

**A Note on the population composition of goat sucking louse,
Linognathus africanus
(Insecta, Phthiraptera, Anoplura, Linognathidae)**

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A. Introduction

There are only few reports relating to population composition of phthirapterans infesting domestic ungulates (HOPKINS 1949, MURRAY 1965, MURRAY & GORDON 1969, KIM 1977). The literature on the subject has already been reviewed (MARSHALL 1981). Recently, the population structure of one goat biting louse, *Bovicola caprae* (ischnoceran Mallophaga) and the efficacy to two methods (brushing cum searching and dissolving) related to population count, has been discussed (KUMAR et al. 1994 a). The information concerning the impact of host colour, health, sex and age on the prevalence of goat lice has also become available (KUMAR et al. 1994 b). Present report furnishes information on the population composition of goat sucking louse, *Linognathus africanus* KELLOGG & PAINE, 1911 (Linognathidae).

B. Material and Method

As many as 68 goatskins carrying *Linognathus africanus* infestation were examined for the purpose (55 by brushing cum searching method and 13 by dissolving method). Fresh goatskins (destined for human consumption) were obtained from butcher's shop (purchased or hired) and placed in polythene bag with a large wad of cotton wool soaked in chloroform (immediately after procurement). For brushing, the skin was vigorously rubbed and combed over a large 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 hrs. searching (by hair parting method) with the help of mounted lens and light source to minimise the residual louse load. For dissolving, entire skin was cut into pieces (6" x 4") which were then soaked in 10% KOH (hair side down) till the softening of hair. The partly dissolved hair were scrapped with the help of blunt knife and transferred to 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.

C. Observations

As many as 55 goatskins have been examined by brushing cum searching method to record the population structure of *Linognathus africanus*. Maximum number of *L. africanus* recorded on any goat remained 1196 while minimum was 10. An average of 340.24 *L. africanus* could be collected per goatskin (n = 55). The data was grouped into six categories in order to record the population structure of *L. africanus*, at different levels of infestations. Nearly half of the examined goatskins carried only 1-200 (n=27) specimens of *L. africanus* (Mean number, 15.8 ♂, 36.5 ♀, 49.9 N; ♂ : ♀ - 1 : 2.3; A : N - 1 : 1) followed by next higher category i.e. 201-400 (n = 9; mean number, 51.3 ♂, 93.5 ♀, 122.4 N; ♂ : ♀ - 1 : 1.8; A : N - 1 : 0.85) (Tab. 1). Eight goatskins could be placed in next higher category 401-600 (n = 8, mean number, 104.3 ♂, 240.6 ♀, 171.5 N; ♂ : ♀ - 1 : 2.3; A : N - 1 : 0.5). Five skin carried 601-800 *L. africanus* (mean number, 130.2 ♂, 269.2 ♀, 311.4 N; ♂ : ♀ - 1 : 2.1; A : N - 1 : 0.8). Four skins carried 801-1000 lice (mean number, 150.3 ♂, 427.3 ♀, 302.5 N; ♂ : ♀ - 1 : 2.8; A : N - 1 : 0.5). The remaining two had 1001-1200 *L. africanus* (mean number, 235.5 ♂, 411.5 ♀, 524.5 N; ♂ : ♀ - 1 : 1.8; A : N - 1 : 0.8). Thus, the females outnumbered the males at all levels of infestation. Except two categories, their number was 2 to 2.8 times to that of males. However, the adult nymph ratio showed unexpected results. The adults outnumbered the nymphs at all levels and remained nearly double in atleast two categories (Tab. 1). The overall adult nymph ratio has been found to be 1 : 0.7 by brushing cum searching method, while male female ratio remained 1 : 2.2. Furthermore, male nymph ratio has been found to be 1 : 2.2 and female nymph ratio, 1 : 1.

Only thirteen goatskins studied by dissolving method were infested with *L. africanus*. The maximum number of *L. africanus* on any goat remained 1157 while minimum was 12. The whole data has been divided into six categories. Three goats had 1-200 lice (mean number, 12 ♂, 20.7 ♀, 49.0 N; ♂ : ♀ - 1 : 1.7, A : N - 1 : 1.5). Five skins carried

Tab. 1. Population structure of *Linognathus africanus* on 55 goatskins examined by brushing cum searching method.

Class	Fre- quency	Total (Mean)	Adult (mean)			Nymph (Mean)			
			♂	♀	Total	IN	II N	III N	Total
1- 200	27	102.19	15.78	36.48	52.26	12.93	17.41	19.59	49.93
201- 400	9	267.33	51.33	93.50	144.89	37.22	32.78	52.44	122.44
401- 600	8	516.37	104.25	240.63	344.88	50.13	55.50	65.88	171.50
601- 800	5	710.80	130.20	269.20	399.40	95.00	111.00	105.40	311.40
801-1000	4	880.00	150.25	427.25	577.50	95.25	99.75	107.50	302.50
1001-1200	2	1171.50	235.50	411.50	647.00	151.50	190.50	182.50	524.50
N=55		340.40	62.64	138.73	201.36	40.80	46.25	51.82	138.87

Class	Ratios				
	♂ : ♀	A : N	♂ : N	♀ : N	IN:II N:III N
1- 200	1 : 2.31	1 : 0.96	1 : 3.16	1 : 1.37	1 : 1.35 : 1.52
201- 400	1 : 1.82	1 : 0.85	1 : 2.39	1 : 1.31	1 : 0.38 : 1.41
401- 600	1 : 2.31	1 : 0.50	1 : 1.65	1 : 0.71	1 : 1.11 : 1.31
601- 800	1 : 2.07	1 : 0.78	1 : 2.39	1 : 1.16	1 : 1.17 : 1.11
801-1000	1 : 2.84	1 : 0.52	1 : 2.01	1 : 0.71	1 : 1.05 : 1.13
1001-1200	1 : 1.75	1 : 0.81	1 : 2.23	1 : 1.28	1 : 1.26 : 1.21
		1 : 2.22	1 : 0.69	1 : 2.22	1 : 1.13 : 1.27

Tab. 2. Population structure of *Linognathus africanus* on 13 goatskins examined by dissolving method.

Class	Fre- quency	Total (Mean)	Adult (mean)			Nymph (Mean)				
			♂	♀	Total	IN	II N	III N	Total	
1- 200	3	81.67	12.00	20.67	32.67	17.00	16.00	16.00	49.00	
201- 400	5	252.60	31.20	45.00	76.20	69.80	55.40	51.20	176.40	
401- 600	1	427.00	55.00	92.00	147.00	113.00	97.00	70.00	280.00	
601- 800	2	705.50	92.50	139.00	231.50	178.00	159.50	136.50	474.00	
801-1000	1	849.00	111.00	141.00	252.00	224.00	198.00	175.00	597.00	
1001-1200	1	1157.00	138.00	232.00	370.00	272.00	242.00	273.00	787.00	
		13	411.67	52.39	79.23	131.62	105.00	90.35	84.23	280.08

Class	Ratios					
	♂ : ♀	A : N	♂ : N	♀ : N	IN:II N:III N	
1- 200	1 : 1.72	1 : 1.50	1 : 4.08	1 : 2.37	1 : 0.94 : 0.94	
201- 400	1 : 1.44	1 : 2.32	1 : 5.65	1 : 3.92	1 : 0.79 : 0.73	
401- 600	1 : 1.67	1 : 1.91	1 : 5.09	1 : 3.04	1 : 0.86 : 0.62	
601- 800	1 : 1.50	1 : 2.05	1 : 5.12	1 : 3.41	1 : 0.90 : 0.77	
801-1000	1 : 1.27	1 : 2.37	1 : 5.38	1 : 4.23	1 : 0.88 : 0.78	
1001-1200	1 : 1.68	1 : 2.13	1 : 5.70	1 : 3.39	1 : 0.89 : 1.00	
		1 : 1.51	1 : 2.13	1 : 5.35	1 : 3.54	1 : 0.87 : 0.80

Tab. 3. Showing population composition of *Linognathus africanus*.

Method applied	n	♂ : ♀	A : N	♂ : N	♀ : N	IN : IIN : IIIN
Brushing cum searching	55	1 : 2.22	1 : 0.69	1 : 2.22	1 : 1	1 : 1.13 : 1.27
Dissolving	13	1 : 1.51	1 : 2.13	1 : 5.35	1 : 3.54	1 : 0.87 : 0.80

201–400 *L. africanus* (mean number, 31.2 ♂, 45.0 ♀, 176.4 N; ♂ : ♀ = 1 : 1.4; A : N = 1 : 2.3) (Tab. 2). One skin had 401–600 lice (Total 427; 55 ♂, 92 ♀, 280 N; ♂ : ♀ = 1 : 1.7; A : N = 1 : 1.9). One skin had 801–1000 lice (Total 849; 111 ♂, 141 ♀, 597 N; ♂ : ♀ = 1 : 1.3; A : N = 1 : 2.4). One remaining skin carried 1001–1200 lice (Total 1157; 138 ♂, 232 ♀, 787 N; ♂ : ♀ = 1 : 1.7; A : N = 1 : 2.1). Thus, female population dominated over male at all levels of infestation (Tab. 2). The A : N remained 1 : 2.1 in dissolving method in contrast to 1 : 0.7 obtained by brushing cum searching.

An examination of Table 3 indicates slight lowering of male female ratio in dissolving method (increased male recovery). Likewise, adult nymph ratio (1 : 0.7, recorded during brushing cum searching rose, to nearly three times (1 : 2.13) in dissolving method. This clearly indicates increased nymph recovery by the latter method. The male, nymph and female, nymph ratio also exhibited similar pattern. Significant differences also exist in the ratio of first, second and third nymphal instars. The proportion of first instars seen to have increased in dissolving method leading to ratio 1 : 0.87 : 0.80 (in contrast to 1 : 1.13 : 1.27 obtained by brushing cum searching).

D. Discussion

Population of lice are highly variable ranging from absence to many hundreds or even thousand per host (MARSHALL 1981). From domestic ungulates maximum number of lice recorded is over one million *Bovicola bovis* from domestic sheep (MURRAY 1965), 19,300 *Damalima (Bovicola) jellisoni* from Dall's sheep (KIM 1977), 20,000 *Trichodectes canis* from injured dog (HOPKINS 1949) and 5,900 *Bovicola caprae* from goats (KUMAR et al. 1994 a). However, during present studies maximum count obtained by either method remained 1196. A number of factors reportedly influence lice population (environmental factors like temperature, humidities, photoperiod, rainfall, thunderstorm, solar radiations; host factors like self and

mutual grooming, age, sex, breed, body size, density, confinement and interspecies interaction etc.) and present data has been obtained from goatskins, it is rather difficult to ascertain the reasons for low lice count. Furthermore, the host may not tolerate the excessive load of sucking lice as compared to biting louse because the former continuously pierce the host skin (being haematophagous in nature) in addition to irritation caused by claws in their feet.

Females generally outnumber the males in phthirapterans occurring of mammalian hosts (MARSHALL 1981). In few cases (e. g. cattle biting louse, *Bovicola bovis* and horse biting louse, *Bovicola equi*) the rare occurrence of males has also been recorded (Parthenogenetic mode of reproduction). Furthermore, the Phthirapteran males are generally shortlived than females (it may result in imbalance in sex ratio). However, the nymphal population dominated the adults in most of cases studied so far (HOPKINS 1949, KIM 1977, KUMAR et al. 1994 a). In present case also, the overall adult nymph ratio has been found to be 1 : 2.1 in case of dissolving method (nymphs dominated adult at every level of infestation) but remained 1 : 0.7 in case of brushing cum searching method. It may be due to the fact that nymphs (being smaller in size and transparent) easily escape detection during brushing cum searching of goatskin. In same way, females being large sized are easily nabbed during brushing cum searching while the small sized males may be lost during exercise. This probably lead to increased male recovery and reduced male, female ratio by dissolving technique.

In case of goat biting louse, *Bovicola caprae*, overall increase in number of specimens collected per goatskin by dissolving method did not improve to the expectations (Kumar et al. 1994 a) but it caused the lowering of ♂ : ♀ and increase in A : N ratio. Thus, the dissolving technique seem to be advantageous from one point of view (recovery of juveniles and males during population studies) but leads to complete destruction of goatskin (which can be used for whatever purpose after brushing cum searching).

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Summary

The population composition of goat sucking louse, *Linognathus africanus* has been recorded by examining 68 goatskins (55 by brushing cum searching and 13 by dissolving method). The overall male, female ratio has been found to be 1 : 2.2 by brushing cum searching method and 1 : 1.51 by dissolving method. The overall adult, nymph ratio remained 1 : 0.69 in brushing cum searching method and 1 : 2.13 in dissolving method. The population composition has been recorded at different levels of infestation. The efficacy of two method has also been discussed.

Zusammenfassung

Über die Populationsstruktur der Ziegenlaus *Linognathus africanus* (Phthiraptera, Anoplura, Linognathidae). – An 68 frischen, auf dem Tiermarkt in Rishikesh (Dehradun, Indien) erworbenen Fellen von Ziegen *Capra hircus f. aegarus* wurde nach zwei gegenübergestellten Methoden der *Linognathus africanus*-Befall untersucht. Das Geschlechterverhältnis ($\delta = \varnothing$) betrug nach der Methode „brushing cum searching“ (n = 55) 1 : 1,2, nach der „dissolving“-Methode (n = 13) 1 : 1,51. Nach ersterer ergab sich ein Imagines-Larven-Verhältnis von 1 : 0,69, dagegen nach letzterer das von 1 : 2,13. Von der

Methode „Fellauskämmen und -ausklopfen mit visueller Nachuntersuchung“ geprägt, erweist sich auch das ermittelte Häufigkeitsverhältnis der drei Larvenstadien zueinander. Der Auflösung des gesamten Wirtinteguments (in KOH) führte dagegen offenbar zu realistischen Werten (z. B. L I : L II : L III = 1 : 0,87 : 0,80). Die Befallsintensität ist in 6 Gruppen klassifiziert, wovon am häufigsten die ersten zwei von 1–200 bzw. 201–400 Ex. vertreten sind.

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