PREVALENCE OF ECTOPARASITES (LICE) AMONG DOMESTIC ANIMALS (BUFFALO, GOAT AND PIG) OF KHANIYABAS RURAL MUNICIPALITY-3, DHADING DISTRICT, NEPAL

A PROJECT WORK SUBMITTED TO THE

DEPARTMENT OF ZOOLOGY

AMRIT CAMPUS

INSTITUTE OF SCIENCE AND TECHNOLOGY

TRIBHUVAN UNIVERSITY

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BACHELOR OF SCIENCE (B.Sc.) IN ZOOLOGY

BY

BINA TAMANG

Symbol No: 500330030

T.U. Registration No: 5-2-33-191-2019

[SEPTEMBER, 2024]

RECOMMENDATION

This is to recommend that **Bina Tamang** (symbol no: 500330030, T.U. Registration No: 5-2-33-191-2019), has carried out project work entitled **"Prevalence of Ectoparasites (Lice) Among Domestic Animals (Buffalo, Goat And Pig) of Khaniyabas Rural Municipality-3, Dhading District , Nepal"** for the requirement to the project work in Bachelor of Science (B.Sc.) degree in Zoology under my supervision in the Department of Zoology, Amrit Campus, Institute of Science and Technology (IoST) Tribhuvan University (T.U.), Nepal.

To my knowledge, this work has not been submitted for any other degree.

She has fulfilled all the requirements laid down by the Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the submission of the project work for the partial fulfillment of Bachelor of Science (B.Sc.) degree.

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Supervisor

Dr. Dipak Gupta

Assistant Professor

Department of Zoology

Amrit Campus

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Bina Tamang

Symbol No: 500330030

T.U. Reg. No: 5-2-33-191-2019

ABSTRACT

Domestic animals are kept in a farming environment to perform work and supply a variety of products like meat, eggs, milk, fur, leather, and wool.The primary ectoparasites affecting domestic animals include fleas, mites, lice, and ticks. These parasites can cause various forms of harm to the animals and lead to substantial losses in productivity. The aim of the study was to assess how common lice infestations are among domestic animals (buffalo, goat and pig) in Khaniyabas - 3, Dhading district, Nepal. Ectoparasites were examined from 200 domestic animals (75 buffaloes, 100 goats and 25 pigs). Among them ectoparasites (lice) were collected from 30 buffalo, 50 goat and 5 pig. They were collected by handpicking, combing and picking up by using forceps.The collected ectoparasites were kept in vials containing 70% alcohol, and slides were made for analysis using different identification methods. Among 200 domestic animals examined, 85 (42.5%) animals were found infested with ectoparasites i.e. lice. Out of 75 buffaloes examined, 30 (40%) were found infested with louse (*Haematopinus tuberculatus*). However among 100 goats were examined, 50 (50%) were found infested by lice. Where the prevalence of lice *Damalinia caprae* and *Linognathus stenopsis* were 26% and 24% respectively. And out of 25 pigs examined, only 5(20%) were found infested with lice (*Haematopinus suis*).Among four different lice species i.e; *Haematopinus tuberculatus*, *Damalinia caprae*, *Linognathus stepnopsis* and *Haematopinus suis* they belongs to four order i.e; Siphunculata, Mallophaga, Phthiraptera and psocodea respectively. Domestic animals hold significant commercial value for farmers, making it essential to conduct further studies to better understand the dynamics of ectoparasitism.

Keywords: diversified products, *Damalinia caprae, Haematopinus tuberculatus, Haematopinus suis, Linognathus stenopsis*

शोधसार

कृषि क्षेत्रमा घरपालुवा जनावरहरु काममा लगाउन र विविध बस्तुहरु ,जस्तैः मासु, अण्डा, दूध,रौ,छाला र ऊन उत्पादन गर्नका लागि पाल्ने गर्दछन् । घरपालुवा जनावरहरुमा पाईने मुख्य बाह्य परजिविहरु उपियाँ,माइट्रस, जुम्रा र किर्नो आदि हुन ।तिनीहरुले जनावरहरुलाई नकरात्मक असर साथै उत्पादनलाई समेत घटाउन सक्छन । यस अध्ययनको मुख्य उदेश्य खनियाबास गाउँपालिका वडा नं: ३, धादिङ जिल्ला, नेपालको घरपालुवा जनावरहरु (भैंसी, बाख्रा र सँुगुर) मा रहेको बाह्य परजिवी (जुम्रा) को ब्यापकताको बारेमा अध्यान गर्नु हो । यसको लागि २०० वटा घरपालुवा जनावरहरु (७५ वटा भैंसी, , १०० वटा बाख्रा र २५वटा सँुगुर) हरुको अवलोकन गरिएको मध्येबाट (३० वटा भैंसी, ,५० वटा बाख्रा र ५वटा सँुगुर) बाह्य परजिविहरु संकलन गरियो । तिनीहरुलाई हात,काईयो र चिम्टाको मद्दतबाट संकलन गरि ७० प्रतिशत रक्सि भएको सिसिहरुमा सुरक्षित साथ राखियो ।त्यसपछि प्रयोगशालामा ल्याएर स्लाइडहरु तयार गरि विभिन्न पहिचान कुन्जीहरुको मद्दतद्धारा पहिचान गरियो। परिक्षण गरिएका २०० घरेलु जनावरहरु मध्ये ८५ (४२.५%) जनावरहरुमा बाह्य परजिवि (जुम्रा) को संक्रमण देखिएको थियो । परिक्षण गरिएको ७५ वटा भैंसीहरु मध्ये ३०(४०%)मा जुम्रा (*Haematopinus tuberculatus*) को संक्रमण पाइयो । तर १०० वटा बाख्राहरुमध्ये ५० (५०%)वटालाई जुम्राले संक्रमण गरेको पाइयो । जहाँ *Damalinia caprae* र *Linognathus stenopsis* प्रजातिका जुम्राहरु क्रमश : २६% र २४% थियो। र परिक्षण गरिएको २५ सँुगुरहरु मध्ये मात्र ५ (२०%) लाई जुम्रा (*Haematopinus suis*) को संक्रमण पाइयो । यी चार अलग अलग जुम्राका प्रजातिहरु क्र्मशस् Siphunculata, Mallophaga, Phthiraptera र Psocodea अडर भित्र पर्दछ । घरपालुवा जनावरहरु किसानहरुका लागि व्यवसायिक रुपमा महत्वपुर्ण छन । त्यसैले बाह्य परजिवीको गतिशिलता बुझ्न थप अध्ययनहरु गरिनुपर्दछ ।

LIST OF ABBREVIATIONS

ARS	Agricultural Research Station
CSA	Community-Supported Agriculture
DPX	Distyrene Plasticizer and Xylene
DLSO	District Livestock Service Office
eg	exempli gratia/ for example
etc	et cetera
GDP	Gross Domestic Product
i.e.	that is
KOH	Potassium hydroxide
RVDL	Regional Veterinary Diagnostic Laboratory
sq. km.	Square kilometer

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CHAPTER 1

1. INTRODUCTION

1.1: Background

Nepal, located in South Asia, lies between two major countries: China and India. It covers an area of 147,181 square kilometers (Pandit et al., 2006). It is roughly rectangular in shape, stretching about 885 kilometers from east to west, while its width from north to south is approximately 193 kilometers (Nepal et al., 2020). Nepal has the greatest altitude change of any location on earth (Karki et al., 2016). Nepal features a varied landscape, consisting of fertile plains, forested subalpine hills and 8 of the 10 tallest mountains in the world, including Mount Everest, the highest peak on Earth.(Gurung, 2024). Kathmandu is the capital of the country and its most populous city. Nepal is home to Mount Everest and birthplace of Lord Buddha (Nepal et al., 2020).

Nepal is primarily an agricultural nation, with around 30% of its population involved in farming (Br et al., 2018). In Nepal, people rear different animals like goats, pigs, cattle, dogs, cats, buffaloes, oxen, chickens. Livestock are domesticated animals kept in a farming environment to provide labor and produce various products for consumption, including meat, eggs, milk, fur, leather and wool. So, these domestic animals are very beneficial to mankind and are useful in our day to day life. Most of the animals exhibit all over the country, whether it is for home purposes or business. Agriculture and animal husbandry for a village of farmers is a backbone in the rural community (Br et al., 2018).

1.2: Domestic animals in Nepal

Humans and domestic animals have shared a long-standing relationship (Waiblinger et al., 2006) . People have taken certain animal species into their homes, and this domestication has fostered the development of connections between humans and animals (Cantarero et al., 2013). Farmers typically own a small number of animals, but they raise a variety of species (Wilson, n.d.). Nepal’s traditional rural livestock systems largely rely on free-range methods (Pradhanang et al., 2015a). The most commonly raised native animals include sheep, goats, pigs, poultry, and cattle (Mazinani & Rude, 2020). This form of animal husbandry is a vital agricultural practice for almost all rural communities and is closely integrated with farming, requiring minimal resources (Ponnusamy & Pachaiyappan, 2018). However, native livestock have received limited attention from research and development organizations in Nepal, despite some interest in their use and potential in the 1990s and early 2000s (Dey et al., n.d.). Domestic animals in Nepali farming systems do not simply provide milk and meat for human subsistence. Their roles are much more intricate in addition to religious and social considerations are intimately related to sustainable production (Acharya et al., 2019). Livestock provide power to till the land and help maintain soil fertility through production of organic manure from dung and compost. Although most farmers have a only small number of animals, they tend to raise multiple species (Herrero et al., 2013). The emphasis on different domestic animal species varies based on factors like personal preference, social status, local environment, and market opportunities (Rege et al., 2011). Rearing multiple species is a practical way to reduce risks, but it can pose management challenges and limit high output of individual products. Livestock farming plays a crical role by providing valuable animal protein through meat and eggs. In addition, it supplies farmyard manure, which is essential for maintaining soil fertility and contributes to social status in many rural communities (Sinkule & Moody,1987). In Nepal, domesticated animals are kept for producing milk, meat, eggs, wool and for performing labor (Wilson, 1997) . It not only supports agriculture by promoting crop cultivation but also enhances soil fertility through the use of animal dung. In the hilly and mountainous regions, animals like yaks, donkeys, mules, sheep, and goats are used for carrying goods, whereas in the Terai region, bullocks and buffaloes are utilized to pull carts (Samanta et al., 2019). Livestock farming is also a key income source for farmers (Saxena et al., 2017). Livestock farming is a key agricultural sub-sector in Nepal (Jha et al., 2021). The livestock sector significantly contributes to Nepal’s economy, accounting for about 11% of the national GDP (Samanta et al., n.d.). Nepalese farmers manage a diverse range of livestock, such as buffaloes, goats, pigs, cattle, oxen, and dogs (Sapkota & Karmacharya, 2022). Key products from animal husbandry include milk, meat, butter, and wool, with dairy production increasing due to a growing number of milk-producing animals (Joshi et al., n.d.). Although the adoption of modern tools in animal farming is still in its early stages in Nepal, the sector holds great potential for further development (Pradhanang et al., 2015b). Meat and eggs are also important outputs of livestock farming (De Vries & De Boer, 2010). Boosting the productivity of rural livestock can significantly help reduce poverty, enhance household food security at the household level and increase protein consumption for both urban and rural communities (Salem et al., n.d.). Furthermore, the health of animals plays a vital role in maximizing the conversion of livestock feed into animal protein, benefiting human consumption and providing income for farmers (Horst et al, 1999)

1.3: Ectoparasites and their impact

Ectoparasites are organisms that live on the outer surface of their hosts, for e.g.; ticks, mites, fleas and lice of various terrestrial vertebrates (Wall, 2007a). Ectoparasitic arthropods and nematods share their ability to cause visible skin lesions in their hosts (Wall & Shearer, 2001). Infestations by these parasites often result in intense itching, causing significant irritation and discomfort.. Ectoparasites commonly ticks, mites and lice are important parasites because of the disease transmission, blood feeding habit and skin damage in most of the livestock population (CSA, 2004). Ectoparasites that permanently inhabit their hosts possess specific characteristics, such as being small, flattened in shape, and capable of moving across the host's body surface or through its hair (Nelson et al., 1975) . Ectoparasites like ticks and fleas can inflict serious harm on a variety of vertebrates, including domestic animals such as cattle and buffalo. These infestations can lead to to anemia, weakness, stress, and in severe cases, death of the affected animals.Domestic animals are more vulnerable to the attack of ectoparasites such as ticks and flies (Muhammad et al., 2021). Ectoparasites greatly impact animal management, productivity, and the well-being of domestic animals (Colebrook & Wall, 2004). Livestock, such as cattle, buffaloes, and sheep, are vulnerable to infections from blood-sucking ectoparasites such as ticks and lice (Hasson, 2016). Lice and mites often cause dermatitis, which can lead to hair loss (alopecia) and necrotic lesions. Mange in particular causes severe itching, leading animals to bite and scratch the affected areas (Nateneal Tamerat Beyene, 2016a). In rural areas, where small-scale animal husbandry is common, animal health is closely tied to public health and economic concerns, as ectoparasites complete their entire life cycle on the bodies of domestic animals (Rahdar et al., 2015). These parasites reside, feed, and find shelter on or just beneath the host's skin and within its hair. (Nizam, n.d.). This leads to irritation, hypersensitivity, dermatitis, and hair loss, and may also cause damage to the skin and underlying tissues. Some ectoparasites can also transmit viruses, bacteria, protozoa, and other pathogens, including zoonotic diseases (Wall, 2007b). The most common ectoparasites in domestic animals include lice, mites, ticks, and fleas. Additionally, another study carried out in Wards 2 and 3 of the Phedilkhola rural municipality in Syangja reported that the occurrence rates of lice, ticks, and fleas were 42.33%, 16.66%, and 5.66%, respectively (Gautam, n.d.) . The average number of goats per household was 5.48 ± 0.15, with a female-to-male ratio of 6:5. Primarily, women in the household were responsible for managing the goats (Dhakal et al., 2021).

1.4: OBJECTIVES

1.4.1: General objective

- To determine the prevalence of ectoparasites (lice) among domestic animals (buffaloes, goats, and pigs) in Ward No. 3 of Khaniyabas Rural Municipality, Dhading, Nepal.

1.4.2: Specific objectives

- To examine the taxonomic classification of ectoparasites (lice) found on domestic animals (buffaloes, goats, and pigs).
- To compare the prevalence of ectoparasites of domestic animals (buffalo, goat and pig).

1.5: Significance of the study

Various animals such as goats, buffaloes, pigs, cattle, oxen, chickens, and dogs are raised by the people. Despite many people being involved in livestock farming, they lack comprehensive knowledge about the effects of ectoparasites on animal health. This study is the first of its kind in Khaniyabas-3, Dhading, aiming to identify and understand the impacts of ectoparasites. The findings will assist farmers in improving their livestock's production performance.

CHAPTER 2

2. LITERATURE REVIEW

Ectoparasites are a frequent cause of skin diseases in domestic animals. Globally, many studies have been conducted on ectoparasitic infestations in domestic animals, but only a limited number have been carried out within the national context of Nepal.

2.1: Global Review

(Sertse & Wossene, 2007) studied in the eastern region of Amhara, Ethiopia, between November 2003 to March 2004, within the goal of determining the prevalence of ectoparasites and identifying related risk factors. Out of 752 goats examined, 56.4% were found to be infested with one or more types of ectoparasites, including *Linognathus* spp. (28.3%), ticks (22.2%), sarcoptic mites (6.1%), and *Ctenocephalides* spp. (8.1%).

(Tasawar et al., 2008) examined 100 buffaloes at a private cattle farm in Multan, Pakistan, showed that 92% were infested with *Haematopinus* spp., 6% with *Damalinia* spp., and 2% with *Linognathus* spp. The study examined the link between the animal's sex and the types of lice: 94.1% of female buffaloes had *Haematopinus* spp., 5.8% had *Damalinia* spp., and 2.35% had *Linognathus* spp.,. However, in males, the infestation rates were 80%, 6.66%, and 0%, respectively.

(Kakar & Kakarsulemankhel, 2008a) investigated in Quetta city,Pakistan, out of 404 cows and 386 buffaloes found that 28.96% of cows and 25.64% of buffaloes were infested with ectoparasites. The prevalence rates for ticks, lice, mites, and mixed infections in cows were 10.14%, 7.17%, 5.19%, and 6.43%, respectively, while in buffaloes, the rates were 7%, 10%, 5%, and 4%, respectively. The study showed that cows had a higher prevalence of ectoparasites compared to buffaloes, which was attributed to differences in their feeding habits and living conditions.

(Natala et al., 2009) conducted a study in Northern Nigeria, updating the records of ectoparasites based on 931 samples submitted to the veterinary Entomology Laboratory at Ahmadu Bello University, Zaria. Out of them 407 (43.72%) were negative, and 524 (56.28%) were positive for pests including lice (11.28%), ticks (15.68%), mites (

23.74%), fleas (3.90%), and myiatic larvae (1.82%). The most common ectoparasites identified were ticks (*Amblyomma variegatum*), mites (*Demodex canis*), lice (*Manecanthus stramineus*), fleas (*Ctenocephalides felis*), and myiatic larvae (*Oestrus ovis*).

(Shiferaw & Onu, 2013a) studied on the prevalence of ectoparasite infestation in cattle a total of 212 cattle examined and found an overall prevalence of 27.3% for single (24.5%) and multiple (2.8%) ectoparasites in Bench Maji Zone, Southwest Ethiopia. The study examined seven species of ectoparasites, including ticks (16.0%), lice (10.4%), and mites (0.9%). Three genera of ticks viz. *Boophilus* sp., *Amblyomma* sp., and *Rhipicephalus* sp., with *Boophilus decoloratus* (8%), *Amblyomma variegatum* (4.7%), and *Amblyomma coherens* (4.2%) being the most prevalent. Among lice, *Linognathus vituli* (4.7%) was the most common. Next, *Haematopinus eurysternus* (3.8%), *Damalina bovis* (1.9%), and *Psoroptes bovis* (0.9%) were recorded.

(Ali et al., 2014) observed a total of 50 buffaloes, 70 sheep, and 13 dogs were inspected for ectoparasites in Iraq. The infection rate varied from 20% to 100%. A total of 89 ectoparasites were identified, i.e. *Rhipicephalus* spp., *Hippobosus* spp., and *Boophilus* spp.

(Ajith et al., 2017) examined ectoparasitism in goats across two agro-climatic regions of India focused on identifying factors influencing ectoparasite prevalence during the winter season. A total of 320 goats from Uttarakhand and Uttar Pradesh were assessed, with ectoparasite prevalence found to be 90.38% in the lower Shivalik region and 39.29% in Bareilly district. The most common ectoparasites identified were *Bovicola caprae* (chewing lice), Linognathus africanus (sucking lice), Ctenocephalides felis (fleas), and Haemaphysalis spp. (ticks), with pediculosis being the dominant condition.

(Ahmed & Khan, n.d.) performed a survey to assess how lice infestation affects the general health and reproductive activity of buffaloes and cows in Lower Egypt. In the study, a total of 1,583 animals were found and among them 409 (27.73%) were infested with various ectoparasites. Additionally, 192 (47.92%) were specifically infested with lice (*Haematopinus tuberculatus*).

(Sayyad et al., n.d.) conducted from July to December 2015 in Muzaffarabad district, Azad Jammu and Kashmir, Pakistan, on 100 ruminants found varying prevalence rates of ectoparasites in goats: 46.34% in July, 36.58% in August, 31.70% in September, 26.82% in October, 19.51% in November, and 9.75% in December .

(Na, n.d.) examined in Tehsil Nikayal, District Kotli, Azad Jammu and Kashmir, Pakistan, from July 2015 through December 2015, eximined the seasonal prevalence of ectoparasites. The research included 200 animals (126 goats, 72 buffaloes, and 2 sheep). The peak prevalence of ectoparasites was recorded 7.2% in July, and the result found that ectoparasite prevalence was higher in summer compared to winter. Mainly, the percentage of infected buffaloes was 8.33% in July, 8.33% in August, 8.33% in September, 4.16% in October, and 0% in November and December.

(Changbunjong et al., n.d.) identified 11 different types of ectoparasitic arthropods in Tak Province, Thailand, including two species of hard ticks (Ixodidae), three species of fleas (Siphonoptera), and six species of lice with two species each from the suborders Anoplura, Ischnocera, and Amblycera. Among the ectoparasites found on 11 cattle (*Bos indicus*), ticks such as *Rhipicephalus* and *Boophilus*, as well as lice like *Linognathus vituli* (27.3%) and *Solenoptes capillatus* (9.1%), were observed.

2.2 : National Review

(Shrestha, 1977) conducted survey on ectoparasites affecting various vertebrates, including buffaloes, goats, and cows, in the Kathmandu Valley. The study identified 23 species of ectoparasites such as ticks, mites, lice, and fleas from various locations including the central zoo, veterinary hospital, and several neighborhoods.

(Khakural, 2003) conducted the research with the DLSO of Syangja and Tanahun districts, the RVDL of Pokhara and the ARS in Bandipur examining 6,094 goats. The results revealed that 48.2% to 63.75% were affected by parasitic diseases, with 10.26% to 22.63% specifically infested with ectoparasites. The infestation levels of ectoparasites were highest in August and September, and again in April and May.

(Gautam, n.d.) In 2018, studied on the prevalence of ectoparasites among domestic animals found that the overall prevalence of ectoparasites in Wards 2 and 3 was 52% in Phedikhola Rural Municipality, Syangja District, Nepal,. Mainly, the prevalence rates of lice, ticks, and fleas in the area were 42.33%, 16.66%, and 5.66%, respectively.

The prevalence of ectoparasites was recorded at 57.04%, with *Damalinia caprae*, *Boophilus microplus*, and *Ctenocephalides canis* having prevalence rates of 49.29%, 11.97%, and 11.97%, respectively in goats. The overall prevalence of ectoparasites was 48.78%, with *Haematopinus tuberculatus* and *Boophilus* spp. being present at rates of 43.90% and 12.19%, respectively in buffaloes. Similarly, in cows only ticks (*Boophilus microplus*) were found with prevalence of 60%, and in oxen, the prevalence was 47.36%.

CHAPTER 3

3. MATERIALS AND METHODS

3.1: Study area

The research was carried out in Khaniyabas -3, Kuri, Dhading, Nepal. Khaniyabas is a Gaupalika formerly: village development committee in Dhading district in the Bagmati zone of central Nepal. The local body was formed by merging three VDCs namely Jharlang, Darkha and Satyadevi(Khaniyabas). Khaniyabas has total 5 wards, which are scattered across 121 square kilometers of geographical area. The borders of this rural municipality are touched with Nuwakot district and Rasuwa district in east region, Gangajamuna and Rubivalley Gaupalika in west region, Rubivalley Gaupalika in north region and the Netrawati Gaupalika and Nuwakot district in the southern region.

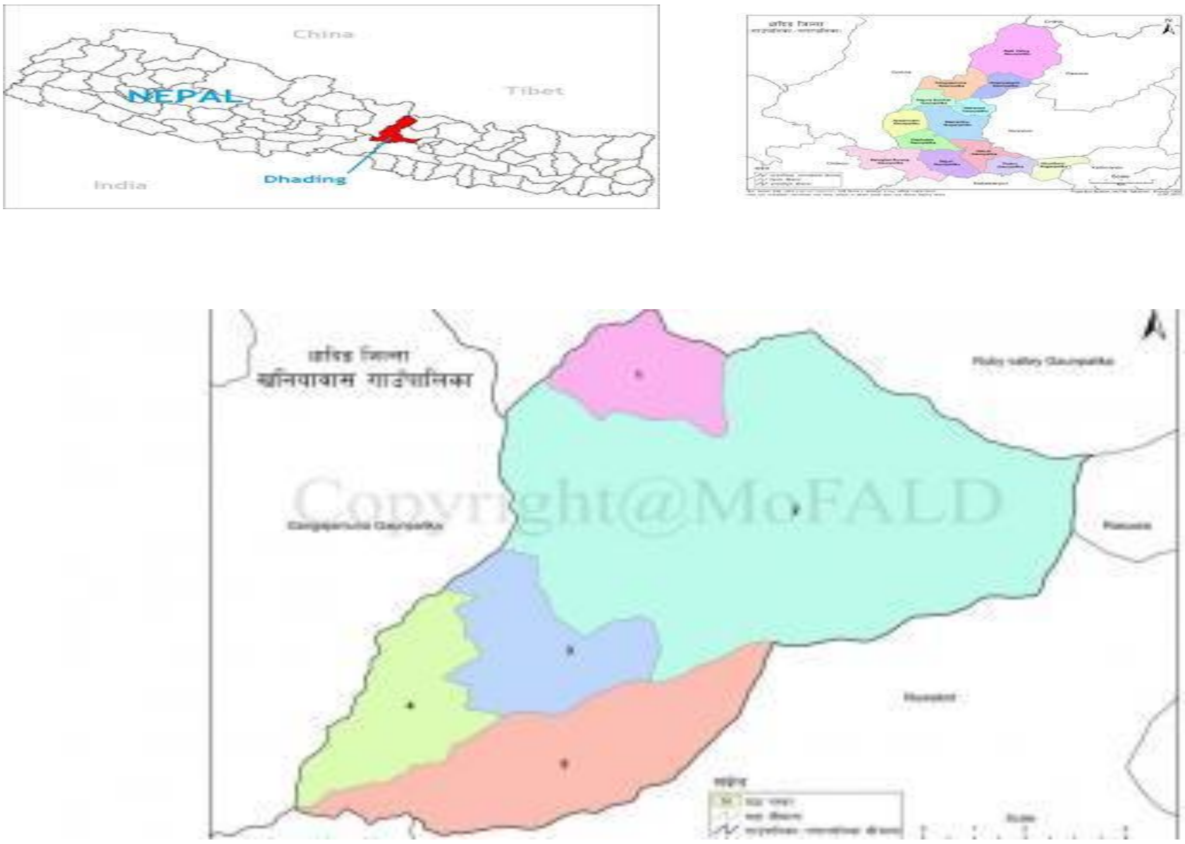

Figure 1 : Map of study area

Source: Nepal Archives.com

Nepalindata,com

3.2: Materials used

3.2.1: Materials for field

- Gloves
- Comb
- Forceps
- Labelled collecting jars

3.2.2: Materials for laboratory

- Apron
- Gloves
- Forceps
- Needle
- Watch glass
- Test tubes
- Microscope
- Slides
- Cover slips

3.2.3: Chemicals used

- KOH 2.5%
- Alcohol series (30%, 50%, 70%, 90%, 100%)
- Xylene
- D.P.X.

3.3: Study design

The research aimed to evaluate ectoparasitic infections in domestic animals within Ward No. 3 of Khaniyabas Rural Municipality. The design of the study is outlined as follows:

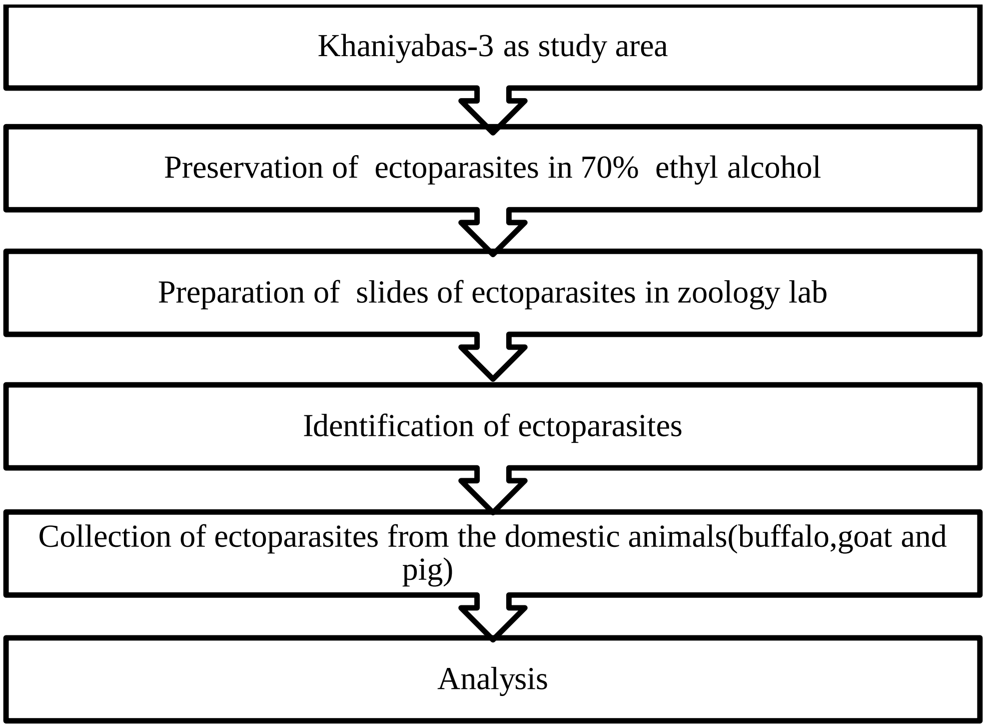

Figure 2: Flow chart of Research Design

3.3.1: Collection of sample size

Ectoparasites were assessed in 200 domestic animals (75 buffaloes, 100 goats, and 25 pigs) from Ward No. 3 of Khaniyabas Rural Municipality in Dhading District.

3.3.2: Collection of sample

Each domestic animal was examined separately, and ectoparasites were gathered through handpicking, combing, and using forceps.

For handpicking, ectoparasites were removed by hand while wearing light surgical gloves. The collected ectoparasites from different animals were stored separately in labeled jars containing 70% alcohol for later identification.

In combing method, each animal was placed on a large white sheet of paper (approximately 2 yards in size), and the ectoparasites were carefully combed out of the animal's fur, especially for goats, onto the paper. The ectoparasites that fell onto the paper were easily collected by hand or with forceps and placed into jars containing 70% alcohol for preservation.

3.3.3: Preservation of sample

The ectoparasites gathered from domestic animals were stored in 70% ethyl alcohol for preservation.

3.3.4: Laboratory works

The ectoparasites were taken to the parasitology laboratory at the Department of Zoology, where slides were made for analysis.

3.3.4.1: Slide Preparation method

First of all, the ectoparasites were washed with clean water and then boiled in KOH until the solution became clear. The mixture was then transferred to a watch glass, rinsed again with water, and subjected to dehydration. Alcohol in concentrations of 30% was added, and the sample was covered with a watch glass for 5 minutes. This process was repeated with 50%, 70%, 90%, and 100% alcohol. Afterward, a few drops of xylene were added, and no white precipitate formed. The sample was then placed on glass slides with drops of DPX, covered with cover slips, and examined under a compound microscope to identify the ectoparasites.

3.3.5: Identification of Ectoparasites

The identification of the collected ectoparasites was based on their morphological features. It was also carried out using information from published literature, such as journals and books (Rony et al., 2010a; Portugaliza & Bagot, n.d.), as well as other published and unpublished articles and online sources.

3.3.6: Analysis

In this study, prevalence was defined as the proportion of host animals infested with a particular parasite. The collected data were recorded and entered into a Microsoft Excel spreadsheet.

CHAPTER 4

4. RESULTS AND DISCUSSION

4. RESULTS

4.1: Taxonomic details of ectoparasites

4.1.1: Taxonomic details of *Haematopinus tuberculatus*

Identification keys to the species level:

1. Ectoparasites of mammals with five-segmented antennae, a short and compact thorax, and a relatively large abdomen with seven visible segments...Siphunculata.
2. Brownish pigmentation along the sides of the abdomen, called paratergal plates, with preural plates present but free tips.
3. Eyes are missing, and the head extends forward behind the antennae; the thorax is wide with noticeable paratergal plates, tibial plates are present, and all three pairs of legs and claws are similar, commonly, found on Artiodactyla and Equida...Haematopinidae.
4. The Haematopinidae family contains only one genus……………………………………………….................*Haematopinus.*
5. A single row of spines on each abdominal segment, observed in buffaloes in Asia.....................................*Haematopinus tuberculatus*.

Photo (1): *Haematopinus tuberculatus* (10x×4x)

Classification

Phylum: Arthropoda

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Siphunculata

Genus: *Haematopinus*

Species: *tuberculatus*

(Burmeister, 1839)

Characteristics:

- Found in buffaloes native to Asia.
- Eyes are either minimized or completely missing.
- All three pairs.Legs and claws are similar.
- Head has temporal angles located posterior to the antennae.
- Distinct paratergal plates are present.

4.1.2: Taxonomic details of *Damalinia caprae*

Identification keys to the species level:

1. The head is broader than the thorax, and the legs are short and uniform……………………………………………………..............Mallophaga.
2. Antennae are thread-like and visible, comprising 3 segments, and parasitize mammals..Trichodectidae.
3. Pleural plates are present, and antennae are identical in both sexes...*Damalinia.*
4. Tarsi with three claws, observed in goats..*Damalinia caprae.*

Photo (2)*: Damalinia caprae* (10x × 4x)

Classification

Phylum: Arthropoda

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Mallophaga

Genus:*Damilinia*

Species: *caprae*

(Gurlt, 1843)

Characteristics:

- Found in goats.
- Also called biting lice of goats.
- Head broad (front usually rounded sometimes triangular)
- Antennae 3 segmented. And alike in both sexes.
- Biting and chewing type of mouth parts present.
- Pleural plates present. And tarsi with 3 claw.

4.1.3: Taxonomic details of *Linognathus stenopsis*

Identification keys to the species level

1. Body is flattened dorso-ventrally, they are wingless and small in size……………………………………………………………………Phthiraptera.
2. They do not have wings and their mouthparts are adapted for piercing the skin and sucking the blood of their hosts………………………… ……..Anoplura.
3. They lack eyes, but they also lack the prominent ocular points …………………………………………………………......……Linognathidae.
4. Head long , front usually pointed …………….…………………..……*Linognathus*
5. Antnnae 5 segmented ……………………..………..………………*stenopsis*.

Classification
Phylum: Arthropoda
Class: Insecta
Subclass: Pterygota
Order: Phthiraptera
Suborder: Anoplura
Genus:*Linognathus*
Species: *stenopsis*
(Burmeister, 1838)

Photo (3): *Linognathus stenopsis* (10x × 4x)

Characteristics:

- Common parasite of goats (*Capra hircus*).
- It is a type of blood-sucking louse that specially infests goats.
- Obligatory permanent ectoparasites, causes considerable harm to hosts.
- Pronotum usually free.
- Legs usually short.
- Paratergal plates absent.

4.1.4: Taxonomic details of *Haematopinus suis*

Identification keys upto species

1. Small and wingless. Have a conical head that is narrower than the thorax. Enlarged tarsal claws are modified for gripping individual hairs of the host………………………………………………………….…….Psocodea.
2. Wings absent………………………………...……………………Anoplura
3. Narrow head with pointed fronts, long lateral antennae with 5 segmented…………………………………..…………...Haematopinidae.
4. Only one genus of Haematopinida…………………..……….*.Haematopinus.*
5. Long mouthparts adapted for sucking blood, lateral spiracle on abdomen with browm plates….………………………………………………………….….*suis.*

Classification

Phylum: Arthropoda

Class: Insecta

Order: Psocodea

Suborder: Anoplura

Genus:*Haematopinus*

Species: *suis*

(Linnaeus, 1758)

Photo (4): *Haematopinus suis* (10x×4x)

Characteristics:

- Commonly known as hog louse.
- It is the only louse found on swine.
- Found primarily on the skin surface of swine, it feeds on blood several times a day from its host.
- Swine that are heavily infested may become nearly bald and in youngs the resulting stress can hinder growth which is a concern for farmers.

4.2: Prevalence of ectoparasites

Out of 200 animals examined, 85 (42.5%) domestic animals (buffalo, goat and pig) were found infested with ectoparasites i.e; lice.

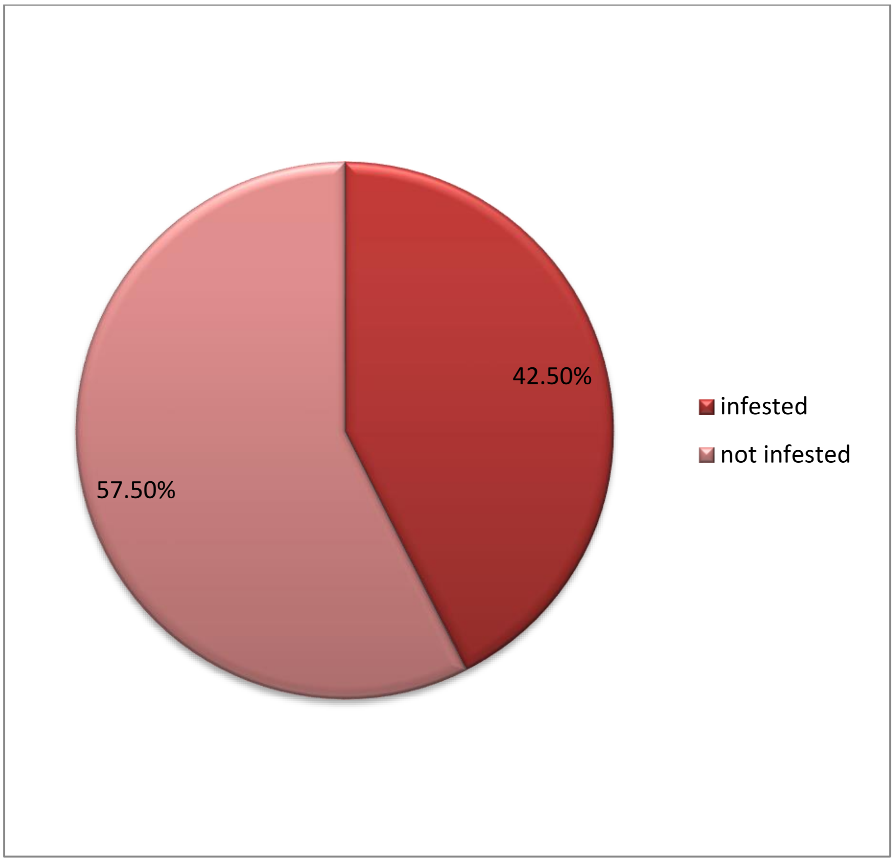

Figure 3: Overall prevalence of ectoparasites (lice)

4.2.1: Prevalence of ectoparasite (lice) on buffaloes

Among 75 buffaloes examined 30 (40%) were observed to be infested with lice (*Haematopinus tuberculatus*).

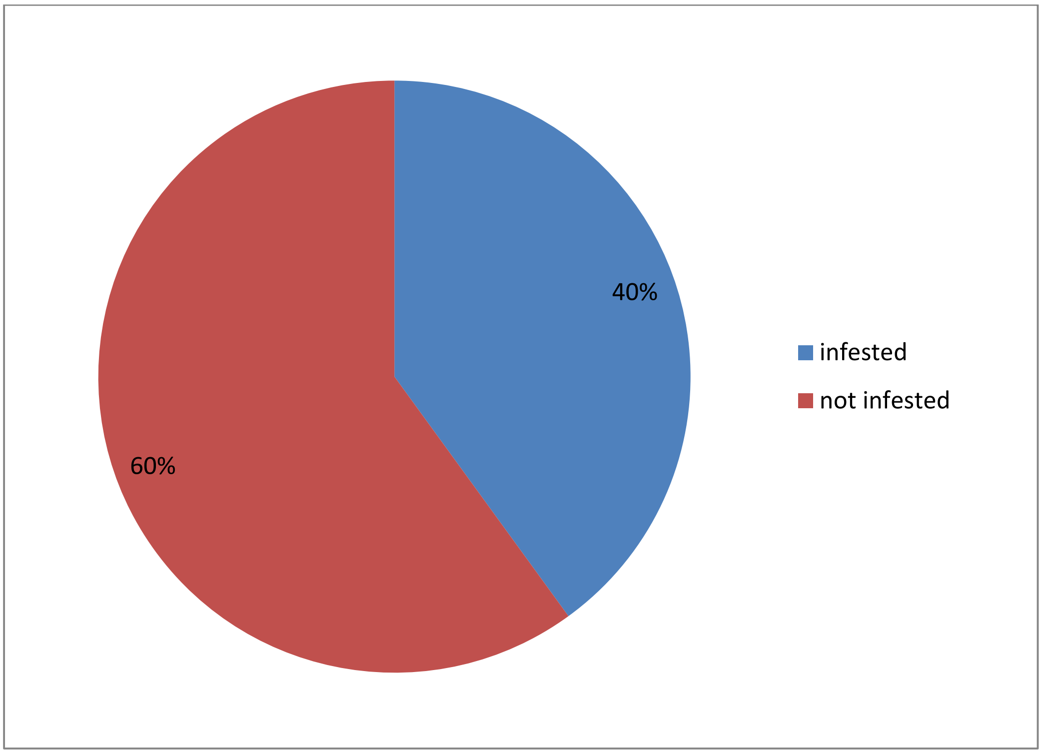

Figure 4: Prevalence of ectoparasites (lice) on buffaloes

4.2.2: Prevalence of ectoparasites on goats

Total of 100 goats inspected, 50 (50%) were found to be affected by ectoparasite i. e; lice. The prevalence of lice *Damalinia caprae* and *Linognathus stenopsis* were 26% and 24% respectively.

Table 1 : Prevalence of ectoparasites (lice) on goats

S.N.	Ectoparasites (Lice)	Number of goats infested	Prevalence
1.	*Damalinia caprae*	26	26%
2.	*Linognathus stenopsis*	24	24%

4.2.3: Prevalence of ectoparasite on pigs

Among 25 pigs were examined only 5 (20%) were found to be infested with lice (*Haematopinus suis*).

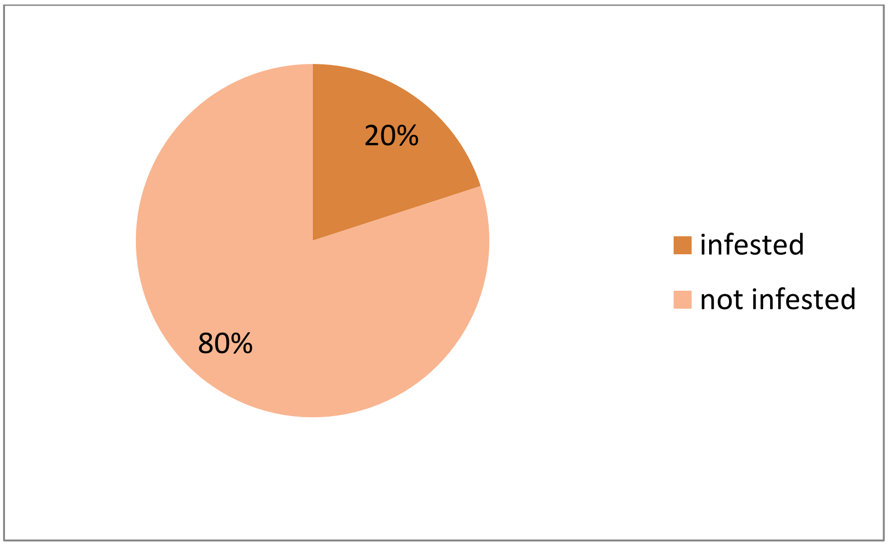

Figure 5: Prevalence of ectoparasites (lice) on pig

4.2.4: Concurency of ectoparasites (Lice) on domestic animals (buffalo, goat and pig)

Of the 85 (42.5%) positive samples, 80 (94.12%) were infested with two or more type of genera while 5 (5.88%) had infestations with only a single genus.

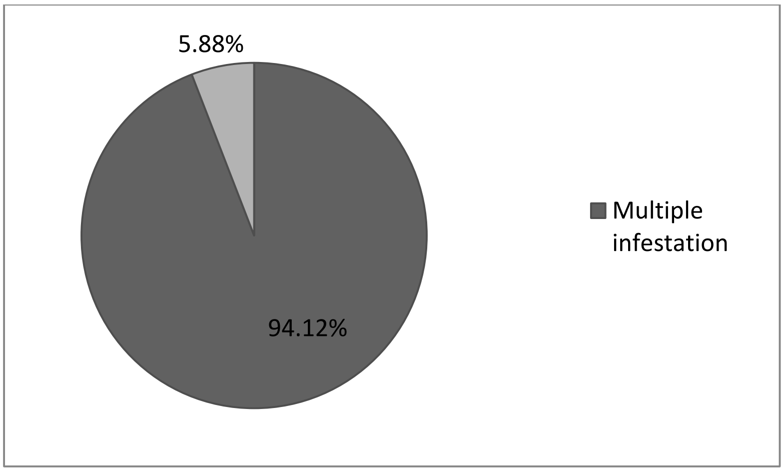

Figure 6: Concurency of ectoparasites (lice) on domestic animals (buffalo, goat and pig)

4.3 DISCUSSION

This study aimed to assess the prevalence of lice infestations on domestic animals—buffalo, goat, and pig—in Ward No. 3 of Khaniyabas Rural Municipality, Dhading District. The presence of lice on these animals is generally influenced by factors such as feeding practices, hygiene, and the area's geographical characteristics. The findings revealed that 42.5% of the domestic animals examined were infested with lice; out of 200 animals, 85 were affected. Specifically, buffaloes had a 40% infestation rate with *Haematopinus tuberculatus*. Among goats, two types of lice were found: *Damalinia caprae* (26%) and *Linognathus stenopsis* (24%). In pigs, the prevalence of *Haematopinus suis* lice was 20%.

These findings highlight the significant impact of ectoparasites in the study area. The results and analysis indicate that lice infestations were more common in buffaloes and goats. This could be attributed to factors such as the lack of modern husbandry practices, insufficient veterinary care, favorable climatic conditions for ectoparasites, poor nutrition in animals, and a lack of awareness among owners about the harmful effects of ectoparasites. All these factors likely contributed to the high incidence of infestations in the area. Likewise, in pig there was less occurrence of infestation by lice.. In previous time there were no any toilet in the study area local people used to f eed them by human defecation. But now there are various changes about health of people as well as domestic animals also. Different types of awareness programme is being conducted and implemented by all. So, the reason behind less pig were affected by lice is, local people education about pig's health , improved husbandry practices, Changes in feeding habit of swine etc.

Only a small number of arthropods have evolved to live directly off other animals (hosts). These parasitic arthropods can target a wide range of hosts, including other arthropods. Most of these parasites either live on the surface of their host's skin or burrow into it, while some invade the host's body internally. Some ectoparasites are highly specific to their host or to particular areas on the host's body. Ectoparasites can have various direct and indirect effects on their hosts. Direct effects may include blood loss leading to anemia and weakness, while indirect effects can involve skin inflammation, itching, and hair loss due to mange mites, or toxic and allergic reactions caused by ticks. Ectoparasites may also function as mechanical or biological vectors

(Nateneal Tamerat Beyene, 2016b).

While there has been extensive research on ectoparasites affecting domestic animals worldwide, there is limited research within the national context. The prevalence of ectoparasites is heavily impacted by climatic and geographic factors. Warm, humid conditions, frequent rainfall, limited grazing areas, contaminated pastures, nutritional deficiencies, and traditional rearing practices all create favorable environments for many ectoparasites to thrive. Some ectoparasites may stay permanently on their hosts or inhibit the host's nest and surroundings, visiting the host periodically. The mechanisms by which parasites find, identify, establish, and sustain contact with their hosts are complex and advanced (Fracasso, 2022). Ectoparasites can cause various issues for animals, including blood loss, the spread of diseases, immune system suppression, and damage to hides and skins (Ghoss et al., 2007). They also serve as both vectors and reservoirs for certain infectious agents (Jongejan and Uilenberg, 2004).

In a recent study by (Gautam, n.d. 2018), it was found that 52% of domestic domestic animals in Ward No. 2 and 3 of Phedikhola Rural Municipality were affected by ectoparasites. Out of 300 animals that were examined, 156 were found to have different types of ectoparasites. The identified external parasites included lice, ticks, and fleas, with occurance rates of 42.33%, 16.66%, and 5.66%, respectively. The prevalence of ectoparasites was highest in goats (57.04%) and buffaloes (48.78%). Specifically, the occurance of the tick *Boophilus microplus* was 60% in cows and 47.36% in oxen.

According to existing literature, common ectoparasites of domestic animals include ticks such as *Boophilus annulatus*, *Boophilus microplus*, *Amblyomma* spp., *Rhepicephalus* spp., and *Hyalomma* spp.; lice such as *Damalinia caprae*, *Linognathus vituli*, and *Haematopinus tuberculatus*; fleas like *Ctenocephalides felis* and *Ctenocephalides canis*; and mites including *Demodex* spp. and *Psoroptes* spp.(Gebreselama,2014a). In the current study conducted in Ward No. 3 of Khaniyabas Rural Municipality, Dhading District, Nepal, only lice were observed. The lice species recorded included *Haematopinus tuberculatus* in buffaloes, *Damalinia caprae* and *Linognathus stenopsis* in goats, and *Haematopinus suis* in pigs. No mites, fleas, or ticks were found in the study area, as the focus was solely on lice.

The present study reported an overall lice infestation rate of 42.5%, which is higher than the 11.28% reported by (Natala et al. 2009). This discrepancy could be attributed to differences in environmental factors, farming practices, and sampling approaches between the studies. Higher lice infestation could also indicate underlying issues for example, poor nutrition and long term illnesss (Wall & Shearer, 1997). Factors Contributing to the higher prevalence in the current study may include management issues,malnutrition, and insufficient veterinary services (Kumsa et al., 2012). In this research, the prevalence of *Haematopinus tuberculatus* in buffaloes was 40%, which is higher than the 4.92% reported by (Kakar & Kakarsulemankhel, 2008b) in Pakistan. The prevalence of *Damalinia caprae* in this study was 26%, higher than the 8.5% reported by (Rony et al., 2010) in Gazipur, Bangladesh. (Khakurel, 2008) discovered a prevalence of 10.26%-22.63% among diseased goats, with differences likely due to varying sampling methods. Variations in results across studies may stem from differences in management and ectoparasite control practices (Gebreselama, 2014b).

The prevalence of *Linognathus stenopsis* in this study was 24%, lower than the 93.3% reported by (Nizamov & Prelezov, n.d.) in Mogila village, Yambol Country. The prevalence of *Haematopinus suis* in this study was 20%, with only 5 out of 25 pigs examined showing lice infestation.

Mixed infestations were also observed in this study, with a rate of 94.12%. This is higher than the 2.8% reported by (Shiferaw & Onu, 2013b) in Bench Maji Zone, Southwest Ethiopia, and greater than the 47% reported by (Gebreselama, 2014c) in Bishoftu Town, Central Ethiopia.

CHAPTER 5

5. CONCLUSION AND RECOMMENDATION

5.1: CONCLUSION

The present study examined the prevalence of ectoparasites (lice) in domestic animals (buffaloes, goats, and pigs) in Ward No. 3 of Khaniyabas Rural Municipality, Dhading. The findings indicate that ectoparasites are a significant factor affecting animal well-being in the area. Among the 200 animals examined (75 buffaloes, 100 goats, and 25 pigs), the overall prevalence of lice was 42.5%. Specifically, the prevalence of *Haematopinus tuberculatus* in buffaloes was 40%, while lice infestations in goats included *Damalinia caprae* at 26% and *Linognathus stenopsis* at 24%. The prevalence of *Haematopinus suis* in pigs was 20%.

The study found that the lice prevalence in buffaloes and goats was higher than usual, attributed to inadequate animal care, insufficient veterinary knowledge and low understanding about external parasites. Goats, with a 50% infestation rate, were particularly more susceptible compared to buffaloes and pigs. Contributing factors to the high prevalence include poor management, inadequate grazing areas, nutritional deficiencies, traditional rearing practices, and local climatic and geographic conditions. The higher prevalence observed is concerning and highlights the need for health awareness programs for domestic animals in the area.

5.2: RECOMMENDATIONS

Based on the conclusions above, the following recommendations are suggested:

- Proper husbandry practices should be employed.
- Molecular techniques should be applied for species level identification.
- Extensive public education about domestic animal should be created.
- Vaccination program and sanitation of domestic animals is needed to minimize the risk.

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APPENDIX

APPENDIX I : Photoplates

Some photo of ectoparasite collection during field work

Photo (5): *Haematopinus tuberculatus* collecting from buffaloes

Photo (6): lice (*Danalinia caprae* and *Linognathus stenopsis*) of goat

Photo (7): *Haematopinus suis* collecting from swine

Some photo of preparing slides and examination of slides

Photo (8): Preparing slides

Photo (9): Examination of slides

Photos of ectoparasites under compound microscope

Photo 10: Head of *Haematopinus tuberculatus* (10x×4x)

Photo 11: Abdomen of *Haematopinus tuberculatus* (10x×4x)

Photo12: Legs of *Haematopinus tuberculatus* (10x×0.25)

Photo 13: Head and thorax of *Damalinia caprae*(10x×4x)

Photo (14): Pleural plates of *Damalinia caprae* (10x × 4x)

Photo (15): Head and thorax of *Linognathus stenopsis* (10x ×4x)

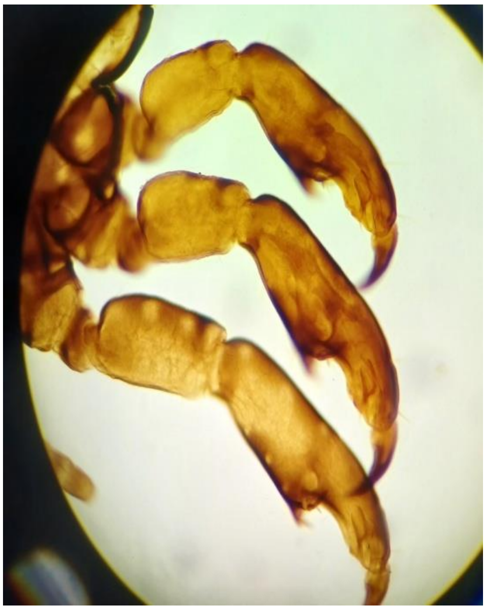

Photo (16): Head of *Haematopinus suis* (10x × 4x)

Photo (17): Legs of *Haematopinus suis* (10× 0.25)

Photo (18): Abdomen of *Haematopinus suis* (10x × 4x)