

Prevalence of ectoparasites on goats in Dehradun (India)

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Summary

The prevalence of two phthirapteran species, *Bovicola caprae* and *Linognathus africanus*, on 1048 goats from Dehradun (India) was 79.2% and 38% respectively. Prevalence of both species was higher on visibly weaker and less hairy goats. Sex related differences in prevalence were not found. The prevalence of *L. africanus* was slightly higher on young goats but the same was not true in case of *B. caprae*. The incidence of *B. caprae* showed moderately negative correlation with environmental temperature and photoperiod. The relative intensity of *B. caprae* has been found higher during winter months, followed by summers. Study primarily deals with lice but the information about prevalence of other ectoparasites like ticks, fleas and keds, has also been supplemented.

Introduction

The prevalence and intensity of phthirapteran infestation on the goats has rarely been investigated. Recently, LOZOYA et al. (1986) have noted the prevalence of Phthiraptera on goats in Mexico. In India, some workers like ANSARI (1951), MISHRA et al. (1974), RAO et al. (1977) and LAKSHMINARAYANA (1979) have provided information about different species occurring on goats (while performing surveys for taxonomic work). The present report deals mainly with the prevalence of lice on goats but certain other ectoparasites (ticks, fleas and keds) have also been taken into consideration.

Materials and methods

Fourteen localities in Dehradun (India) were surveyed during March, 1990 to February, 1992, to ascertain the incidence and intensity of Phthiraptera on the goats. The prevalence was recorded by hair parting method given by LEWIS et al. (1967) for cattle lice. Use of hand lens and light source proved fruitful. The intensity of infestation was recorded by placing the infested host in one of the five categories - VL (very light infestation), L (light infestation), M (moderate infestation), H (heavy infestation) and VH (very heavy infestation) by general experience.

Most of the goats examined were of Himalayan, Jamnapari, Barbari or Angora bred. Only two phthirapteran species (*Bovicola caprae* and *Linognathus africanus*)

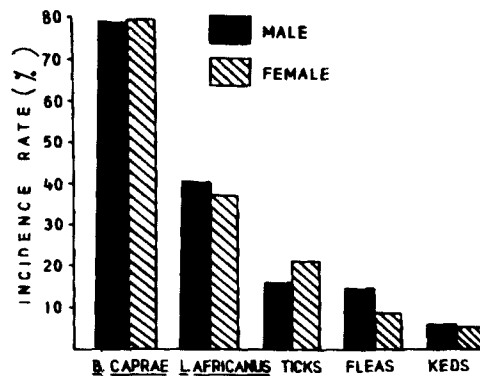


Figure 1. Prevalence of lice, ticks, fleas and keds on goats in relation to host sex (in Dehradun, during March 1990 to February 1992).

were recorded. Out of 1048 goats, 79.2% were infested with *B. caprae* and 37.98% with *L. africanus*. As many as 19.84 goats carried one or other variety of ticks (*Boophilus microplus*, *Haemaphysalis montgomeryi*, *Hyalomma brevipunctata*, *Rhipicephalus haemaphysaloides* and *Haemaphysalis bispinosa*). The incidence of individual species of ticks could not be recorded. Furthermore, 10.2% goats were found infested with flea (*Ctenocephalides* sp.) and 5.82% had ked (*Melophagus ovinus*) infestation (Figure 1).

Maximum numbers of goats (49.6%) carried monoinfestation (B – 40.5; L – 5.15; T – 1.4; F – 1.5 and K – 0.1%). Double infestation was also quite common (26.2%) (BL – 16.5; BT – 3.9; BF – 2.7; LT – 2.5; BK – 0.9; LF – 0.2; LK – 0.2; TK – 0.2 and TF – 0.1%). Certain goats (12.5%) also carried three ectoparasitic arthropods (BLT – 7.5; BLF – 1.8; BFK – 0.9; BLK – 0.9; BTF – 0.6; BTK – 0.4; LTF – 0.4; LTK – 0.1 and TFK – 0.1%). Simultaneous infestation by four arthropods was also encountered on few (1.9%) goats (BLTK – 0.9; BLTF – 0.8; BLFK – 0.2; BTFK – 0.1 and LTFK – 0.1%). The presence of all the five arthropods was noted on nine goats only (BLTFK – 0.85%) (B – *B. caprae*, L – *L. africanus*, T – Ticks, F – fleas and K – keds; Most of the figures rounded off to nearest ten).

Out of 293 male goats, 79% carried *B. caprae*, 40% *L. africanus*, 16% ticks, 15% fleas and 6% keds (Figure 1). Likewise, of the 755 females 79% had *B. caprae*, 37% *L. africanus*, 21% ticks, 8% fleas and 6% keds (figures rounded off). Thus, the prevalence of both the lice and keds on two sexes of host was more or less similar. On the other hand, the slight difference in the incidence rate of ticks and fleas may be circumstantial.

Various goats examined during present work were put in seven categories with respect to their age. The categorisation was done arbitrarily, just for comparison purpose. Furthermore, age record is based on the informations given by owners. Anyway, out of 1048 goats, 297 were young kids (up to six months), 133 of half to one year age group, 309 belonged to 1–2 year age group and 184 related to 2–3 years group. The number of goats belonging to 3–4 years, 4–5 years and above 5 years age group was 80, 36 and 9 respectively.

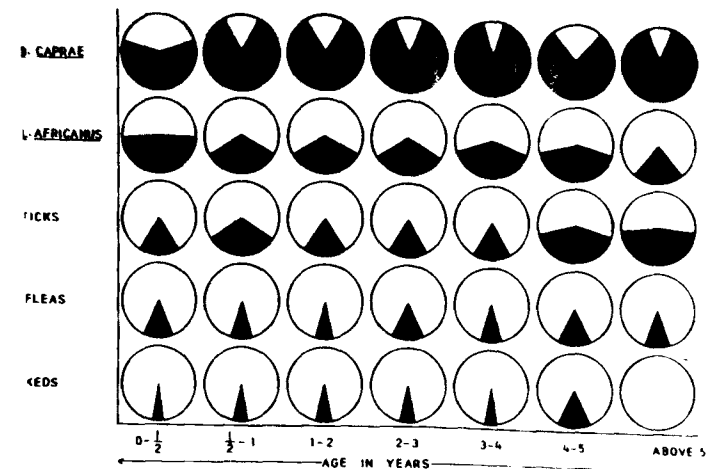


Figure 2. Prevalence of lice, fleas and keds on goats in relation to host age (in Dehradun, during March 1990 to February 1992).

Figure 2 indicates that the prevalence of *B. caprae* was more or less similar in different age groups (78% to 91%) but comparatively lesser (64%) on the goats, below six months of age (kids). On the other hand, the prevalence of *L. africanus* was maximum (48%) on young kids (below six months). It varied from 32 to 42% in rest all categories, except the last one (above 5 yrs. age group) where it was recorded as 22%. Age related differences in prevalence of ticks were comparatively more marked. Maximum incidence rate was recorded on goats belonging to 4–5 and above 5 years age group (42% and 44%), followed by 1/2–1 year group (30%) in contrast to rest other groups (range 16–18%). The data relating to flea infestation on various age group seems to be inconclusive (6–14% in different groups). On the other hand, prevalence of keds remained quite consistent (4–7%) on all the age group, except the 4 to 5 years age group, where it was nearly double (14%). But, the prevalence on the above 5 years group remained nil.

An attempt has also been made to have an idea about impact of hosts coat colour on the prevalence of arthropods, taken into consideration. As many as 355 goats bore black coloured haircoat, 223 brown coloured, 326 white coloured (often spotted) while the rest 144 (including mixed variety) were put into miscellaneous category. Figure 3 indicates that *B. caprae* and fleas were more common on brown coloured goats. On the other hand *L. vituli*, ticks and ked were more abundant on black haired goats (excluding miscellaneous category in case of *L. vituli*). The overall picture indicates that differences are not so marked and may be circumstantial.

Out of 1048 goats examined, 41 appeared to be less hairy (apparently), 127 comparatively more hairy than the rest (880) normal ones. Figure 4 indicates that less hairy goats bore maximum infestation than the other categories in case of all the ectoparasites. Although the differences were minimal in case of both lice and keds, better marked in case of fleas and quite prominent in case of ticks.

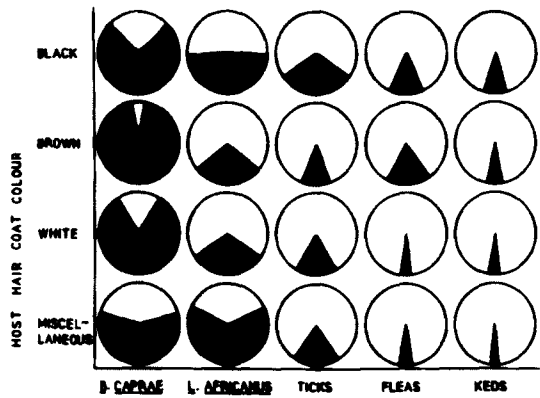


Figure 3. Prevalence of lice, ticks, fleas and keds on goats in having black, brown, white or other coloured hair coat (in Dehradun, during March 1990 to February 1992).

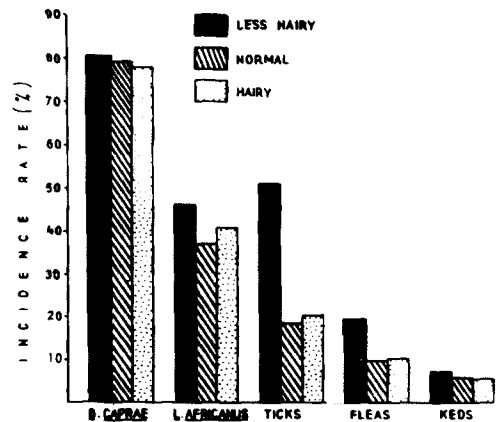


Figure 4. Prevalence of lice, ticks, fleas and keds on less hairy, normal and hairy goats of Dehradun (during March 1990 to February 1992).

Health related differences in the prevalence of ectoparasites have also been recorded. On the basis of general appearance, 72 goats could be put in weak host category, 738 regarded as normal ones while the rest 238 were visibly healthier. Figure 5 indicates that prevalence of both lice, ticks and also of fleas was clearly higher on less healthy goats than the other two categories (where the conditions were almost identical). Such a difference was not evident in case of keds.

An attempt has also been made to analyze the correlation between mean monthly incidence of *B. caprae* and four ecofactors (mean monthly temperature, humidity, rainfall and photoperiod). Moderate negative correlation existed between environmental temperature ($r_{12} = -0.73$ and -0.57) and photoperiod ($r_{15} = -0.53$ and -0.59)

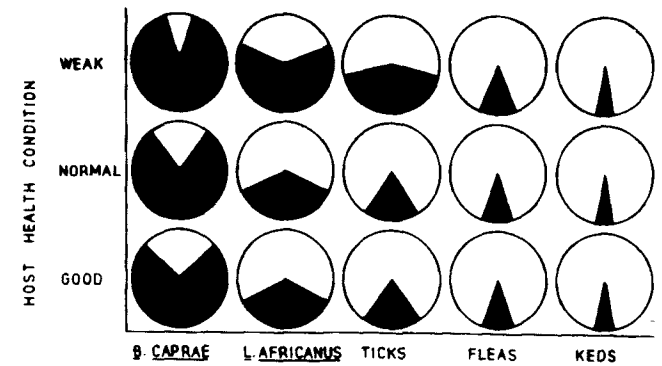


Figure 5. Prevalence of lice, ticks, fleas and keds on goats in relation to host health (in Dehradun, during March 1990 to February 1992).

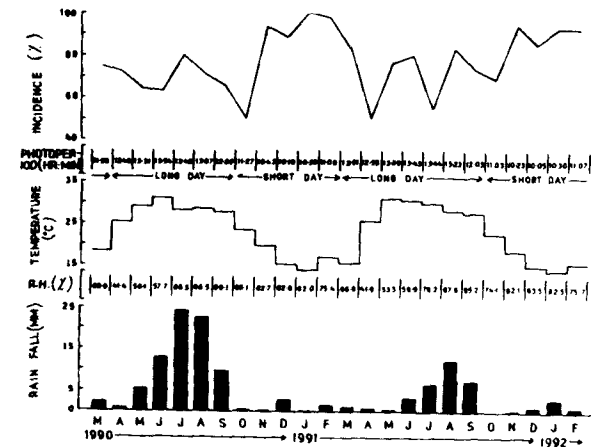


Figure 6. Incidence of *Bovicola caprae* in relation to the changes in ecofactors (in Dehradun, during March 1990 to February 1992).

(Table 1). However, the correlation between mean monthly incidence rate and environmental relative humidity ($r_{13} = +0.21$ and -0.42) and rainfall ($r_{14} = -0.23$ and -0.09) remained insignificant (Figure 6).

The data relating to intensity of infestation of *B. caprae* on 830 infested goats indicate (Figure 7) that maximum number of goats (31%) bore very light infestation, narrowly followed by light infestation category (26%) and moderate infestation category (21%). Heavy infestations were encountered on 16% host while 7% goat carried very heavy infestation. On the other hand, most of the goats infested with *L. africanus* (72%) carried very light infestation, followed by light infestation category (18%). Medium infestation could be observed on 5% goats while 4% goats

Table 1. The values of Pearson's correlation coefficient* between monthly incidence rate of *B. caprae* and the ecofactors during March, 1990 to February, 1992).

| March, 1990 to February, 1991 | March, 1990 to February, 1992 |
|-------------------------------|-------------------------------|
| $r_{12} = -0.73$ | $r_{12} = -0.57$ |
| $r_{13} = +0.21$ | $r_{13} = +0.42$ |
| $r_{14} = -0.23$ | $r_{14} = -0.09$ |
| $r_{15} = -0.53$ | $r_{15} = -0.59$ |

* r_{12} - Karl Pearson's correlation between monthly prevalence and mean monthly temperature;

r_{13} - Correlation between monthly prevalence and mean monthly Relative Humidity;

r_{14} - Correlation between monthly prevalence and mean monthly Rainfall;

r_{15} - Correlation between monthly prevalence and mean monthly photoperiod.

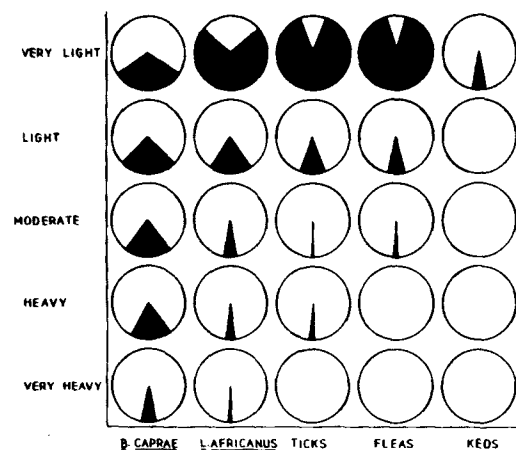


Figure 7. Intensity of *Bovicola caprae*, *Linognathus africanus*, ticks, fleas and keds on goats of Dehradun during March 1990 to February 1992.

bore heavy infestation. Percentage of very heavily infested hosts was negligible (1%). Likewise, most of the goats carrying ticks were lightly infested (87.5%), followed by light infestation category (11%) and then by heavy infestation category. Negligible percentage of goats (0.5%) carried medium infestation while none was very heavily infested. Similarly, most of the goats carried very light infestation by fleas (91%), followed by light (7%) and medium infestation category (2%). None of the goats infested with fleas could be placed in heavy or very heavy infestation category. Lastly, all the goats infested with ked were very lightly infested (Figure 7). The relative intensity of different sp. on host body was assessed by thoroughly searching the parts of body normally inhabited by them. In fact, any reliable method for estimating the louse/ectoparasite load on live host is still not available. Any method adopted for this purpose is likely to remain questionable. However, by

Table 2. Relative intensity (percentage of hosts belonging to each category) of *B. caprae* on the infested goats, during different seasons of year, 1990-1992 (in Dehradun).

| Seasons (Month) | Very light (VL) | Light (L) | Moderate (M) | Heavy (H) | Very heavy (VH) |
|---------------------|-----------------|-------------|--------------|--------------|-----------------|
| Winter (N, D, J, F) | 13.77 | 27.33 | 26.66 | 22.44 | 9.77 |
| Summer (M, A, M, J) | 39.00 | 26.50 | 18.00 | 10.00 | 6.50 |
| Rainy (J, A, S, O) | 66.66 | 21.66 | 8.88 | 2.77 | 0.00 |
| Total | 31.33 | 25.9 | 20.72 | 15.18 | 6.87 |

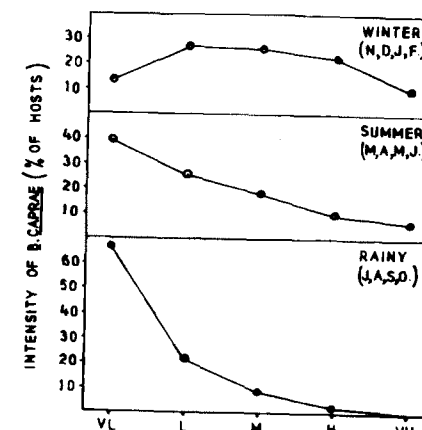


Figure 8. Relative intensity (infestation rate) of *Bovicola caprae* on goats of Dehradun during different seasons (March 1990 to February 1992). VL = very light, L = light, M = moderate, H = heavy, VH = very heavy.

practical experience, it becomes possible to place each of infested host into one of categories taken into consideration (as done in present studies). While discussing the similar point in case of poultry lice EDGAR et al. (1949) commented that "It is realized of course that any method of attempting to count living lice is subject to considerable errors and can be little more than an estimate. However, when a routine method of examination is used and same operator inspects all the hosts, the degree of accuracy is such that comparisons can be made".

An analysis of the data indicates that during winter months (November to February) very heavy infestation of *B. caprae* was present upon 9.8% infested hosts in contrast to 6.5% noted during summers (March to June). None of the infested host carried very heavy infestation during rainy months (July to October). Similarly, maximum numbers of heavily infested hosts were encountered during winter days (33%)

than summers (10%) and rainy month (3%) (Table 2). Medium infestation was also most prevalent during winters (27%) than summer and rainy month (18 and 9% respectively). Light infestation was more or less similar during different seasons (27% during winter, 26.5% in summers and 22% in rainy season) (Figure 8). However, the number of very lightly infested goats was maximum during rainy days (67%) in contrast to 39% during summer and 14% during winter. The data clearly indicate that winter days are highly favourable for population build up resulting in increased infestation rate.

Few lines may be added on the distribution of two phthirapteran species on the body of host. Maximum condensation of *B. caprae* occur on the hair belonging to back and Neck. Nape, abdomen and brisket also carry moderate population of this louse. Other areas of body (tail, legs, head etc.) may carry *B. caprae* in case of moderate to very infestation. On the other hand, eggs of *B. caprae* generally occur on long hair belonging to thigh, neck and tail. The sites of occurrence of *L. vituli* on host body are quite similar to that of *B. caprae*. Hair belonging to back, neck and nape are the most favoured areas. Abdomen and brisket also carry some louse population while other area are scarcely infested. Eggs of *L. africanus* are generally laid on hair belonging to neck, nape and forelegs but can be found on any area of body (wide range of distribution). They are generally laid singly.

Discussion

Out of five phthirapteran species (e.g. *B. caprae*, *Holarktikos crassipes*, *B. limbatus*, *L. africanus* and *L. stenopsis*) reported to normally occur on the goats, only two (*B. caprae* and *L. africanus*) could be recorded from the goats belonging to Dehradun. The presence of *L. stenopsis* and *B. limbatus* has been noted elsewhere in India (LAKSHMINARAYANA 1979) while performing taxonomic work. Furthermore, ANSARI (1951) listed yet another species, *L. oviformis* from the goats of Punjab. However, none of these species seem to occur on the goats of area undertaken for present study. Present study shows that *B. caprae* is a quite common phthirapteran species occurring on 79.2% of the examined goats of Dehradun. The prevalence of *L. africanus* is comparatively lesser (38%). Ticks have been recorded from 19.8% host while fleas and ked have been found present on 10.2% and 5.8% hosts respectively. *B. caprae* and the fleas were more common on brown coloured goats while *L. africanus*, ticks and keds occurred more frequently on black goats. Such a preference may be circumstantial as differences in the prevalence of these ectoparasites are not significantly marked. However, all these ectoparasites have shown higher prevalence on less hairy goats (specially the ticks). It is not clear whether the less hairy goats are more susceptible to lice infestation (and also the other ectoparasites) or infestation by these ectoparasites lead to loss of hair resulting in less hairy appearance. The irritation caused by the lice (due to presence of claws in their feet and the mouthparts) results in frequent grooming by the host. Lousy goats are often found scratching the body to trees, walls or other wooden objects. Furthermore, feeding of lice on epidermis of skin may lead to loss of hair from the affected area.

Age does not seem to have direct correlation with the incidence of *B. caprae* because during present studies it has been observed that older goats (above three years

of age) were more lousy than young ones. However, in the case of *L. africanus* the prevalence was slightly higher on younger ones. *L. africanus* (a sucking louse) seems to prefer kids for the purpose. The host's sex does not seem to have any correlation with the prevalence of *B. caprae* as well as *L. africanus* because their prevalence was more or less similar on both sexes. However, the general assumption that weaker host are more prone louse infestation seem to hold good. The prevalence of *B. caprae*, *L. africanus*, ticks and fleas was higher on visibly weaker hosts. The difference was more marked in case of *L. africanus* and ticks.

Apart from the recent work of LOZOYA et al. (1986) there is hardly any report relating to prevalence and intensity of Phthiraptera on goats. LOZOYA et al. (1986) surveyed the goats belonging to different parts of Mexico and found only two species (*B. caprae* and *L. africanus*). They also found *B. caprae* to be more common species. In the present studies an attempt has been made to find correlation between four ecofactors and the incidence rate. Environmental temperature and photoperiod seem to have moderate negative correlation with the incidence rate of *B. caprae*. This fact is further evident by the increased louse population during winter months. However, similar correlation with relative humidity and rain-fall has not been found during the present studies. The correlation with environmental temperature and photoperiod can also be seen in the data relating to relative intensity during different months of the year. Maximum number of very heavily and heavily (also moderately) infested host were encountered during winter months (followed by summer). On the other hand, most of the goats examined during rainy months carried very light or light infestation. The present study provides the first comprehensive report on the incidence and intensity of Phthiraptera on the goats of any Indian locality (i.e., Dehradun).

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References

- ANSARI, M. A. R. (1951): Studies on phthirapteran parasites of mammals from the Punjab. – Indian J. Entomol. 13: 117–145.
- EDGAR, S. A.; WALSH, W. L.; JOHNSON, L. W. (1949): Comparative efficacy of several insecticides and methods of application in the control of lice on chickens. – Poultry Sci. 28: 320–338.
- LAKSHMINARAYANA, K. V. (1979): A synoptic list of Mallophaga. – Rec. Zool. Surv. India 75: 39–201.
- LEWIS, L. F.; CHRISTENSON, D. M.; EDDY, G. W. (1967): Rearing of long-nosed cattle louse and cattle biting louse on host animals in Oregon. – J. Econ. Entomol. 60: 775–757.
- LOZOYA, S. A.; QUINOES, L. S.; AGUIRVE, U. A.; IGUEZ, E. (1986): Distribution and abundance of Mallophaga and Anoplura lice in sheep and goats of Saltillo Coahuta, Mexico. – Folio Entomol. Mex. 691: 117–126.

MISHRA, A. C.; BHAT, H. R.; KULKARNI, S. M. (1974): A survey of haematophagous arthropods in Western Himalayas, Sikkim and hill districts of West Bengal – Anoplura. – Ind. J. Med. Res. **62**: 1268–1287.

RAO, N. S. K.; KHUDDUS, C. A.; KUPPUSWAMY, B. M. (1977): Anoplura (Insecta), infesting domestic ruminants with a description of a new species of *Haematopinus* from Karnataka (India). – Mysore J. Agricult. Sci. **11**: 588–595.

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