PREVALENCE OF ECTOPARASITES AMONG DOMESTIC ANIMALS OF PHEDIKHOLA RURAL MUNICIPALITY, SYANGJA DISTRICT, NEPAL

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In partial fulfillment of the requirements for the award of the degree of Master of Science
in
Zoology with special paper Parasitology

Submitted to

Central Department of Zoology
Institute of Science and Zoology
Tribhuvan University
Kirtipur, Kathmandu
Nepal

May, 2018

DECLARATION

I hereby declare that the work presented in this thesis has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by the reference to the author(s) or institution(s).

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RECOMMENDATION

This is to recommend that this thesis entitled **"PREVALENCE OF ECTOPARASITES AMONG DOMESTIC ANIMALS OF PHEDIKHOLA RURAL MUNICIPALITY, SYANGJA DISTRICT, NEPAL"** has been carried out by Miss. Sabina Gautam for the partial fulfillment of Master's Degree of Science in Zoology with Special paper "Parasitology". This is her original work and has been carried out under my supervision. To the best of my knowledge, this thesis work has not been submitted to any other degree in any institutions. I recommend that this thesis has been accepted for partial fulfillment and of the requirement for degree of Master's of Science in Zoology especially in Parasitology.

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LETTER OF APPROVAL

On the recommendation of supervisor "Mr. Janak Raj Subedi", this thesis is submitted by Miss Sabina Gautam entitled **"PREVALENCE OF ECTOPARASITES AMONG DOMESTIC ANIMALS OF PHEDIKHOLA RURAL MUNICIPALITY, SYANGJA DISTRICT, NEPAL"** is approved for the examination and submitted to the Tribhuvan University in partial fulfillment of the Master's Degree of Science in Zoology with special paper "Parasitology".

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CERTIFICATE OF ACCEPTANCE

This thesis work is submitted by Miss Sabina Gautam entitled **"PREVALENCE OF ECTOPATASITES OF DOMESTIC ANIMALS OF PHEDIKHOLA RURAL MUNICIPALITY, SYANGJA DISTRICT, NEPAL"** has been accepted as a partial fulfillment of the Master's Degree of Science in Zoology with special paper "Parasitology".

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Sabina Gautam

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List OF ABBREVIATIONS

CCHF	Crimean Congo Hemorrhagic Fever
CDZ	Central Department of Zoology
CI	Confidence Interval
DPX	Distyrene Plasticizer and Xylene
FAO	Food and Agriculture Organisation
i.e.	That is
KOH	Potassiun hydroxide
MoLD	Ministry of Livestock Development
NAST	National Academy of Science and Technology

ABSTRACT

Domestic animals are especially tamed because of their usefulness as work animals, food sources etc. Main ectoparasites found in domestic animals are fleas, mites, lice, ticks. They may harm the animals in many ways and cause significant loss in production. The purpose of the study was to determine the prevalence of ectoparasites of domestic animals of ward no. 2 and 3 of Phedikhola rural municipality, Syangja district, Nepal. Ectoparasites were collected from 300 domestic animals by random sampling method. They were collected by hand picking and brushing method in June 2017. They were preserved in vials containing 70% alcohol and slides were prepared and identified by using different identification keys. Analysis of the result was done by using MS-Excel 2010 and "R" version 3.3.1 software packages. Among 300 animals examined, 156 (52%) animals were found infested with ectoparasites like lice, ticks and fleas. The overall prevalence of lice, ticks and fleas were 42.33%, 16.66% and 5.66% respectively. Identification was done upto species level. Out of 142 goats examined 81 (57.04%) were found infested with louse (*Damalinia caprea*), tick (*Boophilus microplus*) and flea (*Ctenocephalides canis*) and their prevalence was 49.29%, 3.52% and 4.22% respectively. Among 123 examined buffaloes 60 (48.78%) were found to be infested by louse (*Haematopinus tuberculatus*) and tick (*Boophilus microplus*) the prevalence rate of 43.90% and 12.19%. Out of 10 cows were examined 6 (60%) were found to be infested with tick (*Boophilus microplus*), similarly among 19 Oxen examined 9 (47.36%) were found to be infested with tick (*Boophilus microplus*). The distribution of all ectoparasites on all animals was found insignificant. Domestic animals are commercially important to farmers so more studies should be done to understand dynamics of ectoparasitism.

1. INTRODUCTION

1.1 Background

Domestic animals mean the animals of species of vertebrates that has been domesticated by humans so as to live and breed in tame condition and depend on humankind for survival. The word, domestic, means that a species of animal has lived alongside humans for so many years that they are no longer considered wild. Humans keep many kinds of animals as domestic animals. They are especially tamed because of their usefulness as work animals, food sources etc. Examples of domestic animals are cows, buffaloes, horses, oxen, goats, pigs etc. Livestock are domesticated animals raised in an agricultural setting to produce commodities such as meat, milk, leather, and wool. The term is often used to refer solely to those raised for food, and sometimes only farmed ruminants, such as cattle and goats. In recent years, some organizations have also raised livestock to promote the survival of rare breeds. The breeding, maintenance, and slaughter of these animals, known as animal husbandry, is a component of modern agriculture that has been practiced in many cultures since humanity's transition to farming from hunter-gatherer lifestyles. Animal husbandry practices have varied widely across cultures and time periods. Originally, livestock were not confined by fences or enclosures, but these practices have largely shifted to intensive animal farming, sometimes referred to as "factory farming". These practices increase yield of the various commercial outputs, but have also led to negative impacts on animal welfare and the environmental. Livestock production continues to play a major economic and cultural role in numerous rural communities. The importance of rural livestock in the national economy of developing countries and improving the nutritional status and income of many smallholder farmers and landless communities is highly rated (Creevey, 1991).

1.2 Domestic animals in Nepal

Nepal's Traditional rural animal production systems are mainly based on free-range. The indigenous animals mostly reared are sheep, goats, pigs, poultry and cattle. It is an essential agricultural activity of almost all rural communities and is an integral part of the farming systems and needs low inputs. Livestock rearing provides scarce animal protein as meat and eggs; farm yard manure, prestige and act as a reliable source of petty cash (FAO, 1987). In Nepal domesticated animals raised to produce milk, meat, eggs, wool, labor, etc. Livestock farming is used for encouraging and pulling people into cultivation, and the dung of animals is used to enrich the soil fertility. In the hills and the mountains, yaks, donkey, mules, sheep and goats are used to transport goods. In the Terai, bullocks and buffalo bulls pull carts. Livestock farming is also an important source of protein through the consumption of milk, milk products, eggs, meat, etc. It also acts as important source of cash income for farmers. Livestock farming is an important agricultural sub-sector in Nepal. Eighty three percent of the total population of Nepal lives in the rural areas and their principal means of livelihood is agriculture and livestock. Livestock plays significant role in the Nepalese economy contributing around 11% to the national Gross Domestic Product. Livestock sector has a high potential for growth in Nepal. Realizing this huge potential of the sector, Ministry of Livestock Development (MoLD) has been recently formed. This Ministry has been implementing various programs for the

sustainable upliftment of the sector. The number of cattle comprises 28.75% of the livestock population of Nepal and buffalo and goat comprises 14.19% and 50.19% respectively (MoLD, 2017). Animal production at the local level fulfills a number of other functions. These include the use of domestic animals and poultry for performance traditional ceremonies and festivals. In Nepal, animal husbandry is one of the main occupations, along with farming, as Nepal is an agricultural country. About 73.9% of the total population is engaged in agriculture. In Nepal, people rear different animals like goats, pigs, cows, oxen, buffalos, and dogs. Butter, milk, meat, and wool are the main products of animal husbandry. Dairy production is also increasing due to the rearing of milk-giving animals. Nepal has just started using modern tools for animal husbandry, so there is a chance for further development of animal husbandry. Meat and eggs are also some of the main goods produced by animal husbandry.

Strategic increases in the productivity of rural livestock greatly assist in poverty alleviation, improve household food-security and protein intake of both urban and rural dwellers (Kitalyi, 1998). Unfortunately, livestock production is not rated highly in the third-world national economies because of the lack of measurable indicators. Production levels of rural poultry and animals in our country fall far below desirable levels. In many cases, weight gain, and number of offspring per year are very low, while mortality rates are relatively high. Several reasons, including mismanagement of animals, malnutrition, disease and parasite infestation account for the high mortality and low productivity (Awuni, 1990). Animal health is one of the factors that affect the efficiency with which domestic livestock convert food into animal protein for human consumption (Horst, 1996) and income for the farmers. Among the numerous animal health problems is the prevalence of arthropod ectoparasites and their impacts on farm animals (Byford *et al*., 1992).

1.3 Ectoparasites and their effects

Ectoparasites are the organisms that live outside the other animal or organism's body and feed on it. Ectoparasites are diverse and highly adaptable to their host, as they permanently or periodically infesting their host or their host's habitat. The ectoparasites that permanently infesting their host have special characteristic such as small in size, flatted form and also the ability to move on their host's body surface or within the hairs. Ectoparasites have a major impact on husbandry, productivity and welfare of domestic animals (Celebrook and wall , 2004). Livestock mammals including: cows, buffalos and sheep are at the risk of infection by blood-sucking ectoparasites such as ticks and lice (Vatandost, 2001; Hooghogi Rad *et al*, 1996). The ixodid ticks play important role as vectors or reservoirs in zoonosis including diseases leading to death like Crimean Congo Hemorrhagic Fever (CCHF) and severe bacterial diseases (Hooghogi *et al*, 1996). However, sucking lice are responsible for making stress which leading to economic damage like reduction in milk production, among the buffalos (Vatandost, 2001). Ectoparasitism is a serious threat to both animals and humans all over the world. The painful bites of parasites could be a great nuisance, leading to loss of large amount of blood (Walker, 1996; Natala, 1997). Ticks alone transmit several important protozoal, rickettsial, bacterial and viral diseases to animals, thereby causing great economic losses (Agbede, 1981; du plessis *et al*., 1994). Lice and mites usually cause dermatitis, which is

characterized by alopecia and necrotic foci. There is also intense pruritus (especially with mange) which leads to biting and vigorous scratching of affected parts (Lapage, 1968; Yeruham *et al*., 1985; Taylor *et al*., 2007). Therefore, in the rural area where the people are running small animal houses, animal health is considered as a public health and economic significance. It is because the ectoparasites have permanent biological cycle on the bodies of domestic animals (cows, buffalos and sheep) or in the environment of small animal houses (Vatandost, 2001). Then the importance of ticks and lice has raised the attention to be collected and identified as the base of their pest management.

These ectoparasites live, feed and shelter on or just beneath the surface of their host's epidermis and hair (Marshall, 1981). As a result skin and other subcutaneous tissues can be directly compromised by irritation, hypersensitivity, dermatitis and alopecia. Some ectoparasites may also act as vectors of virus, rickettsia, bacteria, protozoa, cestodes and nematodes also as vectors of zoonotic diseases (Arends *et al*, 1990). Feeding activity of the ectoparasites may result in significant blood loss, secondary infestations, parasites, excoriation and in some case premature death. In domestic animals less grazing and general disturbed behavior, decreased production of meat and milk (Matthysse, 1946). The main ectoparasites found in domestic animals are lice, ticks, mites and fleas. A survey in South England found that among 24 farms 75% of inspected herds were infested among which chewing louse (*Boophilus bovis*) was present in 94% of herds and sucking louse (*Linognathus vituli*) was present in 42% of herds (Nafstad and Gronstal, 2001). Likewise in Nepal , a survey which was conducted to compile the diseases of goats at District Livestock Service Office of Syangja and Tanahun districts, Regional Veterinary Diagnostic Laboratory of Pokhara and Agricultural Research Station (goat) in Bandipur, Nepal found that (48.2 - 63.75)% of goats were infected with parasitic diseases and among them (10.26 - 22.63)% were infested with ectoparasites (Khakural, 2003).

1.4 Objectives of the study

1.4.1 General objective

To identify and determine the prevalence of ectoparasites among domestic animals (buffaloes, cows, oxen and goats) of Phedikhola rural municipality ward no. 2 and 3 , Syangja district, Nepal.

1.4.2 Specific objectives

- To identify the taxonomic details of ectoparasites of domestic animals.
- To compare the prevalence of ectoparasites of different domestic animals.

1.5 Significance of the study

Nepal is an agricultural country about 80% of Nepalese people are involved in agriculture for their livelihood. In this context most of people who are involved in agriculture are involved in livestock farming. As we all know there is direct relation between the effect of ectoparasites and production of livestock's. The loss in production increases with the increase in infestation with ectoparasites. Although numerous people are involved in livestock farming they don't have full knowledge about the effect of ectoparasitism, which effect their income and sometimes also their health.This was the first attempt to carry out this type of study in the study are with the aim of identifing and knowing the prevalence of ectoparasites of that area which can help the farmers to uplift the production performances.

2. LITERATURE REVIEW

Ectoparasitic infestation is common among all warm blooded animals. In global context many studies have been done regarding ectoparasitic infestation among domestic animals but very few have been done in national context of Nepal.

2.1 Literature Review about Buffaloes

In global context

A survey on ectoparasites of domestic animals of Ahwaz, Iran was conducted and total of 438 ectoparasites including *Hyalomma* sp, *Rhepicephalu*s sp., *Haematopinus tuberculates* and *Linognathus* sp. were collected from 240 animals including cows, buffaloes and sheep (Vazirianzaden, *et al*., 2007), similarly a survey was carried out on the lice infestation at a private cattle farm, situated in Multan, Pakistan it was found that 92% buffaloes were infested with *Haematopinus* spp., 6% with *Damalinia* spp. and 2% with *Linognathus* spp. The relationship between sex of animal and different lice was also determined. It was 94.1% in females for *Haematopinus* spp., 5.8% for *Damalinia* spp. and 2.35% for *Linognathus* spp., while in males it was 80, 6.66 and 0 percent, respectively (Tasawar *et al*., 2008) likewise a survey which examined 404 cows and 386 buffaloes in Pakistan found that 28.96% and 25.64% respectively, gave positive results for ectoparasites. The prevalence of ticks, lice, mites and mixed infection was found to be 10.14%, 7.17%, 5.19% and 6.43%, respectively in cows and 6.99%, 9.84%, 4.92% and 3.88% respectively in buffaloes. It was concluded that the prevalence of ectoparasites in cows was higher than in buffaloes due to differences in feeding habits and hygienic habitats of the two species (Kakar and Kakarsulemankhel, 2008). Epidemiology of ectoparasites of buffaloes was studied in Kurigram district of Bangladesh from November, 2007 to October, 2008 total of 236 buffaloes were examined, among them 61.86% were found infested with one or more species of ectoparasites. Three species of ectoparasites were identified of which, two species were arachnids, namely, *Boophilus microplus* (13.98%), *Haemaphysalis bispinosa* (11.44%) and one species was insect, namely, *Haematopinus tuberculatus* (51.27%). No mites were detected (Mamum *et al*., 2010). A study was carried out on ectoparasites of domestic animals of small animal houses in Dezful, South Iran in which total of 65 ectoparasites were found including Hyalomma anatolicum, Rhepicephalus sp., *Haematopinus tubercolatus* and *Linognatus* sp. from 10 animals (cows, buffalos and sheep) and *Haematopinus tubercolatus* was the most abundant collected ectoparasites (Vazirianzaden *et al*., 2011). A survey was carried out on tick infestation rate in cattle and buffalo in different areas of Khyber Pakhthunkhwa, Pakistan, total of 1223 (48.35%) cattle and 1306 (51.65%) buffaloes were examined in the study at different altitudes in the same season and tick infestation rate was observed. The results showed that in the hot arid area, the tick's infestation level was higher at the lower altitudes. Cumulative ticks infestation rate was found significantly higher (34.79%) in hot arid plane area than that of (18.63%) in cold hilly area ($p>0.05$). The tick overall infestation rate in cattle (33.36%) was significantly higher than that of buffaloes (22.58%) (Khan *et al*., 2013). Similarly a study was carried out to investigate the prevalence of *Theileria annulata* on hard ticks of cattle and buffalo in Faisalaland,

Jhang and Khanewal districts of Punjab Pakistan. Ticks were collected during july and august 2017 and collected from all age, sex and weight from 30 farms. From 710 cattles in which *Hyalomma* species was 61%.The percentage of cattle infected was 70% and that of buffalo was 34% (Ali *et al*., 2013). In a survey on detection of ectoparasites between domesticated animals in Buslah city, southern Iraq 50 buffaloes, 25 cows, 70 sheep and 13 dogs were inspected and the total percentage of infection was varied between 20% to 100%, while a total number of isolated ectoparasites from the total infected animals was 89 diveded into *Rhiphicephalus* spp., *Hyalomma* spp., *Haematopinus* spp., Hippobosus spp., *Boophilus* spp. (Ali *et al*., 2014), similary a study was conducted to determine seasonal prevalence of ectoparasites in Tehsil Nikayal district Kotli, Azad Jammu and Kashmir Pakistan. Surveys were carried out from July 2015 to December 2015.total of 200 animals including 126 goat, 72 buffaloes and 2 sheep were examined. The highest prevalence of ectoparasites were 7.2% during the month of July and this study showed that the prevalence of ectoparasaties is higher during summer than winter season. In this study the percentage of infected buffalo were 8.33%, 8.33%, 8.33% 4.16%, 0% and 0% durig July, August ,September, October,November and December respectively (Ashraf *et al*., 2016). In a study carried out at different locations of Taluka Gambet District, Khairpur, Pakistan during 2015, 20 buffaloes of 5-10 years were examined to know the occurance of buffalo ticks in which the mean pupolation of ticks was (2+-0.84) during August and (1.33+-0.39) during April (Abbasi *et al*., 2016). A study was conducted in Muzaffarabad district, Azad Jammu and Kashmir, Pakistan from July 2015 to December 2015. Total 100 ruminants were examined including 34 buffaloes, 41 goats, 9 sheep and 16 cows in which the prevalence of ectoparasites on buffalo was 32,35%, 26.47%, 23.52%, 20.58%, 14.70% and 5.88% during July, August, September, October, November and December respectively (Sayyad *et a*l., 2016).

A survey on the effect of lice infestation on general health condition and ovarian activity in buffaloes and cows included 1583 buffaloes and cows of lower Egypt and it was found that 409 which is 27.73% of total data were infested with different ectoparasites and among them 192 which is 47.92% of animals infested with ectoparasites were infested by lice (*Haematopinus tuberculatus*) (Ahmed *et al*., 2009) similarly a survey on prevalence and risk determinants of Ixodid tick infestation of cattle in Beni-suef Governorate Egypt, 265 cattle, 120 buffaloes, 20 sheep and 40 donkeys were investigated. Results indicate that 120 (45.28%) cattle, 26(21.67%) buffaloes, 11(18.33%) sheep and 3(7.5%) donkeys were found to be infested with Ixodid ticks and most prevelant tick was *Boophilus annulatus* (75.3%) followed by *Hyalomma anatolisum excavatum*(72.4%) and least(2.5%) were mixed infection (Fatma *et al*., 2016).

A study was conducted on ectoparasites of small ruminants in three districts (woredas) of the eastern part of Amhara Regional State, Ethiopia, from November 2003 to March 2004, with the objectives of determining the prevalence of ectoparasites and identifying the potential risk factors associated with the problem. Out of 752 goats examined, 56.4% of goats were infested with one or more ectoparasites. The ectoparasites such as *Linognathus* spp. (28.3%), ticks (22.2%), sarcoptic mites (6.1%) and *Ctenocephalides* spp. (8.1%) were identified (Tefera and Abebe, 2007) similarly another study was carried

out with the aim of updating the fauna of ectoparasites infesting domestic animals in Northern Nigeria and utilised the record of samples brought to the Veterinary Entomology Laboratory of Ahmadu Bello University, Zaria Total samples submitted were 931, negative samples were 407 (43.72%), positive samples were 524 (56.28%) with the following pests: lice, 104 (11.28%); ticks, 146 (15.68%); mites, 221 (23.74%), flea 36 (3.90%) and myiatic larvae, 17 (1.82%). The most abundant from each of the groups the ectoparasites included tick (*Amblyomma variegatum),* lice (*Manecanthus stramineus),* mite (*Demodex canis*), flea (*Ctenocephalides felis)* and myiatic larva (*Oestrus ovis)* (Natala *et al*., 2009).

A survey was carried out in South England in which 24 farms were clinically inspected in which 75% of inspected herds were infested among which chewing louse (*Boophilus bovis*) was present in 94% of herds and sucking louse (*Linognathus vituli*) was present in 42% of herds (Nafstad and Gronstal, 2001).

2.2 Literature Review about cattle

In global context

A survey on ectoparasites of domestic animals of Ahwaz, Iran was conducted and total of 438 ectoparasites including *Hyalomma* sp, *Rhepicephalus* sp., *Haematopinus tuberculates* and *Linognathus* sp. were collected from 240 animals including cows, buffaloes and sheep (Vazirianzaden *et al*., 2007) similarly a survey which examined 404 cows and 386 buffaloes in Pakistan found that 28.96 and 25.64% respectively, gave positive results for ectoparasites. The prevalence of ticks, lice, mites and mixed infection was found to be 10.14%, 7.17%, 5.19% and 6.43%, respectively in cows and 6.99, 9.84, 4.92 and 3.88% respectively in buffaloes. It was concluded that the prevalence of ectoparasites in cows was higher than in buffaloes due to differences in feeding habits and hygienic habitats of the two species (Kakar and Kakarsulemankhel, 2008) another study was designed to find out the prevalence of ecto-parasites and to evaluate and compare the efficacy of different drugs against tick infestation in cattle in and around Dera Ghazi Khan, Pakistan. For this purpose a total of 300 cattle were examined for the prevalence of ectoparasites. The prevalence of ticks, mites and lice was found to be 108 (36%), 15 (5%) and 24 (8%), respectively. The main species of ectoparasites observed were *Boophilus microplus, Boophilus annulatus, Hyalomma aegyptium, Psorcoptes bovis, Sarcoptes Scabies var bovis, Haematopinus tuberculates* and *Linognathus vituli* (Ramzan *et al*., 2008). In a survey of ectoparasitic Arthropods on domestic animals in Tak province, Thialand 11 different ectoparasites including two species of hard ticks (Ixodidae), three species of fleas (Siphonoptera) and 6 species of sucking or chewing lice(2 species each in suborder Anoplura, Ischnocera and Amblycera) were collected in which tick *Rhiphicephalus* (*Boophilus*), *Linognothus vituli* (27.3%) and *Solenoptus capillatus* (9.1%) were collected from 11 cattles (*Bos indicus*) (Changbunjong *et al*., 2009). A survey on epidemiology of ectoparasitic infestation in cattle at Bhawal forest area Gazipur, Bangladesh was carried out in which 206 cattles were examined of which 132 (64.07%) were found to be infested with several species of lice and ticks. The prevalence rate was highest in case of *Boophilus microplus* (45.65%), followed by *Rhipicephalus sanguineus* (36.89%), *Linognathus vituli* (23.30%), *Haematopinus eusysternus* (17.96%), *Haematopinus*

pispinosa(16.50%) and *Damalinia bovis* (8.25%) (Rony *et al*., 2010a). A survey on epidemiology of ectoparasites infestation in cattle at Bhawal Forest area,Gazipur, Bangladesh was done and of 206 cattle examined 132 (64.07%) were found to be infested with several species of ticks and lice. The prevalence rate was highest in case of *Boophilus microplus* (45.63%) followed by *Rhipicephalus* sanguineus (36.89%), *Linognathus vituli* (23.30%), *Haematopinus eurysternus* (17.96), *Haemophysalis bispinosa* (16. 50%) and *Damalinia bovis* (8.25%) (Rony *et al*., 2010b). A study was carried out on ectoparasites of domestic animals of small animal houses in Dezful, South Iran in which total of 65 ectoparasites were found including *Hyalomma anatolicum*, *Rhepicephalus* sp., *Haematopinus tubercolatus* and *Linognatus* sp. from 10 animals (cows, buffalos and sheep) and *Haematopinus tubercolatus* was the most abundant collected ectoparasites (Vazirianzaden *et al*., 2011). A survey was carried out on tick infestation rate in cattle and buffalo in different areas of Khyber Pakhthunkhwa, Pakistan, total of 1223 (48.35%) cattle and 1306 (51.65%) buffaloes were examined in the study at different altitudes in the same season and tick infestation rate was observed. The results showed that in the hot arid area, the tick's infestation level was higher at the lower altitudes. Cumulative ticks infestation rate was found significantly higher (34.79%) in hot arid plane area than that of (18.63%) in cold hilly area ($p>0.05$). The tick overall infestation rate in cattle (33.36%) was significantly higher than that of buffaloes (22.58%) (Khan *et al*., 2013) another survey carried out on cattle ticks in Nur, North of Iran in which 150 cattles from 25 herds were examined during spring and summer season of 2011.In which total 1563 ticks were collected and amog them 51% was *Ixodes ricinus* and 49% was *Boophilus annulatus* (Moghadden *et al*.,2011). A study was carried out to investigate the prevalence of *Theileria annulata* on hard ticks of cattle and buffalo in Faisalaland, Jhang and Khanewal districts of Punjab Pakistan. Ticks were collected during july and august 2017 from all age , sex and weight from 30 farms. From 710 cattles in which *Hyalomma* species was 61%. The percentage of cattle infected was70% and that of buffalo was 34% (Ali *et al*., 2013). A study which was carried out for the detection of ectoparasites between domesticated animals in Basrah city, southern Iraq in which 50 buffalo, 25 cow, 11 horses, 70 sheep and 15 dogs were examined the total percentage of infection was between 20%-100% while the total number of isolated ectoparasites from the total animals was 89 and the ectoparasites were *Rhipicephalus* sp., Hyalomma sp., *Haematopinus* sp., *Hippobosca* sp., *Boophilus* sp. (Ali *et al*., 2014). A study was conducted in Muzaffarabad district, Azad Jammu and Kashmir, Pakistan from July 2015 to December 2015. Total 100 ruminants were examined including 34 buffaloes,41 goats, 9 sheep and 16 cows in which the prevalence of ectoparasites on cow was 56.25%, 43.75%, 37.5%, 31.25%, 18.75% and 6.25% during July, August, September, October, November and December respectively (Sayyad *et al*., 2016).

A survey was carried out in South England in which 24 farms were clinically inspected in which 75% of inspected herds were infested among which chewing louse (*Boophilus bovis*) was present in 94% of herds and sucking louse (*Linognathus vituli*) was present in 42% of herds (Nafstad and Gronstal, 2001).

A survey on the effect of lice infestation on general health condition and ovarian activity in buffaloes and cows included 1583 buffaloes and cows of lower Egypt and it was found that 409 which is 27.73% of total data were infested with different ectoparasites and among them 192 which is 47.92% of animals infested with ectoparasites were infested by lice (*Haematopinus tuberculatus*) (Ahmed *et al*., 2009). A study was carried out with the aim of updating the fauna of ectoparasites infesting domestic animals in Northern Nigeria and utilised the record of samples brought to the Veterinary Entomology Laboratory of Ahmadu Bello University, Zaria Total samples submitted were 931, negative samples were 407 (43.72%), positive samples were 524 (56.28%) with the following pests: lice, 104 (11.28%); ticks, 146 (15.68%); mites, 221 (23.74%), flea 36 (3.90%) and myiatic larvae, 17 (1.82%). The most abundant from each of the groups the ectoparasites included tick (Amblyomma variegatum), lice (*Manecanthus stramineus),* mite (*Demodex canis),* flea (*Ctenocephalides felis)* flea and myiatic larva (*Oestrus ovis)* (Natala *et al*., 2009) similarly a survey on population dynamics of cattle ectoparasites in western Amhara nation state Ethiopia was done and 783 cattles were inspected then ticks (89.4%), lice (63.5%) and mange (95.5%) were collected from examined animals. Tick species identified were *Amblyomma variegatum* (49.2%), *Boophilus decoloratus*, (21.2%), *Hyalomma marginatum* (9.8%), *Hyalomma truncatum* (6.2%), *Rhipicephalus* evertsi evertsi (6.6%), and *Rhipicephalus pulchellus* (5.3%). Similarly, *Linognathus vituli* (76.3%) and *Damalina bovis* (23.7%) were lice species identified. Furthermore, mange mites identified were 12 (Kebede and Fetene, 2012).A study was carried out on prevalence of ectoparasites infestation of cattle in Bench maji zone, Southwest Ethiopia in which 212 cattle were examined and study revealed that cattle in the study area were infested with single (24.5%) and multiple (2.8%) ectoparasites with an overall prevalence of 27.3% (58/212). Overall seven species of ectoparasites which belong to tick (16.0%), lice (10.4%) and mite (0.9%), were identified. Seven species of ticks which belong to three genera (*Boophilus* sp., *Amblyoma* sp., and *Rhipicephalus* sp.) were identified. Among the species of ticks *Boophilus decoloratus* (8.0%), *Amblyoma variegatum* (4.7%) and *Amblyoma coherens* (4.2%) were the dominant ones in a decreasing order. Among the three species of lice, the most prevalent was *Linognathus vituli* (4.7%) followed by *Haematopinus euysternus* (3.8%) and *Damalina bovis* (1.9%). *Psoroptes bovis* (0.9%) was the only mite species recorded in this study (Onu and Shiferaw, 2013).

2.3 Literature review about goats

In global context

A study was conducted to determine seasonal prevalence of ectoparasites in Tehsil Nikayal district Kotli, Azad Jammu and Kashmir Pakistan.Surveys were carried out from July 2015 to December 2015. Total of 200 animals including 126 goat, 72 buffaloes and 2 sheep were examined. The highest prevalence of ectoparasites were 7.2% during the month of July and this study showed that the prevalence of ectoparasaties is higher during summer than winter season. In this study the percentage of infected goat were 7.14%, 4.76%, 4.76% 4.76%, 2.38% and 0.78% during July, August, September, October, November and December respectively (Ashraf *et al*., 2016) likely a study was conducted in Muzaffarabad district, Azad Jammu and Kashmir, Pakistan from July 2015 to

December 2015. Total 100 ruminants were examined including 34 buffaloes,41 goats, 9 sheep and 16 cows in which the prevalence of ectoparasites on goat was 46.34%, 36.58%, 31.70%, 26.82%, 19.51% and 9.75% during July, August, September, October, November and December respectively (Sayyad *et al*., 2016).

A study was conducted on ectoparasites of small ruminants in three districts (woredas) of the eastern part of Amhara Regional State, Ethiopia, from November 2003 to March 2004, with the objectives of determining the prevalence of ectoparasites and identifying the potential risk factors associated with the problem. Out of 752 goats examined, 56.4% of goats were infested with one or more ectoparasites. The ectoparasites such as *Linognathus* spp. (28.3%), ticks (22.2%), sarcoptic mites (6.1%) and *Ctenocephalides* spp. (8.1%) were identified (Tefera and Abebe, 2007).

In national context

A survey was conducted on study of ectoparasites of some vertebrates including buffaloes, goats, cows from Kathmandu valley and 23 species of ectoparasites like ticks, mites, lice and fleas were found from different places like Central zoo, Veterinary hospital, Paknajol, Thamel, Lainchaur, Kshetrapati, Thankot, Kirtipur, Thimi, Gausala and Baneshwor (Shrestha, 1977) similarly, another study was carried out on taxonomic studies of ectoparasites and vectors of vertebrates including goats and buffaloes in which 22 species of ectoparasites of 2 class, 6 orders and 13 families of Arthropoda including 10 lice, 4 flies, 3 fleas and 1 mite were identified(Deo, 1992).A survey which was conducted to compile the diseases of goats at District Livestock Service Office of Syangja and Tanahun districts, Regional Veterinary Diagnostic Laboratory of Pokhara and Agricultural Research Station (goat) in Bandipur inspected total 6094 number of goats and it was found that (48.2 - 63.75)% of goats were infected with parasitic diseases and among them (10.26 - 22.63)% were infested with ectoparasites. The ectoparasites were recorded throughout the year but the infestation was found high once during August and September and again April and May (Khakural, 2003).

3. MATERIALS AND METHODS

3.1 The Study Area

The study was conducted in Phedikhola rural municipality ward no: 2 and 3, Syangja, Nepal. This rural municipality lies in Syangja district, a part of province no.4 and Western development region. It is located in hilly region at the altidude of about 800 metres above from the sea level. It lies in about latitude 28460 North and longitude 83520 east. The boarders of this district are touched with Kaski, Tanahun, Parbat and Palpa districts. The climate of this district is Sub-tropical.

Fig 1: Map of Study Area Phedikhola Rural Municipality, Syangja, Nepal
(source: www. ddcsyangja .gov.np)

3.2 Materials used

3.2.1 Materials for field

Forceps	Labelled collecting jars
Tags	Comb
White paper shit	Gloves

3.2.2 Materials for laboratory

Watch glasses	Forceps
Test tubes	Needle
Spirit lamp	Slides
Coverslips	Test tube holder
Microscope	Petridishes etc.

3.2.3 Chemicals used

Pottasium hydroxide (KOH) – 2.5% Xylene

Alcohol series (30%, 50%, 70%, 90%, 100%) D.P.X

3.3 Study Design

The study was designed to assess the ectoparasitic infection in domestic animals of Phedikhola rural municipality ward no. 2 and 3. The study design includes:

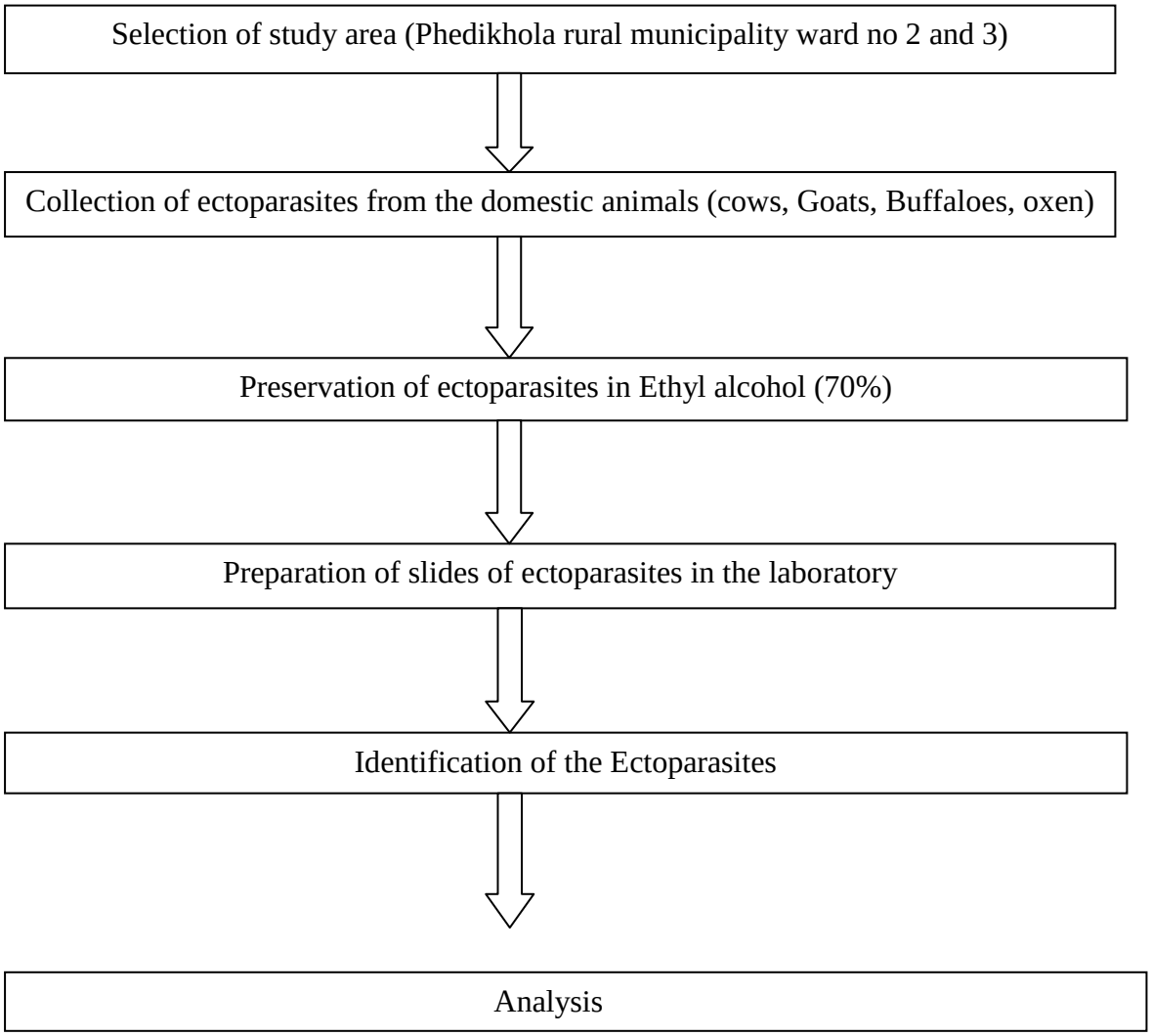

Fig 2: Flow Chart of Research Design

3.3.1 Sample Size

A total of 300 domestic animals were inspected in which 150 from ward no. 2 from 78 sheds and 150 animals from wrd no. 3 from 89 sheds, which includes 70 goats, 60 buffaloes, 8 cows, and 12 oxen from ward no.2 and 78 goats, 63 buffaloes, 2 cows and 7 oxen from ward no. 3.

3.3.2 Collection of Sample

The domestic animals were inspected individually and ectoparasites were observed and collected by handpicking and brushing method. Photos of farm house were taken in which condition they are farming. The study animals were screened for ectoparasites using the following techniques employed by Hall (2006).

Hand-picking

With the aid of light surgical gloves, the ectoparasites were picked by hand. Ectoparasites obtained from the different animals were kept separately in 70% alcohol in labeled collecting jars for identification and counting.

Brushing

With this method, each study animal were placed on a piece (about 2 yards) of white paper sheet and the ectoparasites systematically brushed off the hair (for goats) unto the paper sheet. The ectoparasites felt on the white paper were easily hand-picked into the collecting tubes having 70% alcohol.

3.3.3 Preservation of Sample

Collected ectoparasites of domestic animals were preserved in 70% Ethyl Alcohol that helps in maintaining the morphology of ectoparasites.

3.3.4 Laboratory work

The ectoparasites were brought at parasitology lab of Central Department of Zoology and the slides were prepared.

3.3.4.1 Slide preparation method

The ectoparasites were boiled on Potassium hydroxide and then they were dehydrated by alcohol series. First they were kept on 30% then 50% then 70% and 90% and on 100%.Then they were kept on xylene to confirm that they are dehydrated well or not. Then by using D.P.X. they were mounted on the slides and covered by cover slips and these slides were observed upon 10x X 4x and photographs were taken.

3.3.5 Identification of Ectoparasites

Identification was done on the basis of published literature journals and books (Soulsby, 1982), (Chandler and Clark, 1961), (Rony *et al*., 2010a), (Portugaliza and Bagot, 2015) and other published and unpublished articles and internet sources. The identification of all ectoparasites was done only based on morphological characteristics.

3.3.6 Analysis

For this study, prevalence was measured as the percentage of host individuals infested with a particular parasite. The data were coded and entered into Microsoft Excel spread sheet. Data were statistically analyzed by using "R", version 3.3.1 software packages. In all cases 95% confidence interval (CI) and $p<0.05$ was considered for statistically significant difference .

Photographs During Field and Lab Work

Photo 1: Collection from Buffalo

Photo 2: Collection from Goat

Photo 3: Slide preparation

Photo 4: Examination of slide

4. RESULTS

4.1 Taxonomic details of ectoparasites

4.1.1 Taxonomic details of *Haematopinus tuberculatus*

It was found from all the parts of buffaloes.

Identification keys upto species

1. Ectoparasites of mammals, five segmented antennae, thorax short small, abdomen relatively large, seven abdominal segments visible ……..... Siphunculata.
2. Thick brown pigment on the sides of abdomen called paratergal plate present.
3. Thumb like process for holding the host's hair in between claw and ventral apical angle of tibia.
4. Preural plates present without free apices.
5. Eyes absent, head has forward prolongations behind antennae, thorax broad, marked paratergal plates, tibial plate present,legs and claws alike in all three pairs, found on Artiodactyla and Equida ..……Haematopinidae.
6. Only one genus of Haematopinidae……. *Haematopinus*
7. One row of spines on each abdominal segment and found in buffaloes of Asia……..…… *Haematopinus tuberculatus*.

Classification

Phylum : Arthropoda
Class : Insecta
Subclass : Pterygota
Division : Exopterygota
Order : Siphunculata
Family : Haematopinidae
Genus : *Haematopinus*
Species : *tuberculatus* (Burmeister, 1839)
Photo: (5, 12, 13, 14)

Characters:

- Found in Asian buffaloes.
- Eyes reduced or absent.
- Legs and claws approximately alike on all three pairs.
- Temporal angels behind antennae in head.
- Marked paratergal plates.

Photo 5 : *Haematopinu tuberculatus* (10x X 4x)

Taxonomic details of *Damalinia* (*Bovicola*) *caprae*

Identification keys upto species level

Head is broad or broader than the thorax, legs are short and much alike…….. Mallophaga
Antennae filiform and exposed, antennae 3 segmented, Infest mammals…….....Trichodectidae.
Pleural plates present, antennae of both sexes alike…… *Damalinia.*
Tarsi with 3 claws found in goats……..……..*Damalinia caprae*

Classification

Phylum : Arthropoda
Class : Insecta
Subclass : Pterygota
Division : Exopterygota
Order : Mallophaga
Family : Trichodectidae
Genus : *Damalinia* (*Bovicola*)
Species : *caprae* (Gurlt, 1843)
Photo: (6, 9, 10, 11)

Photo 6 : *Damalinia caprae* (10x X 4x)

Characters

- Found in goats.
- Head broader than that of sucking louse.
- Antennae three segmented.
- Tarsi with 3 claw.
- With pleural plates.
- Antennae alike in both sexes.

Taxonomic details of *Boophilus microplus*

The specimens were collected from all over the body of buffaloes, gotas, oxen and cows.

Identification keys upto Species

Usually with four pairs of legs (most Acarina).
Easily visible to naked eye (ticks).
Body covered by shields or tubercles.
Dorsal shield present and body not tuberculated……Ixodidae.
Dorsal shield is present all over the body in male and only in the anterior part in female.
Anal groove absent or very indistinct, legs of male normal and palpi ridged……*Boophilus.*
Anal shield lacking spur like extension, no ventral bristles bearing protuberance……..*Boophilus microplus*

Classification

Phylum : Arthropoda
Class : Insecta
Subclass : Pterygota
Division : Endopterygota
Order : Acarina
Family : Ixodidae
Genus : *Boophilus*
Species : *microplus* (Canestini, 1887)
Photo: (7, 17, 18)

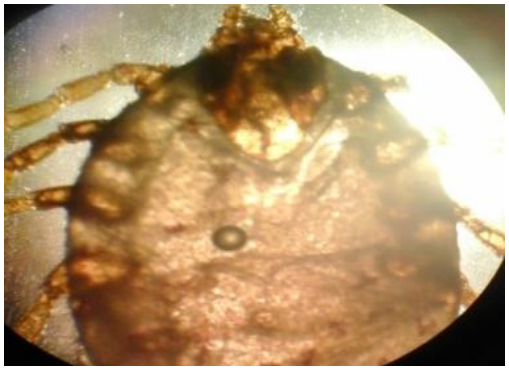

Photo7: *Boophilus microplus* (10x X 4x)

Characters:

- Dorsal shield present.
- Anal groove indistinct.
- Male with two pairs of ventral shields.
- Palpi ridged.
- Legs of male normal (not beaded).

Taxonomic details of *Ctenocephalides canis*

The specimens were collected from all over the body of goats.

Identification keys upto Species

Body much compressed, head broadly joint to thorax, abdomen 10 segmented…….Siphonaptera
Broad thorax segment, antepygidial bristles present……..…….Pulicidae.
Atleast one ctenidia present.
Genal and prenatal both ctenidia present.
Genal ctenidium horizontal with 8 or 9 bristles on each side……...*Ctenocephalidus*
Frontal spine of ctenidium shorter than second spine, head with rounded front, about one and a half times as long as high……..… *Ctenocephalides canis* .

Classification

Phylum : Arthropoda
Class : Insecta
Subclass : Pterygota
Division : Enodterygota
Order : Siphonaptera
Family : Pulicidae
Genus : *Ctenocephalides*
Species : *canis* (Curtis, 1826)
Photo: (8, 15, 16)

Characters:

- Antepygidial bristles present.
- Genal and pronotal ctenidia present.
- Genal ctenidium horizontal having 8 or 9 teeth on each side.
- Frontal spine of genal ctenidium shorter than second spine.

Photo 8: *Ctenocephalides canis* (10x X 4x)

4.2 Overall prevalence of ectoparasites

Out of 300 animals examined, 156 (52%) animals were found infested with ectoparasites lice, ticks and fleas.

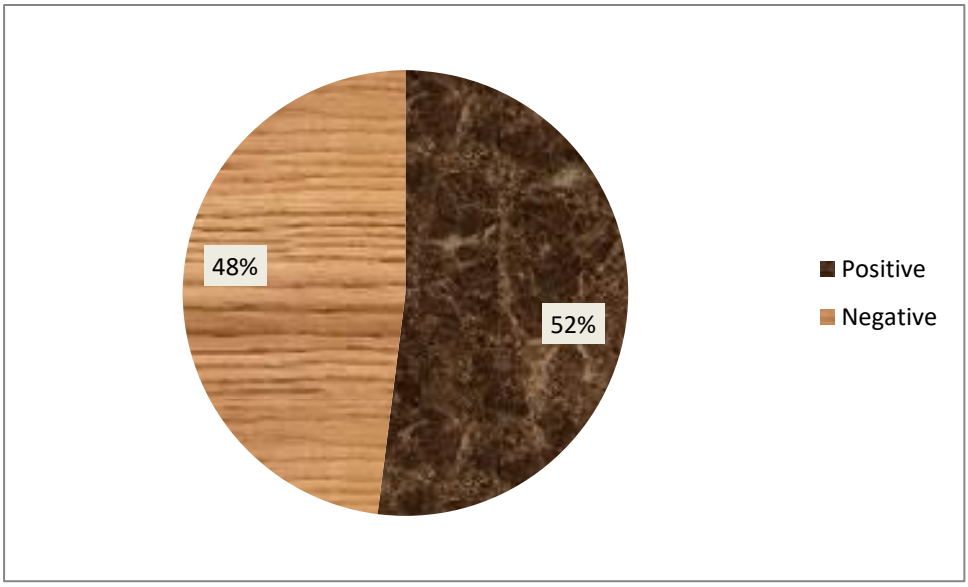

Fig 3: Overall prevalence of ectoparasites.

4.3 Prevalence of lice, ticks and fleas

Among 300 inspected domestic animals 156 were found infested with ectoparasites and among them 127 (42.33%) were found infested with lice, 50 (16.66%) were found infested with ticks, 17 (5.66%) were found infested with fleas. Difference in distribution of these ectoparasites is not found significant (χ 2= 125.63, df=2, p-value=2.2).

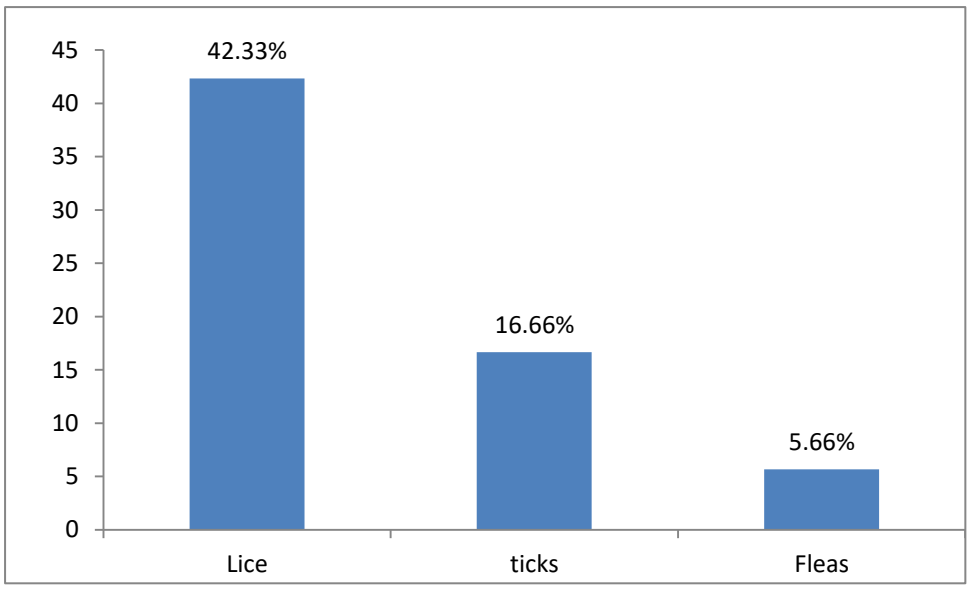

Fig 4: Prevalence of lice, fleas and ticks among total animals

4.4 Prevalence of ectoparasites among goats

Out of 142 goats examined 81 (57.04%) were found to be infested.The ectoparasites found were lice (*Damalinia caprae*), tick (*Boophilus microplus*) and flea (*Ctenocephalides canis*) with prevalence rate of 49.29%, 3.52% and 4.22% respectively.There is no significant difference in the distribution of these ectoparasites amon goats (χ 2=71.466, df=2, p-value=3.02).

Table 1: Prevalence of ectoparasites on goats

S.N.	Parasite name	No.of goats with ectoparasites	Prevalence	χ 2	p-value
1.	*Damalinia caprae*	70	49.29%	0.007	0.93
2.	*Boophilus microplus*	17	11.97%	1	2.2
3.	*Ctenocephalides canis*	17	11.97%	1	2.2

4.5 Prevalence of ectoparasites on buffaloes

Among 123 buffaloes examined and 60 (48.78%) were found to be infested by ectoparasites. The prevalence of lice (*Haematopinus tuberculatus*) and tick (*Boophilus microplus*) were 43.90% and 12.19% respectively. The distribution of these ectoparasites among buffaloes is not significant (χ2=29.086, df=1, p-value=6.925).

Table 2: Prevalence of ectoprasites among buffaloes

S.N.	Ectoparasite	No.of Buffaloes infested	Prevalence	$\chi 2$	p-value
1.	*Haematopinus tuberculatus*	54	43.90%	1.5	0.206
2.	*Boophilus microplus*	15	12.19%	68.8	2.2

4.6 Prevalence of ectoparasites on cows

Among 10 cows examined 6 (60%) were found to be infested with tick (*Boophilus microplus*).

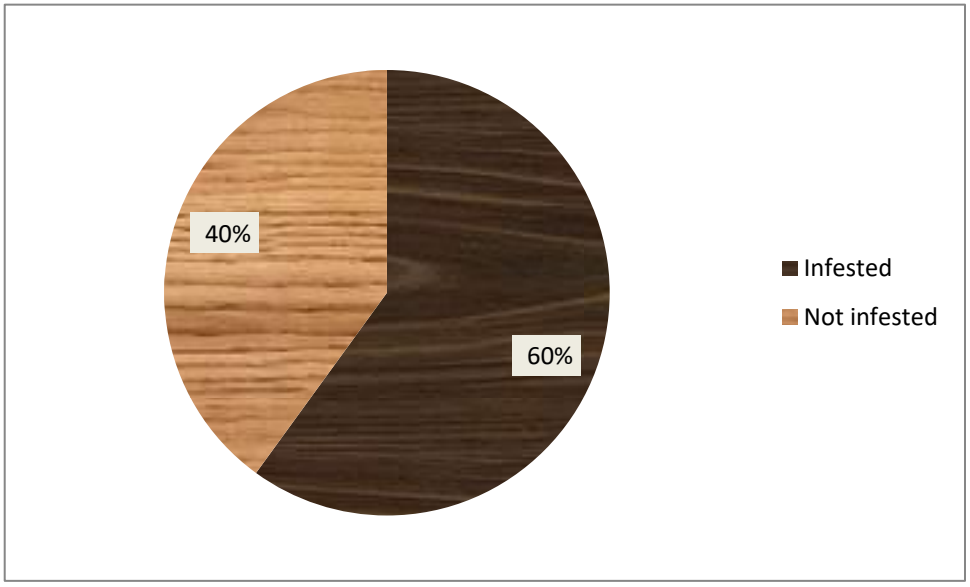

Fig5: Prevalence of ectoparasites in cows

4.7 Prevalence of ectoparasites on oxen

The number of oxen examined were 19 and out of them 9 (47.36%) were infested with tick *(Boophilus microplus*)

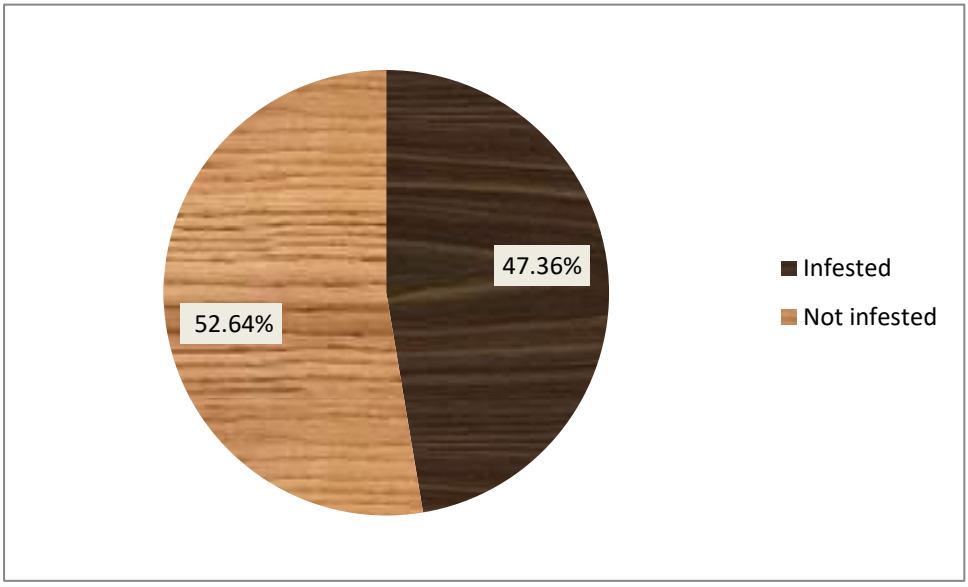

Fig 6: Prevalence of ectoparasites in oxen

4.8 Concurency of ectoparasites on animals

Out of 156 (52%) positive samples, 32 (20.51%) samples were infested with two or more type of genera and 124 (79.49%) samples were detected to have infestation with only one type of genus. There is no significant difference in the distribution of multiple and single infestation (χ 2=106.17, df=1, p-value=2.2).

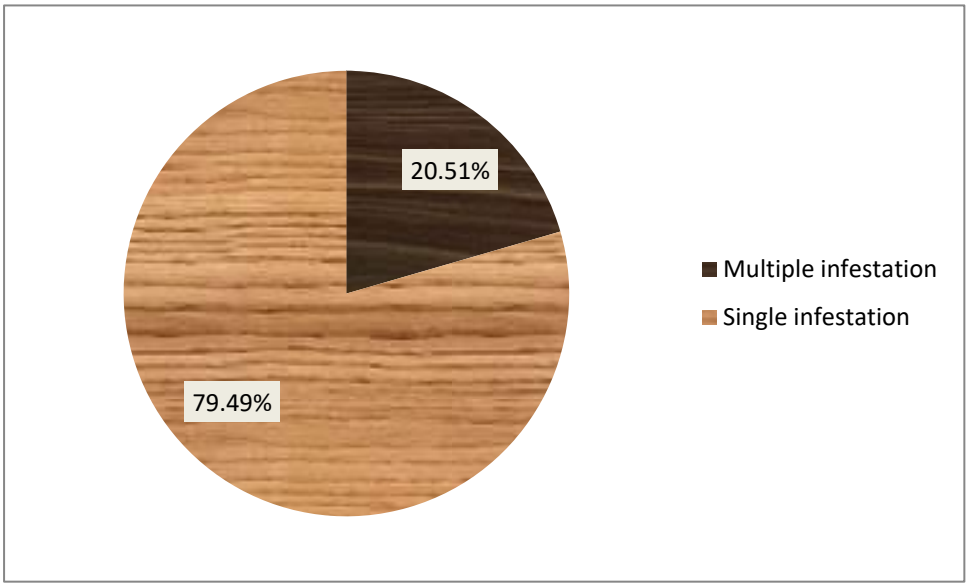

Fig 7: Concurancy of ectoparasites on the domestic animals

Photographs of ectoparasites

Photo 9: Head of *Damalinia caprae*
10x X 4x

Photo 10: Thorax of *Damalinia caprae*
10x X 4x

Photo 11: Pleural plates of *Damalinia caprae*
(10x X 4x)

Photo 12: Head and Thorax of
Haematopinus tuberculatus
(10x X 4x)

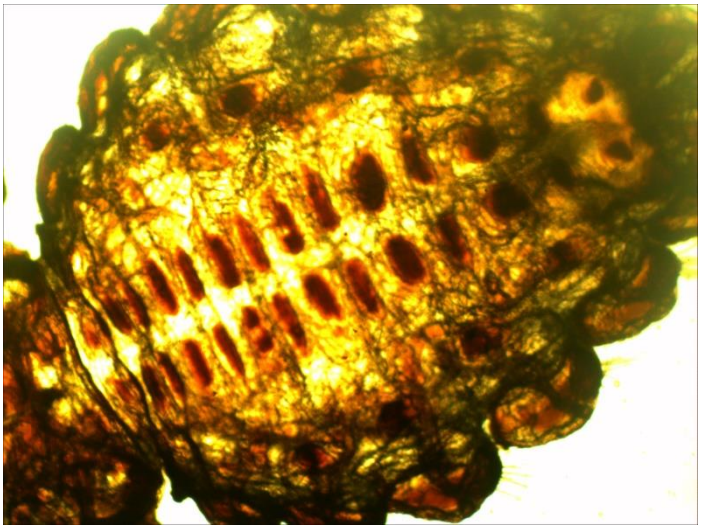

Photo 13 : Abdomen of *Haematopinus tuberculatus*

(10x X 4x)

Photo 14 : Legs of *Haematopinus tuberculatus*
(10x X 4x)

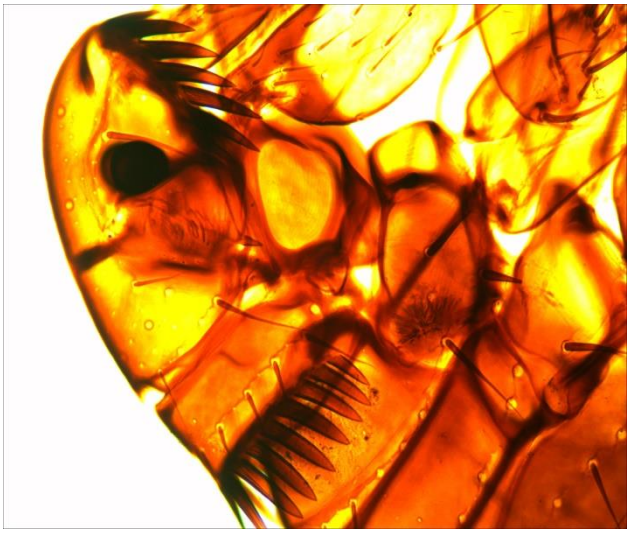

Photo 15: Ctenidia of *Ctenocephalides canis*
(10x X 4x)

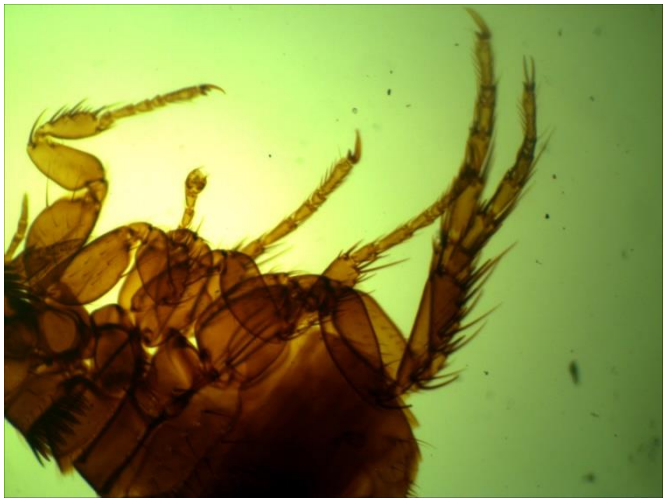

Photo 16: Legs of *Ctenocephalides canis*
(10x X 4x)

Photo 17: Dorsal part of *Boophilus microplus* (10x X 4x)

Photo 18: Ventral part of *Boophilus microplus* (10x X 4x)

5. DISCUSSION

Plenty of researches have been done in ectoparasites of domestic animals in global context but hardly few in national context. Prevalence of ectoparasites is considerably influenced by the climatic and geographical factors. Generally the warm and humid conditions, continuous high rainfall, decrease of grazing area, contaminated pasture, nutritional factors and traditional rearing system provide good condition for many ectoparasites to flourish. Some ectoparasites may live permanently on their hosts or they may occupy the host nest and immediate environment and visit the body of the host periodically. The mechanisms by which the parasites seek, identify, establish and maintain contacts with their host are sophisticated and complex (Combes, 2001). They are nuisance source to animals via blood loss, irritation disease carrier, depression of immunity and damaging hides and skins (Ghosh *et al*., 2007). These annoying parasites act both as vectors and reservoirs of certain infectious agents (Jongejan and Uilenberg *et al*., 2004).

According available literauteres, the common ectoparasites of domestic animals were tick (*Boophilus annulatus*, *Boophilus microplus*, *Amblyomma* spp., *Rhepicephalus* spp., *Hyalomma* spp.), lice (*Damalinia caprae*, *Linognathus vituli*, *Haematopinus tuberculatus*), flea (*Ctenocephalides felis*, *Ctenocephalides canis*) and mite(*Demodex* spp. and *Psoroptes* spp.) (Gebreselama *et al*., 2014; Rony *et al*., 2010a; Kusma *et al*., 2012: Natala *et al*., 2009). In present study tick (*Boophilus microplus*), lice (*Damalinia caprae* and *Haematopinus tuberculatus*), flea (*Ctenocephalides canis*) were recorded from domestic animals of ward no. 2 and 3 of Phedikhola rural municipality, Syangja district, Nepal. No mites were found in this study as in Mamun *et al*. (2010) and Islam *et al*. (2006) because no tissue scrapping was collected.

Present study revealed that the overall prevalence of ectoparasites in domestic animals of ward no. 2 and 3 of Phedikhola rural municipality was 52% i.e. among 300 examined 156 were infested with various ectoparasites. The ectoparasites found were lice, ticks and fleas and their prevalence was 42.33%, 16.66%, 5.66% respectively The prevalence of ectoparasites in goats showed 49.29% of lice (*Damalinia caprae*), tick (*Boophilus microplus*) 11.97% and flea (*Ctenocephalides canis*) 11.97% and total prevalence of ectoparasites in goats was 57.04%. In case of buffaloes the prevalence of lice (*Haematopinus tuberculatus*) was 43.90%, tick (*Boophilus microplus*) was 12.95% and total infestation was 48.78%. Only ticks were found in cows and oxen. The prevalence of tick (*Boophilus microplus*) was 60% in cow and in oxen the prevalence of tick (*Boophilus microplus*) was 47.36%. This finding suggests the great importance of ectoparasites in the study area. The absence of improved husbandary practices and inadequate veterinary services, favourable climatic conditions for ectoparasites, low input of feeds and poor awareness of owners on the effects of ectoparasites might have strongly contributed the wide occurance of infestation by ectoparasites.

Similar studies were conducted by Natala *et al*. (2009), Nafstad and Gronstal (2001) and Rony *et al*. (2010a) in which the overall prevalence of ectoparasites was 56.28%, 75% and 64.07% in Northern Nigeria, South England and Bhawal forest area Gazipur, Bangladesh respectively which were higher than the results of present study 52%, similarly Tefera and Abebe (2007) reported the overall prevalence of ectoparasites in domestic animals was 56.4% in Eastern part of Amhara Regional State, Ethiopia and Islam et al. (2015) reported 62.28% which is also higher than the result of present study. The difference in methods applied for the selection of animals, difference in breeds of animals and variation in geoclimatic factors may be responsible for the variation in the results.

The result of present study was higher than the result of Ahmed *et al*. (2009) in which the overall prevalence of ectoparasites was 27.73% in lower Egypt which may also due to the difference in climatic factors. Difference in prevalence might arise from differences in agroecology, season during which the study was conducted, variation in management, breed and healthcare of animals in the study area and the sensitivity of diagnostic method used (Kumsa *et al*., 2012).

Present study reported almost similar prevalence of tick in domestic animals of that of Natala *et al*. (2009) in which the prevalence of tick was 15.68% in Northern Nigeria. In case of flea the prevalence in present study was 5.66% which is only little more than 3.96% by Natal *et al*. (2009), in Northern Nigeria. Overall lice infestation in this study was 42.33% which was higher than 11.28% by Natala *et al*. (2009).The differences may be due to difference in climatic factors, different husbandry practices and different methods of selection of sample in the study areas. Higher lice infestation may reflect some other underlying problems such as malnutrition and chronic diseases (Wall and Shearer, 1997). The possible reasons for the higher prevalence of lice in the study area include management problems, poor feeding and inadequate veterinary services (Kumsa *et al*., 2012).

In this study tick infestation in oxen was 47.36% which was almost similar to the result of Fatma *et al*. (2016) in which the prevalence of ticks on oxen was 45.28% in Beni- suef Governorate Egypt. This result also shows similarity with the result of Rony *et al*. (2010a) in Bhawal forest area Ghazipur which shows the prevalence of tick (*Boophilus* sp.) was 45.63%. The slight difference may be due to difference in breed, nutritional stress, lactation stage of the animals.

The ovaerall prevalence of ectoparasites in cows was 60%, which was higher than results of Yacob *et al*. (2008b), Yacob *et al*. (2008b) and Onu and Shiferaw (2013) which had overall prevalence of ectoparasites 40.2%, 15.41% and 27.3% in Makelle, Northern Ethiopia,Oramia regional state Northern Ethiopia and Bench Maji zone Southwest Ethiopia respectively. In this study the prevalence of *Boophilus microplus* was 60 % in cow which was higher than 45.63% in Fatma *et al*. (2016) in Bhawal forest area

Ghazipur. This result is also higher than the results of Islam *et al*. (2006), Islam *et al*.(2015) in which the prevalence of *Boophilus* sp. was 42.4% and 37.67% respectively. Forest hilly areas of the study area, animals grazing near the forestland may be responsible for the higher development of ectoparasites in the animals (Islam *et al*., 2015).

The overall prevalence of ectoparasites in cows was lower than that of Tedesse *et al*. (2011), Islam *et al*. (2009) and Rony *et al*. (2010a) which shows results 73.3%, 65.5% and 64.07% in Kombolch Tannary, Northern Ethiopia, Sirajgunj district Bangladesh and Bhawal district Gazipur, Bangladesh respectively. The prevalence of tick in cows found in this study was lower than prevalence found in Tedesset *et al*. (2011), Rony *et al*. (2010a), Islam *et al*. (2009) and Sajid *et al*.(2008) which showed the prevalence of ticks 73.30%, 64.07%, 65.5% and 75.1% respectively. The difference in geoclimatic conditions, Geographical locations, management practices may contribute for the differences (Islam *et al*., 2015).

The prevalence of ectoparasites in goats in this study was 57.04% which was higher than that of 38.5% of Seyoum *et al*. (2015) in northwest Ethiopia. Prevalence of *Boophilus microplus* in goats in this study was 11.97% which is also higher than that of Seyoum *et al*.(2015) that is 4.2%. This is also higher than the result of Kumsa *et al*. (2012) i.e. 49.7% in goats of Ethiopia. This result is also higher than the result of Yakhchali and Hasseine (2006) in which the overall prevalence of ectoparasites in goats is 9.9% and they found ticks, mites, lice and fleas. The prevalence of ticks in this study 11.97% was slightly higher than Angyiereyiri *et al*. (2015) in Vunania, Navrongo, Ghana the prevalence of ticks was 8.7% in goats. Kumsa *et al.*(2012) found the prevalence of *Ctenoceplalides* sp. and *Boophilus* sp. 5% and 1.6% respectively in goats. Prevalence of *Ctenocephalides canis* 11.97% and *Damalinia caprae* i.e. 49.29% in this study was higher than 8.48% by Rony *et al*. (2010a) at Gazipur in Bangladesh. Khakurel (2008) found (10.26- 22.63)% prevalence of ectoparasites among diseased goats this difference may be due to difference in sampling method.. The variations in result may arise from the management and ectoparasite control practices differences in different study areas (Gebreselama *et al*., 2014). It is well established fact that ruminants including goats donot have their own flea species (Urquhart *et al*., 1996) but they can be infested when they get in contact with dogs, cats or any other animals (Cole, 1986; Wall and Shearer, 1997).

In this study the overall prevalence of ectoprasites in goats was 57.04% which is lower than the overall prevalence of ectoparasites in goats 69.09% by Rony *et al*. (2010b) at Gazipur in Bangladesh. The prevalence of *Boophilus microplus* i.e. 11.97% is also lower than 45.45% shown by Rony *et al*. (2010b) at Gazipur in Bangladesh. In this study prevalence of *Ctenocephalidus caprae* in goats is 11.97% which was lower than the result of Angyiereyiyi *et al*. (2015) in which the prevalence is 22.6% in Vunania, Navrongo, Ghana. These Variations may be due to difference in climatic factors also difference in breeds of goats.

The prevalence of *Boophilus microplus* among buffaloes in this study i.e. 12.95% was almost similar to the prevalence of *Boophilus* sp. found in Kurigram district Bangladesh which was 13.98% by Mamun *et al*. (2010). The slight difference may be due to climatic factors and difference in selection methods of samples.

The overall prevalence of ectoparasites in buffaloes in this study is 48.78% which was lower than the result of Mamun *et al*. (2010) i.e. 61.86% in Kurigram district Bangladesh. The prevalence of Lice in buffaloes in this study is 43.90% which is also lower than that of Mamun *et al*. (2010) which was 51.27%. The prevalence of *Boophilus microplus* in this study was 12.95% which is lower than Islam et al., 2006 in which prevalence of *Boophilus* sp. is 56.3%, Khan *et al*. (2013) in which prevalence of ticks in buffaloes is 51.65% in Khyber Pakhtunkhwa, Pakistan also lower than Muhammad *et al*. (2008) i.e. 53.12% in Faisaland, Pakistan and Fatma *et al*. (2016) i.e. 21.67% in Beni suef Governorate Egypt. Varaition in the result may be due to difference in climate along with different management practices.

Overall prevalence of ectoparasites in buffaloes in this study was 48.78%, prevalence of ticks (*Boophilus microplus*) was 12.95%, prevalence of lice (*Haematopinus tuberculatus)* was 43.90% which was higher than 25.64%, 6.99% and 9.84% respectively by Kakar and Kakarsulemankhel (2008) in Pakistan. The overall prevalence of ectoparasites was also higher than 14.7% of Muhammad et al., 2008 at Faisaland, Pakistan. Prevalence of *Haematopinus* sp. in this study i.e. 43.90% is also higher than 4.5% of Veneziano *et al*, 2007 in Pakistan, 34.75% of Azam *et al*.(2002), 18% of Hussain *et al*.(2006) and 11.35 of Manan *et al*.(2007) in Peshawar, Pakistan.

Mixed infestation was also seen in the present study like that of Gebreselama *et al*. (2014) and Onu and shiferaw (2013).The mixed infestation was 20.51% in this study which is higher than 2.8% in Bench maji zone, Southwest Ethiopia by Onu and Shiferaw (2013) and lower than 47.0% by Gebresalama *et al*. (2014) in Bishoftu town, Central Ethiopia. The variations seen in the results mentioned above could not only be associated with climatic factors but it can also be due to the susceptibility of breeds kept by farmers in these days. The selection of more productive breeds, combined with intensified production and the traditional husbandry practices rather than modern techniques has resulted into an increased susceptibility to parasites (Stevens *et al*., 2006).

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion:

The present study conducted on prevalence of ectoparasites of ward no. 2 and 3 of Phedikhola rural municipality, Syangja shows that ectoparasites of domestic animals are one of the factor affecting the well-being of the animals in the area. The study demonstrates the overall prevalence of ectoparasites ectoparasites in ward no 2 and 3 of that rural municipality was 52%. Overall prevalence of lice, ticks and fleas in that area was 42.33%, 16.66% and 5.66% respectively. Prevalence of ectoparasites in goats was 57.04%. Prevalence of *Damalinia caprae* in goats was 49.29%, *Boophilus microplus* was 11.97% and *Ctenocephalidus canis* is 11.97%. Prevalence of ectoparasites in buffaloes was 48.78%. Prevalence of *Haematopinus tuberculatus* was 43.90% and prevalence of *Boophilus* sp. was 12.19% among buffaloes. Only ticks (*Boophilus microplus*) were found in cows and oxen and their prevalence in cows and oxen was 60% and 47.36% respectively. The prevalence was higher in the study area than normal and has been characterized by poor husbandry practices due to lack of veterinarian information and lack of awareness about ectoparasites of domestic animals. The study confirmed that domestic animals were found to be most susceptible and infested by various ectoparasites and the predominant parasite was lice in the study area. In the study area cows (60% infested) were more susceptible to ectoparasites than goats, buffaloes and oxen. Poor management practices, grazing area, nutritional factors, traditional rearing system, climatic conditions and geographical factors can be considered as important factors which influence the prevalence of ectoparasites. The higher prevalence of present study showed an alarming situation in the study area. This finding might be useful while designing control strategies of ectoparasites in domestic animals.

6.2 Recommendations:

Based on the conclusion, it was recommended that:

- Molecular techniques should be applied for species level identification.
- Good husbandry practices should be employed.
- The field veterinarians and stockowners should be aware of the importance and burden of ectoparasites in domestic animals because it is related to human in respect to health and economy as well.
- Additional investigations are required to determine the vectoral role of ectoparasites in disease transmission to humans and animals which have zoonotic importance.

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ANNEX 1

Taxonomic keys of ectoparasites

Taxonomic key of Ixodidae upto genus level

Ixodidae: Dorsal shield present; capitulum anterior; palpi ridged.

1a. Anal groove in front of anus, horseshoelike; scutum inornate; abdomen not festooned; long mouth parts; no eyes; male with many ventral parts……..… *Ixodes*.

1b. Anal groove behind anus or absent…… 2

2a. Palpi longer than width of capitulum……... 3

2b. Palpi shorther than width of capitulum…… 4

3a. Scutum inornate; 2nd and 3rd segments of palpi almost equal; male with 2 pairs of ventral plates; festoons present. ……. *Hyalomma.*

3b. Scutum ornate; 2nd segment of palpi elongated; males without ventral plates; festoons present; only distal half of hypostome toothed……. *Amblyomma*.

4a. Anal groove absent or very indistinct; no festoons; male with 2 pairs of ventral shields……. 5

4b. Anal groove distinct; festoons present ……. 6

5a. Palpi ridged; legs of male normal…….. *Boophilus*.

5b. Palpi not ridged; segments of male legs beadlike…… *Margaropus.*

6a. Ornate; first coxa deeply cleft; basis capituli rectangular; second joint of palpi longer than third; male without ventral shields, but with festoons… *Dermacentor*.

6b. Inornate……. 7

7a. Palpi conical, second joint flaring at base; basis capituli rectangular; first coxa not deeply cleft; male without ventral shields…….. *Haemaphysalis.*

7b. Palpi not conical, 2nd and 3rd segments of palpli about equal; basis capituli pointed at sides; first coxa deeply cleft, male with one pair of ventral shields…… *Rhipicephalus*

Taxonomic keys for Anoplura upto family

1a. Abdomen without any sclerotized plates except on terminal and genital segments…….. 2

1b. Abdomen with pleural plates (paratergites), and usually tergal and sternal plates also…… 4

2a. Body robuts, and bristly or scaly; legs, at least last 2 pairs, with very stout undivided tibiotarsus; on seals……. Echinopthiriidae

2b. Body with setae but not scales; 1st pair of legs smaller than 2nd or 3rd……. 3

3a. Abdominal spiracles several; on Artiodactyla and hyraxes…….. Linognathidae

3b. Only 1 abdominal spiracle, on 8th segment, on shrews…….. Neolinognathidae

4a. Pleural plates (paratergites) with their apical parts projecting free from body; legs all about equal, or 1st pair smaller; majority on rodents, a few on insectivorous and primates, one on Equidae……. Hoplopleuridae

4b. Pleural plates without free apices…… 5

5a. Eyes reduced or absent, legs and claws approximately alike on all 3 pairs; on Artiodactyla and Equidae…… Haematopinidae

5b. Eyes with well-developed lenses and pigment; legs all about equal, or 1st pair smaller; on Primates, including man……..... Pediculidae

Taxonomic keys for suborder Ischnocera of upto family

Ischnocera: Antennae filiform and exposed; no maxillary palpi.

1. Antennae 5-segmented; tarsi with 2 claws; infesting birds…….. Philopteridae

2. Antennae 3-segmented; tarsiwith 1 claw; infesting mammals…... Trichodectidae

Taxonomic key for Trichodectidae upto genus

1. With pleural plates; antennae alike in both sexes…… *Damalinia*

2. With pleural plates; antennae of male with first segment of antenna enlarged…… *Trichodectes*

3. Without pleural plates; antennae alike in both sexes…. *Felicola*

Taxonomic key to the common fleas

1a. No ctenidia…… 2

1b. At least one ctenidium present…… 5

2a. Dorsal plates of thorax very narrow, appearing telescoped…… 3

2b. Metanoth as long as or longer than 1st abdominal tergite…… 4

3a. Pygidium with only 8 pits on each side; inner side of hind coxa without spinelike bristles; no antepygidial bristles; female with abdominal spiracles II-IV very small or absent, V-VII very large…… *Tunga*

3b. Pygidium with 14 pits on each side; inner side of hind coxa with spine like bristles; 1 or more antepygidial bristles present…… *Echidnophaga*

4a. Mesothorax without a vertical rod; frons smoothly rounded… *Pulex*

4b. Mesothorax with a vertical rod; suture between antennal grooves, feebly sclerotized…….. *Xenopsylla*

5a. Genal and pronotal ctenidia present…… 6

5b. Only pronotal ctenidia present…… 7

6a. Genal ctenidium horizontal, in the common species on cats and dogs with 8 or 9 teeth on each side …… *Ctenocephalides*

6b. Genal ctenidium of 3 spines with a broad genal lobe above and posterior to the spines…… *Ctenophthalmus*

6c. Genal ctenidium vertical, with 4 spines……. *Leptopsylla*

7a. One row of bristles on each abdominal segment, metanotum with short apical spines…… *Ceratophyllus*

(Chandler and Clark, 1961).