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Collection and Identification of Ectoparasites in Domestic Mammals of District Malakand KPK, Pakistan

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ABSTRACT

The current study conducted to collect and identify the ectoparasite infesting domestic mammal's i.e cows, buffaloes, goats and sheep in district Malakand, Khyber Pakhtunkhwa province of Pakistan during the months of March, May and July 2023. In the present research work, total 542 mammals were screened, out of them 251 were infested with ectoparasites. During present study, two genera of lice and four gnera of ticks were identified. The four genera of ticks were Hyaloma, Rhipicephalus, Ixode, and Heamaphysalus while the two genera of lice were Linognathus and Damalinia. The specimen were collected with the help of mouth blanded forcep and preserved in the formalin (10%). The collected specimens were identified on basis of morphlogical characteristics with the help of identification key as mention by Wall and Shearer (2001) and walker et al; (2003). There were total 655 ectoparasites collected from selected localities, out of these 364 were ticks and 291 lice. The ticks infestations were observed in all the selected mammalian species, while the lice infestation were observed in goats and sheep. Ticks infestations observed high in the cows (31.31%) than buffaloes (27.47%), sheep (19.78%) and goats (21.42%). While the lice infestation high in the in goats (51.20%) than sheep (19.78%). According to the current study we concluded that ectoparasites infest domestic mammals such they are not only the cause of diseases in them but also adverse effect on their growth and productivity.

1. INTRODUCTION

1.1 Global Burden of Ectoparasites

Pakistan is an agriculture country. Most of Pakistani peoples about 30 to 35 million are engaged in forming and livestock industries. Livestock is the subsector of agriculture that play vital role in the economy of a country. The former depends on livestock for dairy products like meat, milk, ice cream butter, and cheeses. Pakistan possess huge number of livestock, There are about 22.4 million cattle, 23.3 million buffaloes, 24.2 million sheep, and 49.1 million goats, are found in Pakistan (Rehman *et al.,* 2017).

However livestock are badly affected and their products do not reach their potential capacity due to several factors such as parasites, pathogenic diseases, climate, diet, and feeding regime. All these factors highly disturbed worldwide livestock (Ramzan *et al.,* 2020).

Parasites are a group of organisms that completely depend on their host for nourishment, maturation, shelter, and also for development. They are extremely pathogenic; causing diseases that may even cause death of their host. There are basically two types of parasites Ectoparasite and Endoparasite. Ectoparasites are those living organisms that live outside of the body and endoparasites are those that live inside of the body. They are completely dependent on the host for food and shelter. Their hosts may be animals are plants (Gross *et al., 2005*).

Arthropod ectoparasites the main threat to livestock. Arthropod ectoparasites constitute a diverse and highly adapted group of animals that inhabit the external body surfaces of vertebrates. They may live on their host and act as pathogen that cause diseases in animals and as well as in humans. They are completely depending on their host for various life sustaining resources (Wall and Shearer, 2001).

They directly or indirectly affect livestock, as cows, buffaloes, sheep, and goats. They decrease their milk production and also spread harmful diseases in them (Lawrence *et al.*, 1983). They are extremely pathogenic and may even cause the death of organisms depending on the host's immunological condition, nutritional status, and intensity of parasitism (Scott *et al.,* 2001). Some ectoparasites also act as transmitting agents of viruses, bacteria, protozoa, cestodes, and nematodes, including vectors of zoonotic diseases in humans (Rehbein *et al.,* 2003).

1.2 Major ecto-parasites

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. Among the Arthropod ectoparasites some of major ectoparasites are as following mentioned.

1.2.1 Tick infestation

Among the Arthropod ectoparasites ticks are one of the most serious ectoparasites. Their ectoparasitism is a serious threat to both animals and humans all over the world. Ticks were considered parasites of domestic animals as early as 400 B.C. Aristotle in his famous book Historia Animalium" stated that ticks were disgusting parasites that were generated from grass (Dobbelarece; 1999). They belong to the phylum, Arthropoda and order, Acarina. They are classified into three families, Argasidae or soft ticks, Ixodidae or hard ticks, and Nuttalliellidae. 899 ticks' species parasitize the vertebrates including 185 species of Argasidae, 713 species of *Ixodidae*, and one species of Nuttalliellidae (Klompen *et al.,* 1996).

They cause the greatest economic losses in livestock production. About 80% of the livestock population in tropical and subtropical parts of the world including India, Pakistan, and Bangladesh are influenced by ticks and ticks borne diseases. Their effects are various including reduced growth, milk and meat production, damaged hides and skins, transmission of tick-borne diseases of various types and predispose animals to secondary attacks from other parasites such as screw worm flies and infection by pathogens such as Dermatophilos congolensis, the causative agent of streptothricosis. Other losses directly attributable to ticks include skin damage that greatly lowers value of the skin (Desta; 2010). Some of the tick borne parasitic infections in sheep and goats include:

Babesia ovis: Transmitted by Rhipicepalus bursa and Rhipicepalus evertsi.

Babesia motasi: Transmitted by Haemophysalis spp., Dermacentor spp., and Rhipicepalus bursa.

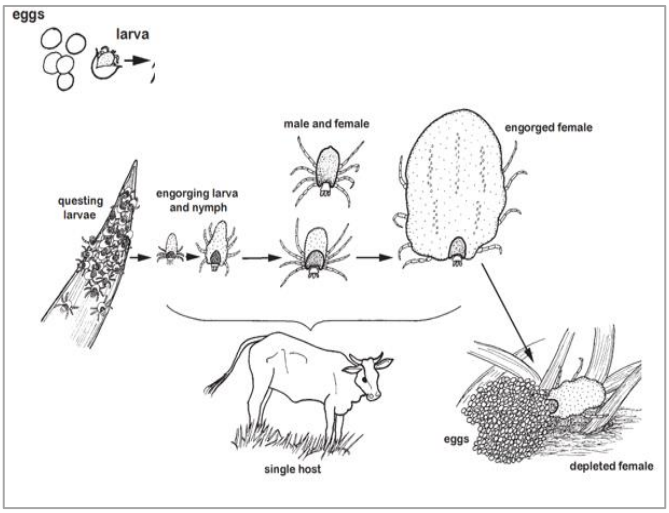
Theileria ovis: Transmitted by Rhipicepalus bursa and Rhipicepalusevertsi.

Heart water: Transmitted by Ambylomma herbarium and Ambylomma variegatum, and

Tick paralysis: Transmitted by Ixodes rubicundus, Rhipicepalus evertsi, Ambyloma and Dermacentor.

1.2.2 Reproduction

In the hard ticks mating takes place on the host, except with Ixodes where it may also occur when the ticks are still on the vegetation. Male ticks remain on the host and will attempt to mate with many females while they are feeding. They transfer a sac of sperm (spermatheca) to the female. The females mate only once, before they are ready to engorge fully with blood. When they finally engorge they detach from the host and have enough sperm stored to fertilize all their eggs. Female hard ticks lay many eggs (2 000 to 20 000) in a single batch. Female argasid ticks lay repeated small batches of eggs. Eggs of all ticks are laid in the physical environment, never on the host.



1.3 Lice infestation

Lice are wingless insects which are classified either as a single order (Phthiraptera) or as two orders Anoplura (sucking lice) and Mallophaga (chewing/biting lice). Approximately 540 valid species of sucking lice are recognized, all of which are obligate haematophagous ectoparasites of mammals. Although only about 20 of these species are pests of domestic animals, they can occur in huge numbers which may result in host irritation, anemia or dermatitis (Durdenl and Musser; 1994).

There are two types of lice, biting lice and sucking lice. Biting lice graze on epidermal tissue, hair and other organic waste. They cause intense itching by their action. Sucking lice have a narrow head with mouthparts adapted for penetrating the skin of the host and sucking blood. Both immature and adult stages suck the blood or feed on the skin. The saliva and feces of lice contain substances capable of causing allergies giving rise to severe irritations to the skin. This is usually shown by the animal rubbing itself against objects. General unthriftiness, matted, dull fleece with tufts of wool may indicate lice infestation. Animal's exhibit reduced weight gain and loss in production. Lameness can result from the foot lice of sheep. Lice are also associated with development of cockle. Cockle is an inflammatory response of the skin to the presence of lice and their saliva. This is seen after the wool or hair has been removed from the skin. Animals in poor body condition are likely to be seriously affected (Desta; 2010).

1.4 Objectives of the study

1. To identify the ectoparasite infesting domestic mammals i.e goats, cows, sheep and buffaloes.
2. To determine most affected mammals with respect to localities.
3. To identify different genera of ectoparasites found in distract Malakand.

1.5 Research Questions

The main research question of the entire work is to identify ectoparasitic fauna infesting domestic mammals, in the locality of distract Malakand.

Ectoparasitic not only remains a leading cause of mortality, but it also influences socioeconomic development of a country.

1.6 Significance of the Study

This research work having great significance for other students such as having valuable information and also awareness of this issue. It can also valuable for the association working in healthcare of the domesticated mammals professional health workers, and health care programs. This study can also provide information to those working in the area of infectious disease proficient.

1.7 Seasonal changes in ectoparasites infestation

Seasonal changes influence ectoparasites infestation. Seasonal trend showed highest prevalence of ticks and lice during the months of winter while peak frequency distribution of ticks and flies was recorded during summer and spring months, respectively (Iqbal; 2014).

1.8 Status of Ectoparasites in district Malakand

The infestation of ectoparasites reported highly in malakand division (Mohsin *et al.,* 2021). The entire work conducted in the localities of district Malakand, including Batkhela, Agra, Alladand, Bazdara bala. The infestation of ectoparasites may cause many diseases and also threat for mammalian productivity.

The main ectoparasites reported in district Malakand are as follows.

1.8.1 Tick Infestation

Tick infestation were reported from the certain locality indicate that 21.42% in goats, 19.78% in sheep, 27.47% in buffaloes and 31.31% in cows.

1.8.2 Lice Infestation

While the lice infestations were observed only in sheep and goats. The infestations of lice in goats were 51.20% and in sheep ware 48.80%.

1.9 Risk Factors

Mehlhorn, (2018) find out some negative impacts of ectoparasite on health and wellbeing of domestic mammals. Some of these deleterious impacts mentioned by Mehlhorn, (2018) are as under.

i. Skin irritation: Ectoparasites can cause severe itching and irritation to the skin of domestic mammals, leading to skin lesions, hair loss, and secondary bacterial infections.
ii. Blood loss and anaemia: Blood-sucking ectoparasites such as lice and ticks can cause significant blood loss in domestic mammals, which can lead to anaemia and weakness.
iii. Transmission of diseases: Ectoparasites can transmit a range of diseases to domestic mammals, such as Lyme disease, Rocky Mountain spotted fever, and bubonic plague.
iv. Allergic reactions: Some domestic mammals may have an allergic reaction to the saliva of ectoparasites, which can cause intense itching, swelling, and redness.
v. Infested domestic mammals may exhibit changes in behaviour, such as restlessness, irritability, and decreased appetite.

1.10 Prevention of ectopararsite

Rather than waiting until the problem of ectoparasites becomes serious, the farmers should maintain a strict preventative regimen for controlling ectoparasites. Conduct a thorough physical evaluation of their mammals at least once weekly. Run their hand over each animal's hair coat, visually inspecting for excessive hair loss, flakes of loose skin, areas of skin irritation, and any crusty lesions or bumps that might indicate infection with an external ectoparasites. Immediately separate and place any animal that shows sign of parasite infection or seems to be unthrifty. This helps to reduce the chances of passing infection on to the rest of their mammals. Quarantined mammals should not be mixed with the main flock until treatment is complete and the parasite eradicated. Isolate newly introduced animals and treat them for ectoparasites before mixing them with other animals.

Practice good sanitation habits; Clean animal houses regularly, seal with cement or mud all cracks in the floor and walls of livestock housing, remove grass/plants around the barn and all litter and discarded wool must be collected and burnt or deposited out of animal contact. Spray housing with an appropriate pesticide every two weeks if possible. Farmers should also be aware of ways to reduce the number of ticks on pasture rotate the land where livestock graze, avoid pasture which has many ticks as long as possible, Chickens can be kept in places where there are many ticks, for example around watering places, etc. (Desta., 2010).

2. MATERIALS AND METHODS

2.1 Study locality and sampling

The current study conducted in the localities of district Malakand Khyber Pakhtunkhwa, Pakistan, including Batkhela, Agra, Pingan Alladand Dheri and Bazdara bala, to collect and identify different species of ectoparasite infesting in domesticated mammals. District Malakand situated at 34°29′59.99″N and 71°44′59.99″E. The annual temperature is 39° F to 105°F, and average rainfall is 2.8 inches. The minimum relative humidity is 28% and maximum is 57 %, respectively. Domesticated animals like sheep, goats, cows and buffaloes are the major agricultural enterprises for farmers in the study area. Different farms and local houses of Malakand raising domesticated mammals were visited to collect ectoparasites (Pakistan Meteorological Department, Malakand, 2019).

2.2 Ectoparasites Collection

The whole bodies of selected mammals were screened for the presence of ectoparasites. They were collected from inner thighs, udder, tail, external genitalia, peritoneum, dewlaps, and flanks, around eyes, ears and neck. Mouth blunted forceps were used to collect the observed ectoparasites carefully from the attachment site. To prevent damage to ectoparasites forceps were used (Adil *et al.,* 2021).

During this study, total of 542 domesticated mammals include cows, sheep, goats and buffaloes were examine for ectoparasites infestation in the including areas, out of which 241 were found positive for infestation and 301 are negative. There are total of 655 ectoparasites collected, consisting of 364 ticks and 291 lice were collected from different body parts of the selected mammals. The collected specimens were brought to the college laboratory for further processing.

2.3 Survey Design

Systematic surveys were designed to collect and identify of

mammalian ectoparasites in the sellested localities. The selected study area including; Batkhela, Agra, Alladand Dheri and Bazdara bala of district Malakand.

2.4 Visits and Data Collection

Our research team conducted multiple visits to the selected study area during early March, May, and June 2023. Observations and data collection were carried out using systematic sampling procedures.

2.5 Procedure of Preservation

The collected ectoparasites were washed with fresh water to remove debris. Then we counted and preserved collected specimens in vials containing 10% formalin. The collected specimens were brought to the college laboratory for further processing. Before identification, preserved specimens were incubated in 10% potassium hydroxide (KOH) at room temperature for more lucidity. Afterwards, specimens were dehydrated through a graded series of alcohol 30%, 50%, 70%, 90%, and 100% for 20 min. After dehydration, the specimens were treated with xylene and mounted on slide (Ramzan *et al*., 2020).

2.6 Identification of Collected Sample

The Identification of collected sample carried out by using morphological keys written by Wall and Shearer (2001) and walker *et al;* (2003).

3.RESULTS

During the current study, there were total 542 domestic mammals were screened in the mention area of district Malakand, including 99 sheep, 159 cows, 104 buffalos, 180 goats. Out of these 542 mammalian species, 251 were infected by ectoparasite. All 251 domestic mammals were infected by ticks and lice. Ticks were found in all 251 mammals while lice were observed only in goats and sheep that were 132 in number.

The total of 655 ectoparasites species were collected. Among them, 164 samples were collected from the village Bazdara Bala (25.03%), 174 from Alla Dandh Dheri (26.56%), 167 from Agra (25.49%), and 150 from Batkhela (22.90%). The collected samples were identified to genus level. Out 655 ectoparasites, 364 were ticks and 291 were lice.

The whole bodies of selected mammals were investigated for the presence of ectoparasites. They were collected from thighs, udder, tail, external genitalia, peritoneum, dewlaps, and flanks, around eyes, ears and neck. Mouth blunted forceps were used to collect the obseved ectoparasites carefully from the attachment site.

Out of 364 ticks, 121 belonged to genus *Hyaloma*, 102 ticks were belonged to genus *Rhipicephalus*, 66 ticks were belonged to *Ixode* and 94 ticks were belonged to *Heamaphysalus*.

There are total 291 lice were collected, out of these 159 lice were belonged to *Linognathus* and 132 were belonged to *Damalinia.*

During conducting our research we visited following mentions area of district Malakand to collect various mammalian ectoparasites Surviving/ Visited based on mention area/ localities brought in months of March, May and June.

Survey/ Visits based on mention area/ localities in months of March, May and June.

3.1 Visits to the village Bazdara Bala:

During research work our teams visited to the village Bazdara Bala to collect ectoparasites. The survey conducted in the month of March, May, and July. During survey, the temperatures were also recorded.

The first visit conducted in the month of March. During this survive our team examine 58 mammalian species and also recorded temperature "30^{0}C". Out of 58 mammalian species 20 goats, 15 cows, 05 buffaloes, 08 sheep were examined. Among them 06 species were infected by ticks and 04 were infected by lice. There were 40 ectoparasites species collected including 22 ticks, and 18 lice.

The second visit conducted in the month of May. At this survive our team examine 41 mammalian species and recorded temperature is "35^{0}C". Out of these 41 mammalian species 15 goats, 13 cow, 06 buffaloes, and 07 sheep were examined. Among them 9 species infected by ticks and 07 were infected by lice. The total 58 ectoparasites species were collected including 32 ticks and 26 were lice.

Our research team visited to the Bazdara Bala for third time in the month of June. There are 50 mammalian species examined including 8 Sheep, 19 Goats, 14 Cows and 9 were Buffaloes and also recoded temperature '41^{0}C'. Among them 19 species were infected by ticks, 11 were infected by lice. The total 66 ectoparasites species were collected including 37 ticks and 29 were lice.

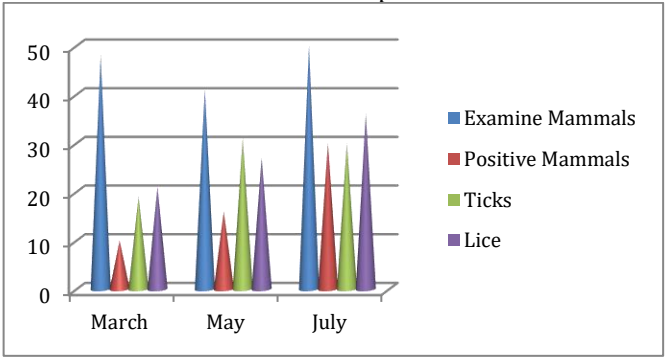
Table 1

Show samples of ectoparasites number and number of examined mammal's base on including months in the Bazdara Bala District Malakand kpk Pakistan.

Visits	Months	Examine Mammals	Positive Mammals	Collected Ectoparasites	Ticks	Lice
First	March	48	10	40	19	21
Second	May	41	16	58	31	27
Third	July	50	30	66	30	36
Total No.		139	56	164	80	84

Graph 1

This graph show samples of ectoparasites number and number of examined mammals base on including months in Bazdara Bala District Malakand kpk Pakistan.



3.2 Visits to the village Alla Dandh Dheri:

Our research teams also visited to the village Alla Dandh Dheri to examined ectoparzasites infestation. The surviving conducted in the month of March, May, and July. During surviving, the temperatures were recorded.

In the month of March our team conducted visited to the village of Alla Dandh Dheri district Malakand. 40 mammalian species were examined including 07 Sheep, 13 Goats, 12 Cows and 8 were Buffaloes, out of these 03 goats, 04 cow, 03 buffaloes, 02 sheep were infected. Among of them 7 species were infected by ticks and 5 were infected by lice. Our research team collected 44 ectoparasites species including 23 ticks and 17 were lice. The environmental temperature is '28^{0}C'.

In the month of May, The second visited conducted and 55 mammalian species were examined including 11 Sheep, 19 Goats, 14 Cows and 11 were Buffaloes. Among them 13 species were infected by ticks, 12 were infected by lice. The environmental temperature is '32^{0}C'. There were 60 ectoparasites species collected including 33 ticks and 27 were lice.

The third visit was conducted in month of July and there were 60 mammalian species examined including 8 are Sheep, 19 Goats, 14 Cows and 9 were Buffaloes. Among them 17 species were infected by ticks, 13 were infected by lice. The environmental temperature is '40^{0}C'. There were total 70 ectoparasites species including 39 ticks and 31 were lice.

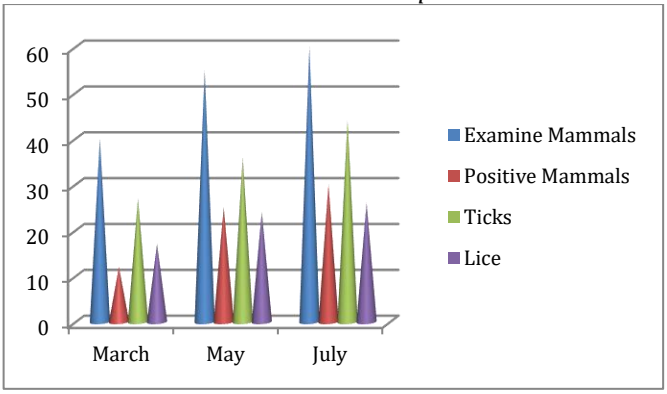
Table 2

Show samples of ectoparasites number and number of examined mammal's base on including months in the Bazdara Bala District Malakand kpk Pakistan.

visits	Months	Examine Mammals	Positive Mammals	Collected Ectoparasites	Ticks	Lice
First	March	40	12	44	27	17
Second	May	55	25	60	36	24
Third	July	60	30	70	44	26
Total No.		155	67	174	107	67

Graph 2

This graph show samples of ectoparasites number and number of examined mammals base on including months in Alla Dandh Dheri District Malakand kpk Pakistan.



3.3 Visits to the village Agra.

During research work our teams visited to the village Agra to examine ectoparasites infestation. The surviving conducted in the month of March, May, and July. During surviving, the temperatures were recorded.

The first visit conducted in the month of March. During this survive our team examine 38 mammalian species and recorded temperature were "27^{o}C". Out of 38 mammalian species 15 are goats, 12 cow, 04 buffaloes, 07 sheep were examined. Among them 06 species were infected by ticks and 04 were infected by lice. Our research team collected 45 ectoparasites species including 21 ticks and 17 were lice.

The second visit conducted in the month of May. At this survive our team examine 49 mammalian species and recorded temperature is "31^{o}C". Out of these 49 mammalian species 19 are goats, 13 cow, 07 buffaloes, 10 sheep were examined. Among them 12 species were infected by ticks and 10 were infected by lice. During this visit we collected 59 ectoparasites species including 32 ticks and 27 were lice.

Our research team visited for the third time in the month of June. There are 54 mammalian species examined including 10 are Sheep, 20 Goats, 14 Cows and 10 were Buffaloes and also recoded temperature '39^{0}C'. Among them 19 species were infected by ticks and 17 were infected by lice. Our research team collected 63 ectoparasites species including 35 were ticks and 28 were lice.

Table 3

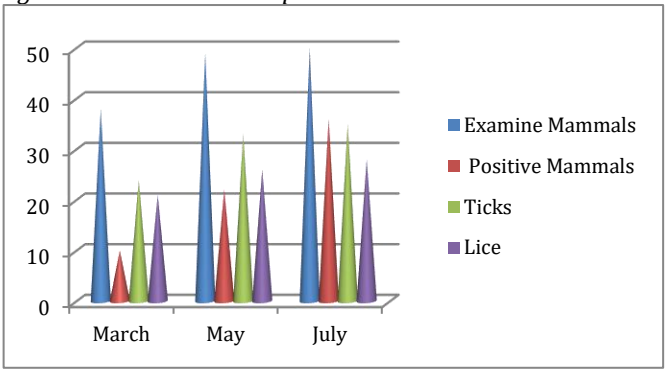
Show samples of ectoparasites number and number of examined mammal's base on including months in the Agra District Malakand kpk Pakistan.

Visits	Months	Examine Mammals	Positive Mammals	Collected Ectoparasites	Ticks	Lice
First	March	38	10	45	24	21

Second	May	49	22	59	33	26
Third	July	50	36	63	35	28
Total No.		137	68	167	92	75

Graph 3

This graph show samples of ectoparasites number and number of examined mammals base on including months in Agra District Malakand kpk Pakistan.



3.4 Visits to the village Batkhela:

Our research teams also visited to the village Batkhela to examined ectoparzasites infestation. The surviving conducted in the month of March, May, and July. During surviving, the temperatures were recorded.

In the month of March our team conducted visited to the village of Batkhela district Malakand. 30 mammalian species were examined including 06 Sheep, 09 Goats, 07 Cows and 8 were Buffaloes, out of these 02 goats, 02 cow, 03 buffaloes, 02 sheep were infected. Among them 07 species were infected by ticks, 03 were infected by lice. Our research team collected 36 ectoparasites species including 19 were ticks and 17 were lice. The recorded temperature was "27°C".

In the month May, The Second visited conducted and 33 mammalian species were examined including 09 were Sheep, 11 Goats, 08 Cows and 07 were Buffaloes. Among them 07 species were infected by ticks and 05 were infected by lice. The environmental temperature is '34°C'. Our research team collected 50 ectoparasites species including 27 were ticks and 23 were lice.

Our research team conducted visit for third time in the month of June to the Batkhela. There are 42 mammalian species examined including 8 Sheep, 12 Goats, 10 Cows and 12 were Buffaloes. Among them 13 species were infected by ticks, 11were infected by lice. The environmental temperature was "41°C". Our research team collected 64 ectoparasites species including 37 ticks and 27were lice.

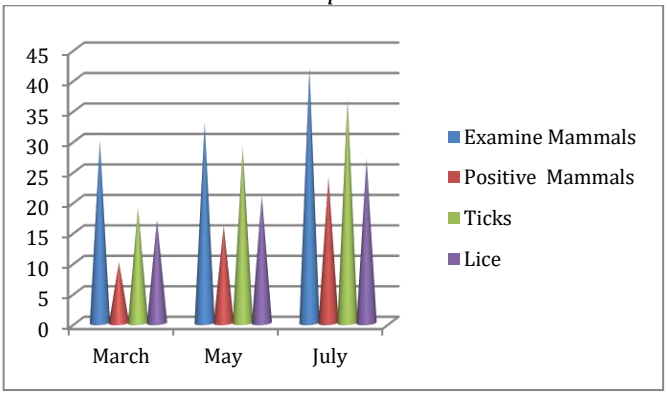
Table 4

Show samples of ectoparasites number and number of examined mammal's base on including months in the Batkhela District Malakand kpk Pakistan.

Visits	Months	Examine Mammals	Positive Mammals	Collected Ectoparasites	Ticks	Lice
First	March	30	10	36	19	17
Second	May	33	16	50	29	21
Third	July	42	24	64	37	27
Total No.		105	50	150	85	65

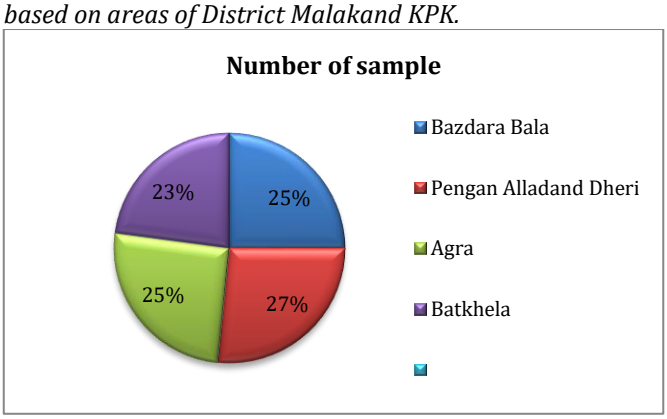
Graph 4

Show samples of ectoparasites number and number of examined mammal's base on including months in the Batkhela District Malakand kpk Pakistan.



Graph 5

This graph show total number of samples in percentage based on areas of District Malakand KPK.



Number of Samples in percentage Based on Area

Table 5

This table show total number of samples in percentage based on areas of District Malakand KPK.

Area	Number of sample	Percentage (%)
Bazdara Bala	164	25.03%
Pengan Alladand Dheri	174	26.56%
Agra	167	25.49%
Batkhela	150	22.90%
Total No.	655	100%

Number of Selected Mammalian species Based on Area:

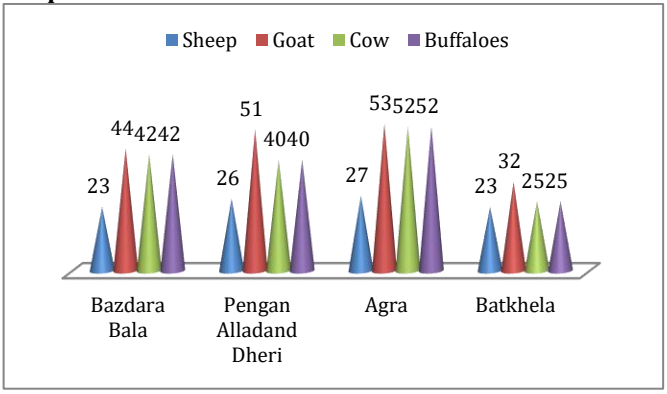
Table 6

This table showed mammalian species of selected Localities of District Malakand KPK.

Localities	Selected Mammalian species			
	Sheep	Goat	Cow	Buffaloes
Bazdara Bala	23	44	42	42
Pengan Alladand Dheri	26	51	40	40
Agra	27	53	52	52

Batkhela	23	32	25	25
Total No.	99	180	159	104

Graph



DISCUSSION

Domestic mammals are important contributors of food production and also providing meat, milk and an income generation for the country's farming system. The ectoparasite infestation considered as a serious problem of domestic mammals due to their worse effect on mammals health, reducing milk and meat production.

Research was about collection and identification of ectoparasite of domestic mammals was conducted in the Malakand district of Khyber Pakhtunkhwa (KPK). The study aimed to collect and identify ectoparasites (Ticks and Lice) infested in domestic mammals including goat, sheep, cow and buffaloes. The sample were collected from the local area of district Malakand including Bazdara Bala, Alladhand Dheri, Agra and Batkhela. The samples were collected in the months of March, May and June. Our team conducted three visits to each and every locality.

During the entire study, there were total of 542 domestic mammals were screened in the mention area of district Malakand, including 99 were sheep, 159 cows, 104 buffalos and 180 were goats. Out of these 542 mammalian species, 251 were infected by ectoparasite. All 251 were infected by ticks and out of these 132 were infected by lice. There are 655 ectoparasite species were collected, among them 164 sample were collected from the village Bazdara Bala (25.03%), 174 from Alla Dandh Dheri (26.56%), 167 from Agra (25.49%) and 150 from Batkhela (22.36%). The collected samples were identified to genus level. Out 655 ectoparasites, 364 were ticks and 291 were lice.

The whole bodies of selected mammals were screened for the presence of ectoparasites. They were collected from thighs, udder, tail, external genitalia, peritoneum, dewlaps, and flanks, around eyes, ears and neck. Mouth blunted forceps were used to collect the observed ectoparasites carefully from the attachment site.

During the present study, the four genera of ticks, genus *Hyaloma*, *Rhipicephalus*, *Ixode* and genera *Heamaphysalus* while two genera of lice, genera *Linognathus* and genera *Damalinia* were identified with the help of morphological keys written by Wall and Shearer (2001) and walker *et al.,* (2003).

Members of genus *Rhipicephalus* and *Hyaloma* were collected from Bazdara Bala and Alladand Dheri, While the members of *Ixode*, *Heamaphysalus, Linognathus, Damalinia* were collected randomly from the all the selected areas. The buffaloes and cows were highly infested with the ticks such as genera *Rhipicephalus* and *Hyaloma*. The current findings are supported by Sarfraz *et al;* (2023) and Khatoon *et al;* (2018) and they reported highly infestation of ectoparasites in cows and buffaloes.

GoatS and sheeps were highly infested by *Hemophysalis* and *Rhipicephalus.* The highest infestation was caused by Hemophysalis followed by Rhipicephalus in goat than sheep. This is supported by Shah *et al;* (2015) and Khatoon *et al.,* (2018). According to Lemos *et al.* (1985) ticks attack on both kinds of mammals, i.e. those with their bodies fully cover by wool and those without wool (Khatoon *et al.,* 2018).

The tick infestation rate was higher in sheep than in goats. This pattern has been observed during the study. But in another study we observed the opposite result: that infestation was lower in sheep as compared to goats. The lower rate of tick infestation in goats was may be due to pasturing in steep and rocky habitats that limit contact with other species of livestock. This is supported by Khan *et al*., (1993)

During the present study, we observed that tick infestation increased from May to August, such as highest tick infestation found throughout the summer while the tick infestations lower during the winter between November and January. This resembled with the Ali *et al.,* (2021).

The infestation lowers in local breed goats than cross bred. This study suggests that indigenous goat could have a higher innate and/or acquired resistance. This agrees with results of Sajid *et al.,* (2007).

Khatoon *et al;* (2018) reported high lice infestation in animals that suffer from malnutrition and intestinal parasitism.

During the current study, high ticks infestation were observed than lice. Ticks were observed in all the selected mammalian species (Sheep, Goats, Cows and buffaloes).While the lice were found in the sheep and goats. The tick's genus *Hyaloma and Rhipicephalus* were collected only from Bazdara Bala and Alladand Dheri except of all the selected localities. The tick's genus *Hyaloma*, *Rhipicephalus* and *Ixode* infestation were highly observed in cow and buffaloes while the genus *Heamaphysalus* infestation were highly observed in the goats and sheep. The genera *Linognathus* of lice were highly found in domestic mammal goat while genera *Damalinia* were in the sheep.

There were total 655 ectoparasites collected from selected localities, out of these 364 were ticks and 291 lice. There were 72 ticks species collected from sheep (10.99%), 78 from goats (11.90%) 114 from cows (17.40%) and 100 from buffaloes (15.26%). The genus lice, 149 species were collected from goats (22.74%) and 142 from sheep (21.67%).

The infestations of ticks in cows were 31.31%, in buffaloes 27.47%, in goats 21.42% and in sheep were 19.78%. While the lice infestations were observed only in sheep and goats. The infestations of lice in goats were 51.20% and in sheep was 48.80%. So ticks infestation high in the cows (31.31%) than buffaloes (27.47%), sheep (19.78%) and goats (21.42%). While the lice infestation

high in the in goats (51.20%) than sheep (48.80%). The lice infestation not observed in cows and buffaloes.

Ectoparasites of the domestic Mammals have clearly demonstrated the impact both on the health of mammals and their performance. Ectoparasites of the mammals are currently a disease of considerable importance in domestic animals production sector as a major cause of down grading and rejection of skin and hide in Malakand. It has been revealed that external parasites are not an outcome of a single determinant, but also consequent to the effects of multiple factors such as poor management, poor plan of nutrition and hygienic conditions. Therefore improving husbandry practices and veterinary services may reduce the level of ectoparasites. The economic losses by the infestation are also the result of reduction in productivity, reproductive performance and death of the affected mammals.

CONCLUSION

During the research study, total of 542 domesticated mammals were screened (99 sheep, 159 cows, 104 buffalos, 180 goats) from selected localities of the district Malakand. There were 251 mammalian species infected by ectoparasite (Ticks and Lice). Total 655 ectoparasites were collected including 364 ticks and 291 were lice. There were four genera of ticks (*Hyaloma*, *Rhipicephalus*, *Ixode* and *Heamaphysalus*) and two genera of lice (*Linognathus* and *Damalinia*) identified.

The overall tick's infestation was 55.58% and lice was 44.42%, with the highest ticks infestations (31.31%) in cows, (27.47%) in buffaloes, (19.78%) in sheep and (21.42%) in goats. While lice infestation was highly observed in goats (51.20%) than sheep (48.80%).

In the present research study, the highest infestations in the domastic mammals were reported. The reason may be lack of education and hospital facilities, unhygienic conditions, and a gap of coordination between Extension staff and farmers were the main reasons of infestation in the study area. Many other factors like climatic conditions and hosts were also involved in ectoparasites growth and reproduction. The infestation increases during summer (June and July) than winter season.

The present study signifies the need of control measure to be undertaken for ectoparasite infesting domestic mammals because they not only cause diseases in mammals but also badly effect their growth and productivity.

RECOMMENDATION

- All possible economic losses due to the disease should be assesses at different stages of skin and hide processing including at its early trading stages and in different tanneries.
- Public education should be created on the effect of skin disease on production, productivity, and skin/hide quality as well as how to care and handle these products.
- The government, private sectors and veterinarians should work together in order to minimize ectoparasites and their impact.
- Further studies should be conducted on ectoparasites infestation and skin disease in different agriculature and ecological parts of the country and in the selected areas.

REFERENCES

Shah, A., Shah, S. R., Rafi, M. A., Noorrahim, M. S., & Mitra, A. (2015). Identification of the prevalent ticks (Ixodid) in goats and sheep in Peshawar, Pakistan. *Journal of Entomology and Zoology Studies*, *3*(2), 11-14.

Iqbal, A., Siddique, F., Mahmood, M. S., Shamim, A., Zafar, T., Rasheed, I., ... & Ahmad, W. (2014). Prevalence and impacts of ectoparasitic fauna infesting goats (Capra hircus) of district Toba Tek Singh, Punjab, Pakistan. *Cell*, *92*, 300-6560477.

Bayou, K. (1998). Overview of Sheep and Goat Skin Diseases, Treatment Trial for Improved Quality of Hides and Skins. *Addis Ababa, Ethiopia.(Phase II)*, 13-20.

Desta, H. (2010). Control of external parasites of sheep and goats. *Technical Bulletin*, *41*, 1-16.

Dobbelaere, D., & Heussler, V. (1999). Transformation of leukocytes by Theileria parva and Theileria annulata. *Annual Review of Microbiology*, *53*(1), 1-42. https://doi.org/10.1146/annurev.micro.53.1.1

Durdenl LA, Musser GG (1994). The sucking lice (Insecta, Anoplura) of the world: A taxonomic checklist with records of mammalian hosts and geographical distributions. *Bull Am Mus Natur Hist 218: 1-90.*(lice). https://digitallibrary.amnh.org/items/d2f053e3-a260-43a7-b716-3db4faaff561

Ghosh, S., Bansal, G. C., Gupta, S. C., Ray, D., Khan, M. Q., Irshad, H., Shahiduzzaman, M., Seitzer, U., & Ahmed, J. S. (2007). Status of tick distribution in Bangladesh, India and Pakistan. *Parasitology Research*, *101*(S2), 207-216. https://doi.org/10.1007/s00436-007-0684-7

Gross TL, Ihrke PJ, Walder EJ, Affolter VK (2005). Skin disease of the dog and cat: Clinical and histopathologic diagnosis (2nd edn). *Blackwell Publishing Science, UK, pp. 11-555.* https://doi.org/10.1002/9780470752487

Gross TL, Ihrke PJ, Walder EJ, Affolter VK (2005). Skin disease of the dog and cat: Clinical and histopathologic diagnosis (2nd edn). *Blackwell Publishing Science, UK, pp. 11-555.* https://doi.org/10.1002/9780470752487

Islam, M. S., Rahman, S. A., Sarker, P., & Anisuzzaman, M. M. H. (2009). Prevalence and population density of ectoparasitic infestation in cattle in Sirajgonj district, Bangladesh. *Bangladesh Res. Publ. J*, *21*, 332-339.

Kamal, A. H., Uddin, K. H., Islam, M. M., & Mondal, M. M. (1996). Prevalence of economically important ticks in cattle and goat at Chittagong hilly areas of Bangladesh. *Asian-Australasian Journal of Animal Sciences*, *9*(5), 567-570. https://doi.org/10.5713/ajas.1996.567

Klompen, J. S., Black, W. C., Keirans, J. E., & Oliver, J. H. (1996). Evolution of ticks. *Annual Review of Entomology*, *41*(1), 141-161. https://doi.org/10.1146/annurev.en.41.010196.001041

Lawrence, J. A., Norval, R. A., & Uilenberg, G. (1983). Rhipicephalus zambeziensis as a vector of bovine theileriae. *Tropical Animal Health and Production*, *15*(1), 39-42. https://doi.org/10.1007/bf02250760

Adil, M. M., Parveen, A., Asif, M., Farooq, M., & Iqbal, F. (2021). Prevalence and identification of tick species on large ruminants from district Rajanpur in Punjab

Pakistan. *International Journal of Acarology*, *47*(7), 633-637. https://doi.org/10.1080/01647954.2021.1976832

Khatoon, N., Noureen, S., Khan, Z., Gul, S. U., & Ur, H. (2018). Domestic animals ectoparasite fauna of district Karak, KP, Pakistan. *Int J Biosci*, *13*, 384-8.

Pakistan Meteorological Department, Malakand. (2019). Government of Pakistan. https://www.pmd.gov.pk/meteorogram/kpk.php

PANGUI, L. (1994). Gale des animaux domestiques et méthodes de lutte. *Revue Scientifique et Technique de l'OIE*, *13*(4), 1227-1247. https://doi.org/10.20506/rst.13.4.817

Sarfraz, R. (2023). Identification, prevalence, distribution of ectoparasites and associated host-related risk factors on domestic animals in district Dera Ismail Khan, KPK, Pakistan. *Pure and Applied Biology*, *12*(2). https://doi.org/10.19045/bspab.2023.120094

Ramzan, M., Naeem-Ullah, U., Saba, S., Iqbal, N., & Saeed, S. (2020). Prevalence and identification of tick species (Ixodidae) on domestic animals in district Multan, Punjab Pakistan. *International Journal of Acarology*, *46*(2), 83-87. https://doi.org/10.1080/01647954.2020.1711803

Ramzan, M., Naeem-Ullah, U., Saba, S., Iqbal, N., & Saeed, S. (2020). Prevalence and identification of tick species (Ixodidae) on domestic animals in district Multan, Punjab Pakistan. *International Journal of Acarology*, *46*(2), 83-87. https://doi.org/10.1080/01647954.2020.1711803

Rehbein, S., Visser, M., Winter, R., Trommer, B., Matthes, H., Maciel, A., & Marley, S. (2003). Productivity effects of bovine mange and control with ivermectin. *Veterinary Parasitology*, *114*(4), 267-284. https://doi.org/10.1016/s0304-4017(03)00140-7

Rehman, A., Jingdong, L., Chandio, A. A., & Hussain, I. (2017). Livestock production and population census in Pakistan: Determining their relationship with agricultural GDP using econometric analysis. *Information Processing in Agriculture*, *4*(2), 168-177. https://doi.org/10.1016/j.inpa.2017.03.002

Wall, R., & Shearer, D. (2008). *Veterinary ectoparasites: biology, pathology and control*. John Wiley & Sons.

Khan, S. S., Ahmed, H., Afzal, M. S., Khan, M. R., Birtles, R. J., & Oliver, J. D. (2022). Epidemiology, distribution and identification of ticks on livestock in Pakistan. *International Journal of Environmental Research and Public Health*, *19*(5), 3024. https://doi.org/10.3390/ijerph19053024

Sajid, M., Iqbal, Z., Khan, M., Muhamamd, G., & Iqbal, M. (2007). Effect of Hyalomma Ticks (Acari: Ixodidae) on Milk Production of Dairy Buffaloes (Bos Bubalus Bubalis) of Punjab (Pakistan). *Italian Journal of Animal Science*, *6*(sup2), 939-941. https://doi.org/10.4081/ijas.2007.s2.939

Miller, W. H., Griffin, C. E., & Campbell, K. L. (2012). *Muller and Kirk's small animal dermatology*. Elsevier Health Sciences.

Walker, A. R. (2003). *Ticks of domestic animals in Africa: a guide to identification of species* (Vol. 74). Edinburgh: Bioscience Reports.

Wall, R., & Shearer, D. (2001). Veterinary ectoparasites: biology, pathology and control.