

Population levels of phthirapteran ectoparasites on the goats in Rampur (U.P.)

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Abstract Out of the four phthirapteran species known to occur, only two were recovered from the goats in district Rampur (ischnoceran louse, *Bovicola caprae* and the anopluran, *Linognathus africanus*). As many as, 26.5% (n = 250) of the goats examined were found infested with Phthiraptera. The prevalence on two sexes of goats remained similar ($X^2 = 0.013$, $P < 0.05$). However, lice were more prevalent on younger goats than adults and older ones ($X^2 = 9.78$, $P < 0.05$). The correlation between the prevalence and mean monthly temperature of Phthiraptera was found significant. On the other hand correlation between prevalence and humidity was found insignificant. As many as, 74.5% of the infested goats carried both the species while 25.4% exhibited single species infestation. The ischnoceran louse, *B. caprae* was comparatively more prevalent (18.4%) than the anopluran *L. africanus* (11.2%). The mean intensity (mean number of lice counted per square inch, at 20 anatomical sites) of *B. caprae* was comparatively higher than that of *L. africanus*. As far as, the population composition is concerned the females outnumbered the males in natural population. On the other hands, nymphs dominated over adults in natural population.

Keywords Phthiraptera · Lice · *Linognathus africanus* · *Bovicola caprae* · Anopluran

Introduction

Information on the ectoparasitic insects infesting goats has been furnished by selected workers during last few years (Kaufman et al. 2006; Tally 2007; Gabaj et al. 2008; Okawa and Alangangan 2008). Workers like Yakchali and Hosseine (2006), Idris and Umar (2007) have noted the prevalence of goat lice. Information on the prevalence of two phthirapteran species on Indian goats in Dehradun region, has been given by Kumar et al. (1994a, b). Kumar et al. (1997) have also indicated the population composition of two species. Some idea about the distribution pattern of Phthiraptera on the goats can be derived from the contributions of James and Moon (1999). The nature of skin injuries caused by these ectoparasities have been indicated by Rodostits et al. (1994), Bayou (1998), Chalachew (2001), Haffize (2001) and Yacob et al. (2008). The mode of transmission of goat ectoparasite has been studied by Hallen (1985). Economic effect of parasitism of phthirapteran ectoparasite infesting goats has been discussed by Fouric et al. (1995) and Yacob et al. (2008).

Materials and methods

During present studies the hosts were examined by the hair parting method given by Lewis et al. (1967), at 20 anatomical sites (measuring 1 square inch, by placing the thick wire molded in square shape) normally inhabited by the lice. Each site was thoroughly checked for the presence of lice. Lice from positive hosts were placed in glass tubes containing 70% ethyl alcohol, using a separate vial for each host. Each tube contained information regarding host, sex, age or stage, condition and locality. Later, identification and sexing provided the remaining data for the discussion

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of lice population. Sampled specimens were treated with 10% KOH for 24 h. Washed in water and transferred to 10% acetic acid for 1 h. Specimens were then subjected to dehydration (ethanol series), clearing (clove oil) and mounting (Canada Balsam) for microscopy.

Results

Out of the five phthirapteran species reported to occur on goats (*Capra hircus*), only two species, one ischnoceran, *Bovicola caprae* (Gurtl), and one anopluran *Linognathus africanus* (Kellogg and Paine) were recovered from goats in district Rampur, in 2007. The presence of *Bovicola crassipes* (Rudow), *Bovicola limbatus* (Gervais) and *Linognathus stenopsis* (Burmeister) could not be recorded. Prevalence of Phthiraptera on goats was 23.6% (n = 250) in district Rampur, during 2007. Out of 250 goats, 80 were males and 170 females. Prevalence of phthirapterans on males and females remained 23 and 23.5%, respectively ($X^2 = 0.0013, P < 0.05$, insignificant). Thus, prevalence of lice on two sexes remained nearly similar. Furthermore, out of the 250 goats examined, 30 were young, 120 adults and remaining 100 older ones. The prevalence of goat lice on three groups remained 43.3, 25 and 16.0% respectively. Statistical analysis showed that difference in prevalence rate in three groups was significant ($X^2 = 9.78, P < 0.05$). Furthermore, the data shows that maximum percentage of infested goats carried single species infestation (74.5%) while double species infestation occurred upon 25.4% goat.

Bovicola caprae

Prevalence of *B. caprae* on goats was 18.4%, (n = 250). As many as, 1867 specimens (all the stages) were collected from the infested goats (mean intensity, 2.02 per square inch). The sample mean abundance was 0.37 per square inch.

For studying the population composition, entire data was divided into four categories. Maximum number of goats (20) were infested with 1–30 (based on 20 sites) lice (mean number, 18.25; 3.5M, 5.6F, 9.1N; M:F = 1:1.5; A:N = 1:1) (Fig. 1). Seventeen goats carried 31–60 lice (mean number, 45.1; 6.2M, 10.0F, 28.82N; M:F = 1:1.6, A:N = 1:1.7). Six goats had 61–90 lice (mean number, 73.0; 10.0M, 15.0F, 48.0N; M:F = 1:1.5, A:N = 1:1.9). Only three goats were infested with more than 90 lice (mean number, 99.0; 12.3M, 18.3F, 68.3N; M:F = 1:1.4; A:N = 1:2) (Fig. 1). In over all population composition mean number remained 40.6 (5.9M, 9.3F, 25.3N; M:F = 1:1.5, A:N = 1:1.6). The ratio of three nymphal instars was found to be 1:1.8:2.

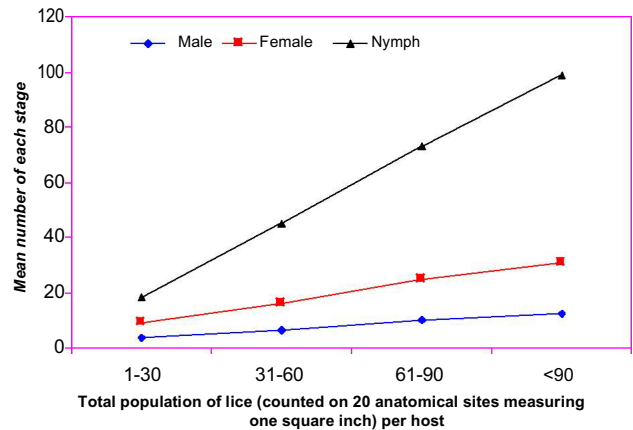


Fig. 1 Population composition of *Bovicola caprae* on goats

The neck carried 26.9% of total population, narrowly followed by back (22.17%). These two areas carried nearly 50% of total lice population. Nape was the next preferred site (12.7%), followed by abdomen (10.5%) and head (9.1%). The hind and forelegs were scarcely infested (8.2 and 7.4% respectively) while tail carried minimum infestation (2.9%).

Linognathus africanus

The prevalence of *L. africanus* on goats was 11.2% as, 28 goats (out of 250) carried this louse. As many as, 1256 specimens (all the stages) were collected from the infested goats (mean intensity, 2.24 per square inch). Sample mean abundance was 0.25 per square inch.

Maximum number of goats (11) carried 12–32 lice (mean number 22.5; 3.1M, 5.9F, 13.5N; M:F = 1:1.9; A:N = 1:1.5) (Fig. 2). Eight goats were infested with 33–52 lice (based on 20 sites) (mean number, 41.3; 5.8M,

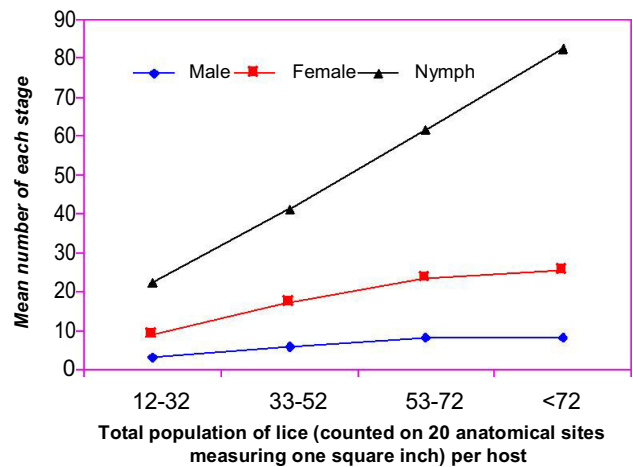


Fig. 2 Population composition of *Linognathus africanus* on goat

11.5F, 24.0N; M:F = 1:1.9; A:N = 1:1.3) and four goats in 53–72 lice category (mean number, 61.7; 8.2M, 15.2F, 38.2N; M:F = 1:1.8; A:N = 1:1.6). Five goat carried more than 72 lice (mean number, 86.0; 8.4M, 17.3F, 46.8N; M:F = 1:2.4; A:N = 1:1.9) (Fig. 2). In overall population structure the mean number remained 44.8 (5.6M, 11.2F, 27.7N). In overall ratio the female outnumbered the male (1:2), nymphs dominated over adults (1:1.6) while the ratio of three nymphal instars was 1:1.8:2.

The distribution of *L. africanus* on the infested goats resembles to considerable extent to that of *B. caprae*. Back was the most heavily infested site (harboring 24.8% of the population), followed by abdomen (23%). These two areas carried approximately 50% of total *L. africanus* population. Nape, head and neck were the next preferred sites (16.9, 11.1 and 9.7% respectively). However, in case of *L. africanus* tail was minimally infested site (4.0%) as it harbored lesser number of lice than hind and forelegs (5.1% and 5.3% respectively). Field observations further reveal that in case of heavy infestation, *L. africanus* could occur on any part of the body but the neck (also the back and nape) remain most lousy areas during most period of year.

Seasonal variation

The prevalence of goat lice remained 27 and 28% during January and February (Fig. 3). It remained low from March to May (20.8, 18.7 and 18.8%, respectively), rose in June (28%), became low in July and August (15.3 and 13.0%, respectively), increased in September and October (25% each) and reached maximum level in November (35.2%). Prevalence rate exhibited slight decline in December (31.5%).

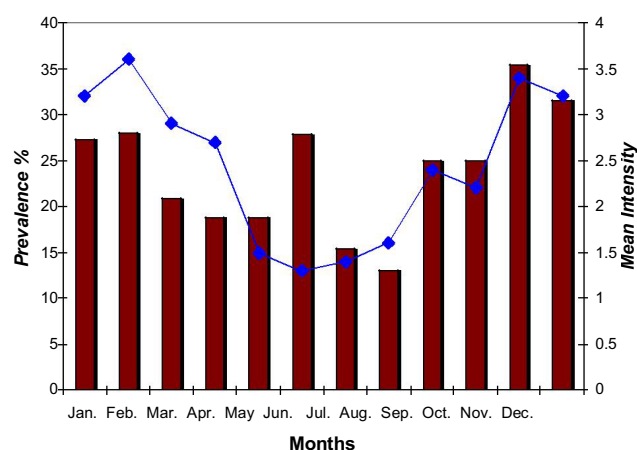


Fig. 3 Showing the prevalence and intensity of infestation (based on mean of numbers counted on 20 sites per host) of phthirapterans on 250 goat during different months of the year 2007, in the district Rampur (U.P.)

As far as, intensity of infestation is concerned, it remained 3.2 per square inch (mean number of lice noted on 20 anatomical sites measuring per square inch) during January. It showed slightly reduction during two subsequent months (February- 3.6, March- 2.9), exhibited steep decline in April (2.7) (Fig. 3) and remained low during four subsequent months (May- 1.5, June- 1.3, July- 1.4 and August- 1.6). It rose in September (2.4), remained at nearly similar level in October (2.2) and reached maximum level in November (3.4). Slightly decrease in lice index was observed in December (3.2). The data indicates that the significant (negative) correlation ($r = -0.719$) existed between mean monthly prevalence and mean monthly temperature at 5% level. Correlation between prevalence of goat lice and mean monthly relative humidity ($r = 0.51$) was not significant. Likewise, correlation between mean monthly intensity and temperature ($r = -0.51$) and mean monthly intensity and relative humidity ($r = -0.54$) were also found insignificant at 5% level.

Discussion

As many as five phthirapteran species (two anoplurans, *L. africanus*, *L. stenopsis*, and three ischnoceran *B. caprae*, *B. limbatus* and *B. crassipes*) reportedly infested the goats (Price and Graham 1997). There is only one report on the prevalence of lice on Indian goats (Kumar et al. 1994a). The latter recorded only two species *B. caprae* and *L. africanus* (79.5 and 38%, $n = 1048$) from goats in Dehradun region. During present studies the same species were recovered (*B. caprae* and *L. africanus*) but their prevalence was too low (18.4 and 11.2%, $n = 250$) on the goats, in district Rampur. Elsewhere, Idris and Umar (2007) reported the prevalence of *Linognathus* sp. as 3.0% and *Bovicola* sp. as 0.17% on Nigerian goats. On the other hand prevalence of lice on Iranian goats appeared to be high (*Linognathus* sp. 62.2% and *Bovicola* sp. 71.4%, $n = 1200$). However lice were significantly more prevalent on the younger goats than adults and older ones. Present studies further indicate that females dominated the natural population of goat lice and nymphal population outnumbered the adults. Kumar et al. (1994a) also noted more or less similar trend of population structure of the goat lice. *B. caprae* preferred the neck, back, nape and abdomen region while *L. africanus* was more found concentrated on the back, abdomen, neck and nape region. The distribution of two lice on the body of goats noted during present studies corresponds to the account given by Kumar et al. (1994b). Furthermore, the prevalence and intensity of infestation of Phthiraptera on goats remained comparatively low during summer months.

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