

**Population structure of goat biting louse *Bovicola caprae*
(Phthiraptera: Ischnocera)**

ADESH KUMAR, B.S. RAWAT, A.K. SAXENA and G.P. AGARWAL

Department of Zoology, Pt. L.M.S. Govt. Post Graduate College, Rishikesh (Dehradun), India.

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Summary

The population structure of *Bovicola caprae* on goats has been recorded by examining 57 goatskins (45 by brushing cum searching and 12 by dissolving method). Population composition, sex ratio, adult nymph ratio has been recorded at different levels of infestation. The female dominated over the male population and ♂ : ♀ has been found to be 1:2 by brushing cum searching and 1:1.7 by dissolving method. Likewise, A:N was found to be 1:1.2 by brushing cum searching and 1:1.7 by dissolving method. The number of males and females follow similar pattern throughout population and were found to exhibit a high degree of correlation.

Introduction

Population of lice are highly variable ranging from absence to many hundreds or even thousands per host. From mammals, maximum numbers of lice recorded is over a million *Damalinia* (= *Bovicola*) *ovis* from domestic sheep (MURRAY 1965); 19,300 *D. jellisoni* from Dall's sheep (KIM 1977) and 20,000 *Trichodectes canis* from injured dog (HOPKINS 1949). However, a thorough survey of literature reveals that any exhaustive attempt to furnish information on the population structure of phthirapterans infesting domestic ungulates has rarely been made. Leaving out the occasional counts obtained through the searching (hair parting method) alive hosts (in order to record population fluctuations) only few papers deal with population structure of lice occurring on domestic mammals. HOPKINS (1949) has made valuable contribution in the field. KIM (1977) also supplemented information on population of *D. jellisoni* on Dall's sheep. On the other hand, population dynamics of *B. ovis* on alive sheep has been studied in greater details (MURRAY & GORDON 1969). MARSHALL (1981) has reviewed the work done in the field. The present report furnishes information on population composition of *Bovicola caprae* infesting domestic goat, *Capra hircus*. The study is based on the examination of goatskins by brushing cum searching as well as dissolving method.

Materials and methods

Fresh skin of goats (destined for human consumption) were obtained from butcher's shop (mostly purchased, few hired) of Dehradun. The goatskins were placed each in a big polythene bag along with a large wad of cotton wool soaked in chloroform (immediately after procurement). As many as 45 skins were examined by brushing cum searching method, while 12 by dissolving technique. For brushing the skin was vigorously rubbed, brushed and combed over a large within plastic sheet and the debris so obtained were searched for the presence of lice (under stereozoom binocular). Every brushed skin was then subjected to at least 6 h searching (by hair parting method) with the help of mounted lens and light source to minimise the residual lice load. For dissolving, the entire skin was cut into pieces (6" x 4") which were then soaked in 10 % KOH in enamel trays (hair side down) till the softening of hair. Then the partly dissolved hair were scrapped with the help of blunt knife and transferred to fresh 10 % KOH (in 2500 ml. battery jars) and allowed to stand overnight in incubators (at 60°C). The contents were then filtered in very fine mesh (stainless steel wire gauge) and washed with a jet of water to remove smallest particles. The remainder was collected in petridish, the lice sorted out and counted sexwise and stagewise under stereozoom binocular microscope.

Results

An average of 1902.4 *B. caprae* were collected per goatskin (n = 45) by brushing cum searching method and 2377.3/skin by dissolving method (n = 12). Thus, there was 20 % increase in recovery of lice by dissolving method. Maximum numbers recorded from any skin by brushing cum searching was 5900 while minimum 23. Likewise, highest record obtained by dissolving was 4870 and minimum 486.

To study the age structure and sex ratio of *B. caprae* on 45 goatskins examined by brushing cum searching, entire data has been divided into 6 categories (as shown in Table 1 and Figure 1). Maximum numbers of goatskin (n = 16) carried 1 – 1000 *B. caprae* (mean number, 60 ♂, 153 ♀, 311 N; ♂:♀, 1:2.5 and A:N, 1:1.5), followed by 1001–2000 lice category (n = 13; mean numbers, 197 ♂, 511 ♀, 821 N; ♂:♀, 1:2.6 and A:N, 1:1.2). Six skins carried 2001–3000 *B. caprae* (mean numbers 353 ♂, 800 ♀, 1087 N; ♂:♀, 1:2.3 and A:N, 1:0.9). Four skins each could be placed in 3001–4000 lice category (mean numbers, 599 ♂, 965 ♀, 1907 N; ♂:♀, 1:1.6 and

Table 1. Population structure of *Bovicola caprae* on 45 goatskins examined by brushing cum searching method (N – Nymphs, A – Adults).

Class	Frequency	Mean number				
		♂	♀	N	♂:♀	A:N
1 – 1000	16	60	153	311	1:2.55	1:1.46
1001 – 2000	13	197	511	821	1:2.59	1:1.16
2001 – 3000	6	353	800	1087	1:2.27	1:0.94
3001 – 4000	4	599	965	1907	1:1.61	1:1.21
4001 – 5000	4	868	1205	2503	1:1.39	1:1.21
5001 – 6000	2	740	1637	3494	1:2.21	1:1.47

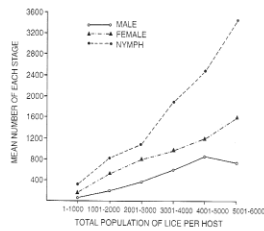


Figure 1. Showing the population structure of *Bovicola caprae* in relation to total population on *Capra hircus* (by Brushing Technique).

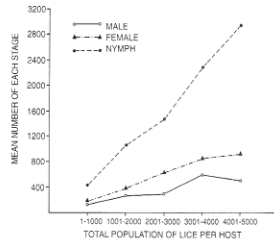


Figure 2. Showing the population structure of *Bovicola caprae* in relation to total population on *Capra hircus* (by Dissolving Technique).

A:N, 1:1.2) and 4001–5000 lice category (mean numbers, 868 ♂, 1205 ♀, 2503 N; ♂:♀, 1:1.4 and A:N, 1:1.2). Only two skins carried more than 5000 lice i.e. 5001–6000 category (mean number, 740 ♂, 1637 ♀, 3494 N; ♂:♀, 1:2.2 and A:N, 1:1.4). As evident from Table 1, the females outnumbered the males in adult populations at all the levels of infestations. Moreover, their number remained 2 to 2.5 times higher than males in at least 4 categories. The overall ♂:♀ (including all the categories) has been found 1:2. On the other hand number of nymphs remained higher than adults in all categories except one (2001–3000). The overall A:N has been found to be 1:1.2. Furthermore, the overall nymphal population was 3.6 times higher to that of adult males (♂:N, 1:3.6) and 1.8 times to that of females (♀:N, 1:1.8). An attempt has been made to find the degree of correlation between male, female population and adult nymph population observed during present studies. Significantly higher value of *r* have been found in both cases (0.91 for ♂, ♀ and 0.98 for A, N). It shows that there is simultaneous expansion of population of males, females and nymph at various levels of infestation.

Likewise, result obtained from 12 goatskins studied by dissolving method are presented in Table 2 (and Figure 2). Two skins carried 1–1000 *B. caprae* (mean numbers, 140 ♂, 194 ♀, 444 N; ♂:♀, 1:1.4 and A:N, 1:1.3) and 4 skins carried 1001–2000 *B. caprae* (mean numbers, 283 ♂, 378 ♀, 1077 N; ♂:♀, 1:1.3 and A:N, 1:1.6). Three skins were found belonging to 2001–3000 *B. caprae* category (mean numbers 301 ♂, 641 ♀, 1494 N; ♂:♀, 1:2.1 and A:N, 1:1.6). Only one skin carried 3001–4000 lice (611 ♂, 872 ♀, 2317 N; ♂:♀, 1:1.4 and A:N, 1:1.6). 4001–5000 lice were present on only 2 goatskins (519 ♂, 957 ♀, 2976 N; ♂:♀, 1:1.8 and A:N,

Table 2. Population structure of *Bovicola caprae* on 12 goatskins examined by dissolving method (N – Nymphs, A – Adults).

Class	Frequency	Mean numbers			$\delta:\varphi$	A:N
		δ	φ	N		
1 – 1000	2	140	194	444	1:1.38	1:1.33
1001 – 2000	4	283	378	1077	1:1.33	1:1.63
2001 – 3000	3	301	641	1493.6	1:2.13	1:1.58
3001 – 4000	1	611	872	2317	1:1.43	1:1.56
4001 – 5000	2	519	957	2976	1:1.84	1:2.02

1:2.02). The females outnumbered the males at all levels of infestation, but could double their numbers in only one category. The overall sex ratio has been found to be 1:1.7. Likewise, nymphal population dominated the adults at all levels and was found double in one category. The overall adult nymph ratio has been found to be 1:1.7.

Discussion

The predominance of females in phthirapteran population (specially those infesting domestic ungulates) has been noted by many workers (see MARSHALL 1981). The imbalances in sex ratio may be due to fact that males are shortlived than females. Furthermore, the juveniles outnumber the adults in most of the cases studied so far (HOPKINS 1949; KIM 1977). High degree of positive correlation indicates the simultaneous expansion of population. But, in present case the lice recovery from goatskins (examined by either method) remained considerably low. Maximum lice count on any infested goat could reach to only 5,900. However, from other domestic mammals, the maximum number of lice recorded is over a million *D. ovis* from domestic sheep (MURRAY 1965); 19,300 *D. jellisoni* from Dall's sheep (KIM 1977) and 20,000 *T. canis* from injured dog (HOPKINS 1949). Since, a number of factors influence lice population (environmental factors like temperature, humidities, rainfall, thunderstorm, solar radiations; host factors like self and mutual grooming, age, sex, breed, body size, density, confinement and the interspecies interaction etc.), and the present data has been taken from goatskin, it is rather difficult to ascertain the reasons for low lice count.

Table 3. Showing population composition of *Bovicola caprae* on 45 goatskins examined by brushing cum searching method and 12 goatskin studied by dissolving technique (A – Adults, N – Nymphs).

Method applied	$\delta:\varphi$	A:N	$\delta:N$	$\varphi:N$
Brushing	1:2	1:1.2	1:3.6	1:1.8
Dissolving	1:1.7	1:1.7	1:4.5	1:2.7

It has been noted that proportion of adults remained slightly higher in case of brushing. Furthermore, dissolving method yielded increased ♂ recovery (Table 3). It may be due to the fact that females being bigger in size are easily nabbed during direct examination than the males (which are smaller) and nymphs (which are smaller as well as transparent). Thus, dissolving leads to increased recovery of males resulting in lowering of ♂:♀ ratio and increase in A:N ratio. However, overall increase in number of specimens collected per goatskin by dissolving method did not improve to the expectations. This may not be true in case of goatskins possessing higher louse densities (in present case the louse densities were supposedly low). However, the dissolving method leads to complete destruction of skin which may be used for any purpose after brushing and searching.

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Authors' address:

Dr. A.K. SAXENA, ADESH KUMAR and B.S. RAWAT, Department of Zoology, Pt. L.M.S. Govt. P.G. College, Rishikesh (Dehradun) 249 201 India; Dr. G.P. AGARWAL Dept. of Zoology, Banaras Hindu University, Varanasi – 221005, India.