concerning the population levels of Phthiraptera infesting various Indian birds, such as common mynas (Chandra *et al.*, 1990), bank mynas (Rajput *et al.*, 2009), house crows (Beg *et al.*, 2008), red avadavats (Gupta *et al.*, 2007), house sparrows, Indian parakeets, and white-breasted kingfishers (Saxena *et al.*, 2007), domestic fowls (Trivedi and Saxena 1992, Trivedi *et al.*, 1991; Saxena *et al.*, 1995, 1996, 1997, Kumat *et al.*, 2004; Singh *et al.*, 2009), Indian finches (Saxena *et al.*, 2011); red whiskered bulbuls (Arya *et al.*, 2010), common bayas (Arya *et al.*, 2011), common hoopae (Agarwal *et al.*, 2011), poultry birds (Khan *et al.*, 2008, 2009; Singh *et al.*, 1998; Kumar *et al.*, 2013; Ahmad *et al.*, 2015, 2023) have been published over the past two decades. The current report provides details on population levels, including prevalence, mean intensity, sample mean abundance ranges of infestation, sex ratios, adult nymph ratios, and the ratios of first, second, and third nymphs on domestic pigeons, *Columba livia domestica* Gmelin, 1789.

MATERIALS AND METHODS

A total of thirty domestic pigeons, *Columba livia domestica* Gmelin, 1789, were examined for ectoparasites in various villages of the Amritsar District, Punjab, during the year 2024 as part of the faunal survey conducted at the Rakh Sarai Amanat Khan Conservation Reserve, Punjab. This reserve area is located in Amritsar and is in close proximity to the international borders between India and Pakistan. The domestic pigeons were visually inspected using a magnifying lens with an integrated light source. After securing their legs, the un-infested hosts were released back into their original locations, while the infested hosts underwent delousing using the modified Fair Isle method (Gupta *et al.*,2007). The entire louse load collected was preserved in 70% alcohol and categorized by species, sex, and developmental stage. The data obtained were utilized to document the population characteristics, including prevalence, mean intensity, sample mean abundance, range of infestation, sex ratios, adult to nymph ratios, and the ratios of first, second, and third nymphs for all species.

RESULT AND DISCUSSION

Four species of phthirapterans were recorded *i.e.*, *Colpocephalum turbinatum* Denny, 1842; *Columbicola columbae* Linnaeus, 1758; *Campanulotes compar* Burmeister, 1838; and *Hohorstiella lata* Piaget, 1880, from a sample of thirty domestic pigeons, *Columba livia domestica* Gmelin, 1789. The prevalence of *C. turbinatum* Denny, 1842 was recorded at 63.3%. A total of 2753 specimens (across all life stages) were gathered from the infested birds, yielding a mean intensity of 144.89 and a median intensity of 140.0. The mean abundance of the sample was 91.77, with a range of 55-345 (n=30). The population of composition of the species was also observed at different level of infestation. The overall male to female ratio was 1:1.20. The adult to nymph ratio was 1:1.29, while the ratios for the first, second, and third instars of nymphs were 1:0.77:0.48 (Table 1; Fig. 1). The prevalence of *C.*

columbae Linnaeus, 1758 was 50.0%. A total of 1625 specimens (all stages) were collected from the infested birds, with a mean intensity of 108.33 and a median intensity of 128.0. The sample mean abundance was 54.17, ranging from 25 to 160 (n=30). The overall male to female ratio was 1:1.17. The adult to nymph ratio was 1:1.30, while the ratios for the first, second, and third instars of nymphs were 1:0.67:0.32 (Table 1; Fig. 1). The prevalence of *C. compar* Burmeister, 1838 was 46.7%. A total of 1741 specimens (all stages) were collected from the infested birds, with a mean intensity of 117.79 and a median intensity of 103.5. The sample mean abundance was 54.97, with a range of 45-339 (n=30). The overall male to female ratio was 1:1.22. The adult to nymph ratio was 1:1.36, while the ratios for the first, second, and third instars of nymphs were 1:0.77:0.56 (Table 1; Fig. 1). The prevalence of *H. lata* Piaget, 1880 was 33.3%. A total of 173 specimens (all stages) were collected from the infested birds, with a mean intensity of 24.71 and a median intensity of 25.0. The sample mean abundance was 5.77, with a range of 18-33 (n=30). The overall male to female ratio was 1:1.65. The adult to nymph ratio was 1:1.84, while the ratios for the first, second, and third instars of nymphs were 1:0.61:0.59 (Table 1; Fig. 1).

Out of a total of thirty domestic pigeons, *Columba livia domestica* Gmelin, 1789, 83.3% were found to be infested with four species of phthirapterans, with only five birds being free of lice Among the infested pigeons, five carried a single species, eight carried two species, and ten carried three species. In summary, the most prevalent infestation among the domestic pigeons, *C. livia domestica* Gmelin, 1789, was of three species. The population levels of the four phthirapteran species infesting the domestic pigeons, *C. livia domestica* Gmelin, 1789, are detailed in Table 1.

An examination of the literature indicated that the prevalence of *C. turbinatum* Denny, 1842 among domestic pigeons, *C. livia domestica* Gmelin, 1789, was greater (63.3%) than that of three other species, namely *C. columbae* Linnaeus, 1758 (50%), *C. compar* Burmeister, 1838 (46.7%), and *H. lata* Piaget, 1880 (23.3%). Reportedly, the prevalence of phthirapteran species among other Indian birds varies, ranging from 6.9-51.3% in domestic fowls, 28.8-61.0% in pigeons, 13.0-42.0% in common myna, 14.0-31.0% in house sparrows, 17.0-34.0% in Indian parakeets, 40.0% in kingfishers, 3.0-36.2% in house crows, 20.8-36.2% in red avadavat, 58% in red whiskered bulbuls, and 74% in common bayas, as well as 16-31% in domestic ducks and 33.3-60.0% in helmeted guinea fowl (Singh *et al.*, 1998; Saxena *et al.*, 2007; Gupta *et al.*, 2007; Beg *et al.*, 2008; Arya *et al.*, 2010, 2011; Ahmad *et al.*,2015, 2023). Therefore, the prevalence of phthirapteran ectoparasites found on domestic pigeons, *C. livia domestica* Gmelin, 1789, during the current study (23.3 to 63.3%) was moderate in comparison to other examined bird species.

Table 1: Population levels of four phthirapteran species on thirty domestic pigeons, *Columba livia domestica* Gmelin, 1789.

Population parameter	*Colpocephalum turbinatum* Denny, 1842	*Columbicola columbae* Linnaeus,1758	*Campanulotes compar* Burmeister, 1838	*Hohorstiella lata* Piaget,1880
Prevalence (%)	63.3	50.0	46.71	23.3
Mean intensity	144.89	108.33	117.79	24.71
Median intensity	140.0	128.0	103.5	25.0
Sample mean abundance	91.77	54.17	54.97	5.77
Range of infestation	55-345	25-160	45-339	18-33
Sample size	30	30	30	30
Male: Female	1:1.20	1:1.17	1:1.22	1:1.65
Adult: Nymph	1:1.29	1:1.30	1:1.36	1:1.84
I:II:III	1:0.77:0.48	1:0.67:0.32	1:0.77:0.56	1:0.61:0.59

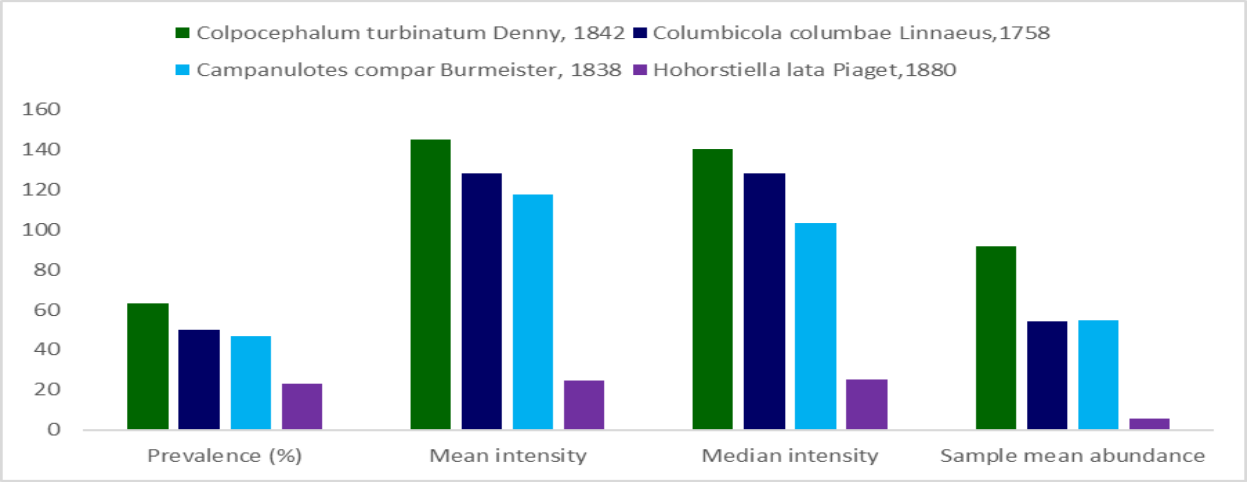

Fig.1. Showing population levels of Phthiraptera on domestic pigeons, *Columba livia domestica* Gmelin, 1789.

Regarding the intensity of Phthiraptera infestation on Indian birds, it has been documented to be 80.15 per bird on the common myna (Chandra *et al.*,1990). The infestation levels varied from 18.4 to 182.5 per host on 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 Indian parakeets, and 17.7 per bird on king fishers (Saxena *et al.,* 2007). Additionally, the infestation ranged from 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). The infestation levels were recorded as 12.38 to 22.89 per host on domestic ducks and 18.10-23.20-51.67 per host on helmeted guinea fowl (Ahmad *et al.*, 2015, 2023). In the current study, the intensity of infestation on thirty domestic pigeons, *Columba livia domestica* Gmelin, 1789, was found to be 144.89 for *Colpocephalum turbinatum* Denny, 1842, 108.33 for *Columbicola columbae* Linnaeus, 1758, 117.79 for *Campanulotes compar* Burmeister, 1838, and 24.7 for *Hohorstiella lata* Piaget, 1880).

A further review of the literature suggests that in the case of avian lice, the nymphal population typically exceeds that of the adults in natural populations (Eveleigh and Threlfall 1976; Chandra *et al*., 1990; Trivedi and Saxena 1991; Kristofik *et al*., 1996; Saxena *et al.,* 1996; Singh *et al*., 1998; Ahmad *et al*., 2015, 2023). Avian lice demonstrate seasonal fluctuations in their population, and the ratio of juveniles is likely to change over time. Furthermore, numerous additional factors may affect the population dynamics of avian lice.

In the current studies, the nymphal population was predominant over adults in the overall ratio across all four lice species. For avian lice, females typically outnumber males in the natural population (Eveleigh and Threlfall 1976; Chandra *et al*., 1990; Trivedi and Saxena 1991; Kristofik *et al.*,1996; Singh *et al.*, 1998). Conversely, in mammalian lice, the ratio is more imbalanced, with males being scarce in the natural population for certain species (Marshall, 1981). The current findings suggest that the male-to-female ratio remained skewed in favor of females for all four species: *C. turbinatum* Denny, 1842; *C. columbae* Linnaeus, 1758; *C. compar* Burmeister, 1838; and *H. lata* Piaget, 1880, found on domestic pigeons, *C. livia domestica* Gmelin, 1789.

CONCLUSIONS

The occurrence of *Colpocephalum turbinatum* Denny, 1842 was notably higher (63.3%) compared to *Columbicola columbae* Linnaeus, 1758 (50%), *Campanulotes compar* Burmeister, 1838 (46.7%), and Hohorstiella lata Piaget, 1880 (23.3%). Nevertheless, the infestation intensity of *C. turbinatum* Denny, 1842, which was-144.89, surpassed that of the other three species: *C. columbae* Linnaeus, 1758-108.33, *C. compar* Burmeister, 1838-117.79, and *H. lata* Piaget, 1880-24.71. The sex ratios for all four species were biased towards females, with *C. turbinatum* Denny, 1842-1:1.20, *C. columbae* Linnaeus, 1758-1:1.17, *C. compar* Burmeister, 1838-1:1.22, and *H. lata* Piaget, 1880-1:1.65. Additionally, the nymphal population was greater than the adult population, with *C. turbinatum* Denny, 1842-1:1.29, *C. columbae* Linnaeus, 1758-1:1.30, *C. compar* Burmeister, 1838-1:1.36, and *H. lata* Piaget, 1880-1:1.84.

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