



Journal of  
**Entomology**

ISSN 1812-5670



Academic  
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## Research Article

# First Report of lice Infestation Among Saanen Goats in Kuantan, Malaysia

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## Abstract

**Background and Objective:** Ectoparasites remains as one of major challenges in goat farming industry. They are ubiquitous and often cause harmful effects on livestock production and productivity. Ectoparasites give rise to morbidity and mortality among goat population which consequently lead to reductions in meat and milk. This study was conducted to identify and determine the risk factors of ectoparasitic infestations among Saanen goats in Kuantan, Malaysia. **Materials and Methods:** A total of 30 goats were inspected for the presence of ectoparasitic infestations. The infested ectoparasites were collected through hand-picked and brushing methods. The collected ectoparasites were preserved in 70% ethanol. The counting of ectoparasites was done by using light microscope. The number of ectoparasites were counted and analyzed by chi-square ( $\chi^2$ ) test. **Results:** The results show that the lice were the only ectoparasite found in all 30 goats. The lice infestation was significantly associated with the age and sex factors of goats. Female goats were infested with lice with higher percentage of lice (51.6%,  $n = 372$ ) than male goats (48.4%,  $n = 349$ ). With regard to age factor, young goats were more susceptible to lice infestation than adult goats with the percentage of lice (67%,  $n = 483$ ) and (33%,  $n = 238$ ), respectively. The predilection site of lice infestation was mostly found on the body region of goats. **Conclusion:** Good sanitary condition and proper ectoparasite control are needed to reduce the transmission of ectoparasites in goat herds.

**Key words:** Lice infestation, ectoparasite, saanen goats, livestock, predilection site

**Citation:** Afzan Mat Yusof, 2018. First report of lice infestation among saanen goats in Kuantan, Malaysia. *J. Entomol.*, 15: 62-68.

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**Competing Interest:** The author has declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

Asia represents the largest total world of goat population at about 56%<sup>1</sup>. Goat population plays major contributor in an agricultural industry primarily in socio-economic aspect. In Malaysia, ruminant sector is one of the established sector in the agricultural field<sup>2</sup> with a total number of goat populations was 429,398 in 2014<sup>3</sup>. They maintain an ecological niche in Malaysia livestock industry<sup>4</sup>.

One of dairy goat breeds known as "Saanen", a common choice among goat farmers in Malaysia for rearing because it is easy to breed and able to produce high quality of milk<sup>5</sup>. Goat milk also can be used to make cheese and can be easily digest than cow's milk<sup>6</sup>. Thus, the goat industry attracted extra attention from smallholder farmers to well-known ranchers including commercial enterprise as opportunities in developing their business<sup>7</sup>. Tropical climate with warm and humid environment<sup>7</sup> is suitable condition for goat production and adaptability traits in this country.

However, the tropical climate was attributed to ideal habitat for the ectoparasites infestation in goats<sup>8,9</sup>. Ectoparasite is defined as an arthropod organism which resides on the external surface of the host's skin and live at the expense of its host<sup>10</sup>. Generally, there are four common ectoparasite infestations in goats namely ticks, fleas, lice and mites<sup>11</sup>. The emergence of ectoparasites infestations is a major challenge among goat farmers and domestic related enterprises. Ectoparasites disrupt the normal ecological niche in goat farming field. Their presence impaired the production of goat populations by spreading blood parasite diseases such as Theileriosis, Babesiosis and Anaplasmosis<sup>12</sup>.

Ectoparasites gave potential threats in goats as these parasites affect both skin and blood of the host which lead to irritations and loss of blood<sup>13</sup>. Unknowingly, the ectoparasitic infestations lead to mortality in goats. Considering ectoparasites are hematophagous, these blood feeder parasites are eventually resulting in anemia among infected goats<sup>14</sup>. The host feels listless and lethargic due to blood loss state. Skin diseases such as dermatitis and hyperkeratosis can cause irritation to goats' skin<sup>15</sup>. Infestation from ectoparasites developed unpleasant appearance on the skin called cockle which downgraded the quality of the skin<sup>13</sup>.

One of the most common ectoparasites infected goats is lice. Lice belongs to class insect. Lice is host specific arthropods which only infest goats to survive. Lice obtaining nutrition from the body of host by feeding on body fluid secretion such as sebaceous gland and blood, debris from epidermal tissue and fragment from the hair<sup>16</sup>. Lice are transmitted via direct contact from one infected host to

another host. Lice can only survive away from their host for a limited period<sup>17</sup>. There are two types of lice that infected goats based on different feeding habits which are sucking lice and chewing lice. The sucking lice feed from their hosts by penetrating skin via tiny spike located at the mouthparts and suck blood from the capillaries of the host. The chewing lice or also known as biting lice use their mouthparts to grind the hair and skin of the host<sup>18</sup>.

Feeding habits of lice causes irritation and discomfort to animal. Saliva and faeces of lice contains substances that lead to allergies and severe irritations to the skin of infested goats. Infested animals show several attributes of lice infestation such as frequent rubbing itself against objects, reduced weight gain, weight loss, matted, unthriftiness and dull fleece, tufts of wool, lameness and development of cockle disease<sup>17</sup>. Severe irritation of the skin lead to excessive rubbing, scratching and licking behavior of the goats that eventually cause restlessness to the hosts. The behaviors negatively affect the production and skin quality of goats and lead to economic losses to farm owners due to mortality, decreased reproduction and decreased production of the goats<sup>19</sup>. So far, very few studies on ectoparasite infestations particularly ticks<sup>20</sup> and mites<sup>21</sup>. Ectoparasite infestation is seem neglected, underreported or unreported. Hence, the study conducted to identify the ectoparasites and associated risk factors (age and sex) of Saanen goats in Kuantan, Malaysia.

## MATERIALS AND METHODS

**Ethical clearance:** The study had obtained ethical approval prior the lice samples collection from Institutional Animal Care and Use Committee (IACUC), International Islamic University Malaysia (IIUM). All the procedures during lice samples collection were done according to standard operating procedures given by IACUC.

**Sample selection and location:** The study was carried out in a dairy goat farm with intensive farm management system situated at the coordinate of latitude 3.844755°N and longitude 103.1377°E in Kuantan, Pahang, Malaysia. A total of 30 Saanen goats were chosen by using quota sampling method by which 30 goats were divided based on the sex (15 female: 15 male) and age (15 young: 15 adults) of goats. The goats were further sub-classified into two age groups: Young (less than one-year old) and adult (more than one-year old) as suggested by Department of Veterinary Malaysia. Basic details such as age and sex of chosen goats and type of farming management system used were collected from the owner and recorded prior to sample collection. On average,

the weight of the goats is between 30-60 kg. In terms of healthiness, goats are in good condition with a regular veterinary examination. The goats are bred mainly for milk production. Goats were placed separately based on their age. Pregnant goats were kept in the individual pen. The sampling was conducted from January, 2017 to March, 2017. During the sampling period, the climatic condition was warm and humid. All samples were processed and analyzed at the Integrated Centre for Research Animal Care and Use (ICRACU) laboratory, International Islamic University Malaysia (IIUM), Kuantan, Pahang.

**Sample collection:** Goats were inspected and screened for ectoparasites by using hand magnifying lens and collected on three predilection sites which are head, neck and body of each goat. Collections of ectoparasites were taken place in the morning as suggested by Elsaid *et al.*<sup>22</sup>. Two methods namely hand-picked method and brushing method were applied in this study. Hand-picked method was applied for visible ectoparasites. The ectoparasites were hand-picked with the help of light gloves and a pair of forceps. The ticks were removed directly from the surface of skin by dabbing the ticks and around the skin with alcohol. Precaution was taken to ensure that the mouthpart of the ticks was not left behind. Brushing method pertained for lice, fleas and mites collection. The hair of goats was combed out onto a white cloth for the ectoparasites to drop. The plastic comb was dipped into the container with 70% ethanol and later decanted into the labelled container.

**Sample preservation:** The ectoparasites obtained from the hand-picked and brushing method were preserved in a closed container contained 70% ethanol for ectoparasites examination. The container was labelled with age, sex, date and time collection. The ectoparasites on the white cloth were detached and inserted in the labelled container. The hairs collected were mounted in alcohol for the counting of the ectoparasites.

**Counting of ectoparasites:** The ectoparasites were counted under a light microscope for total ectoparasite's infestation. The number of ectoparasites in each container were counted and recorded based on the methodology from Taylor *et al.*<sup>10</sup>. For mites' identifications, about 10 mL dipped alcohol of the sample was mixed with 20 mL of 10% potassium hydroxide (KOH) solution. The mixture was heated for 20 min at 37°C and centrifuged at 1500 rpm for 5 min. The supernatant was discarded and the sediment was placed on a clean glass slide.

One or two drops of glycerol were added onto a clean slide. The sediment was covered with a cover slip. The prepared slide was examined under a light microscope for total amount of ectoparasitic infestation.

**Statistical analysis:** The number of ectoparasites were entered in Microsoft Excel spread sheet and analysed with Statistical Package Science Software (SPSS) version 12.0.1. chi-square test was used to determine the associations between age and sex with the lice infestation in goats. The study was considered 95% as confidence interval with 5% precision level. The associated factor was known as significant if the value of  $p < 0.05$ .

## RESULTS

**Prevalence on predilection sites of infested lice:** There was only one type of ectoparasites known as lice were identified on all 30 goats. Table 1 shows the percentage of lice infestation in goats based on three predilection sites which were head, neck and body. A total of 721 lice were collected from 30 Saanen goats. Among three predilection sites, body had the highest number of lice infestation with the percentage of 73.9% ( $n = 533$ ). The lowest number of lice infestation was on the head part with the percentage of 6.2% ( $n = 45$ ). The percentage of 19.8% ( $n = 143$ ) lice were infested on neck part of goats.

**Association of sex and age as risk factors with the lice infestation in goats:** Table 2 shows the association of sex as a risk factor with the lice infestation in goats. The result revealed that male goats had higher risk to be infested by lice on body part with the percentage of 37.9% than female goats with the percentage of 36.1%. Overall, the percentage of 100% ( $n = 721$ ) of lice infestation, 48.4% ( $n = 349$ ) of lice were infested in male goats while the remaining 51.6% (372) lice were infested in female goats. Thus, lice were more common in female goats than male goats with the chi-square ( $\chi^2$ ) value, 21.135. The result shows that there was a significant association ( $p < 0.05$ ) between predilection sites and sex of goats. Table 3 shows the association of age as a risk factor with the lice infestation in goats. Lice were more infested on neck and body area of goats with the percentage of 12.3% for

Table 1: Percentage of lice infestation in goats based on three predilection sites

Predilection sites	Number of infested lice	Percentage (%)
Head	45	6.2
Neck	143	19.8
Body	533	73.9
Total	721	100

Table 2: Association of sex as a risk factor with the lice infestation in goats

Predilection site	Sex**		Percentage	
	Male goats (n = 15)	Female goats (n = 15)	Percentage	Percentage
Head	7	38	1.0	5.3
Neck	69	74	9.6	10.3
Body	273	260	37.9	36.1
Total	349	372	48.4	51.6 (x <sup>2</sup> : 21.135)

p-value of less than 0.05 (\*\*) was considered statistically significant (\*\*p<0.05)

Table 3: The association of age as a risk factor with the lice infestation in goats

Predilection site	Age**		Percentage	
	Young goats (n = 15)	Adult goats (n = 15)	Percentage	Percentage
Head	15	30	2.1	4.2
Neck	89	54	12.3	7.5
Body	379	154	52.6	21.4
Total	483	238	67.0 (x <sup>2</sup> : 28.597)	33.0

p-value of less than 0.05 (\*\*) was considered statistically significant (\*\*p<0.05)

adult goats and 52.6%, for young goats. Overall, the percentage of 100% (721) lice were found on three predilection sites (head, neck and body). For young goats, the percentage of 67% (483) lice were recorded. Meanwhile, for adult goats, the percentage of 33% (238) lice were observed. A chi-square test shows that lice were more widespread in young goats than in adult goats with x<sup>2</sup> value, 28.597. The results revealed that there is a significant association (p<0.05) between predilection sites and age of goats.

## DISCUSSION

In the present study, all 30 goats in dairy farm were infested by lice with the percentage of 100%. In Malaysia, to the best of our knowledge, there is no reports on the occurrence of lice in goats. Hence, this is the first study to identify the lice infestation in goats. Most of ectoparasite studies were reported on the prevalence of ticks and mites' in goats<sup>6,20,21</sup>. In Terengganu, 16 out of 40 Jamnapari and Katjang goats from two different farms were infested with high prevalence of ticks and mites<sup>6</sup>. In Perak, blood parasites, *Theileria* sp. were found in 25 goats because of tick infestations. The study suggested control efforts on tick infestations must be implemented in order to reduce mobility and mortality in goats<sup>21</sup>. Thus, the present study observed the omnipresent of lice infestation in goats could be due to different climatic condition. It was documented that the lice infestations were influenced by climatic condition and not conformed to geographical distribution<sup>23</sup>. In the present study, the climatic condition was warm and humid which can stimulate the infestation of lice among goats. According to Dadas *et al.*<sup>24</sup> lice infestations were higher in winter, declining in spring and low during summer season.

In addition, the identification of lice as the only types of ectoparasites in the present study might be associated with the preference condition of ectoparasites to inhabit. Optimum temperature and humidity attributed to reproduction of lice<sup>25</sup>. The present study was conducted in tropical environment. Tropical climates promote a higher number of parasitic load in goats<sup>14</sup>. Furthermore, lice infestation act as an indicator of some other latent problems such as malnutrition or chronic diseases<sup>10</sup>. Hence, the goats from this study area were more likely having such diseases which require extra attention by the goat farmers. Malnutrition was one of the factors on the higher occurrence of disease among goats. Moreover, the prevalence of lice was higher in debilitated animal which exacerbated by lack of nourishment<sup>26</sup>.

In the present study, the goats were reared under intensive management system which defines that the goats were kept in a closed setting with a limited type of pasture. Therefore, goats were less exposure on open grazing behavior. Less grazing behavior attributed for a lesser number of ectoparasites to be identified<sup>27</sup>. Although the goats were not exposed to open grazing, goats were placed too close to one another with four to six goats in each pen. Packed condition in the pens will increase the stress level among goats. Goats with higher level of stress will exhibits higher lice infestations than goats with lower stress level<sup>28</sup>. The arrangement facilitated lice infestation from one goat to another goat by direct physical contact<sup>10</sup>. This findings with the agreement from a study done by Bekele *et al.*<sup>29</sup> which reported that this type of arrangement create opportunity for lice to infest through direct physical contact easily. Apart from that, lice can also transmit their diseases through attachment of flies called as phoresy as an alternative mode of transmissions<sup>10</sup>.

Lice was characterized as a site-specific which influenced by its capability to reach blood capillary of the hosts easily<sup>12</sup>. The present study shows that body area had the highest susceptibility of lice infestation in goats. The finding in agreement with Adang *et al.*<sup>30</sup> which discovered that lice were more likely to infest on body parts as lice able to reach blood capillary area easily. Higher prevalence of lice infestation on body region might be explained by the nature of lice which require fleece for their development<sup>29</sup>. The presence of hairs or feathers were required for the development and survival of lice<sup>14,31</sup>.

Apart from surrounding environment, age and sex of the animals are vital factors of lice infestations<sup>32</sup>. In the present study, the prevalence of lice was significantly higher in female goats than male goats. The present study similar to a previous research that reported the female goats were more vulnerable to lice infestations as compared to male goats<sup>32</sup>. The prevalence of ectoparasitic infestations was influenced by hormonal changes which experienced by female goats during lactation and pregnancy stages. This is due to higher level of progesterone and prolactin which induced higher vulnerability of lice infestations on female goats<sup>33</sup>. Female goats exhibit higher level of lice infestation due to low immunity and less activity level than male goats<sup>24</sup>. Similarly, the finding was associated with another study that found higher lice infestation on female goats because of low level immunity during lactation and pregnancy<sup>12</sup>. Besides, infected male goats can transmit the lice to healthy female goats during mating<sup>12</sup>.

The present study also found that young goats had higher prevalence of lice infestation than adult goats because poor living condition in the pen. Congested living arrangement for young goats in the pen favoured lice to transmit from one to another easily<sup>29</sup>. Moreover, poor sanitation condition of pen increased the transmission of lice<sup>7</sup>. Apart from that, in this study, the young goats were placed apart from their mothers. The separation can cause lacking grooming behavior from mothers to their kids. Behaviour known as maternal grooming may help in reducing the lice infestations of young goats<sup>33</sup>. Lack of grooming weakened goats' body condition as lice were left undisturbed. The behaviour attributed to the higher occurrence of lice infestations among young goats<sup>23</sup>. Poor body condition of young goats than adult goats stimulates higher lice infestation in young goats<sup>33</sup>. Besides that, the lower prevalence of lice infestation in adult goats due to most of adult goats are killed for meat while only few of adult goats are kept in the pen for further production<sup>34</sup>.

Finally, high level of immunity on adult goats shielded them from ectoparasitism<sup>26</sup>. Weak defense mechanism of

young goats also might contribute to ectoparasitic infestations. Moreover, goats were active at the young age and competing for survival which eventually exposed to ectoparasitic infestations<sup>26</sup>. Hence, in this study, young goats were significantly higher occurrence of lice infestation than the adult. On the other hand, a study done by Sarkar *et al.*<sup>35</sup> showed higher prevalence of lice infestation in adult goats and goat kids due to less developed of goat kids' immune system and exhausted immune system of adult goats.

To decrease the prevalence of lice infestation among goat herds, farm owners need to apply suitable pesticide routinely especially before warm and wet season arrival. Thorough education to the farm owners and cost-effective control strategies need to be implemented to minimize this problem. Further research to investigate the effect of lice infestation on the production, health and performance of goat herds are suggested.

## **CONCLUSIONS**

In conclusion, lice were identified in all Saanen goats in the dairy goat farm, Kuantan, Malaysia. The body of goats was vulnerable to lice infestation in goats. Age and sex were significantly associated with lice infestation. Tropical climates and poor living arrangement of goats in the pens enhanced the transmission of lice infestation. Poor hygienic condition in the pens can prone to widespread of lice infestation among goats. Therefore, good sanitary condition and proper ectoparasite control are needed to reduce the transmission of lice in goat herds.

## **SIGNIFICANCE STATEMENT**

This study is the first study conducted in Malaysia that reveal the prevalence of lice infestation in goats. This study discovers the prevalence of lice infestation among goats in Kuantan, Malaysia and increases the awareness of lice infestation in goats among the goat farmers. It could be suggested that goat farmers can prevent or minimize the lice infestation in goat herds through proper pesticide control and thorough education pertaining to this matter.

## **ACKNOWLEDGMENTS**

The authors are very grateful to the farm owner and the workers for their kind cooperation during the study period. For this research, the source of funding is from International Islamic University Malaysia, under IIUM Research Initiative Grants Scheme Foundation Project (RIGS) no. 16-301-0465.

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