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Morphological hair identification key of wild mammals in Bagh, Azad Jammu and Kashmir, Pakistan

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SUMMARY

The objective of research was to study the shape and to prepare an identification key of hair for wild mammalian species in District Bagh; and also to prepare a broad technique for identification key of mammalian hair of Bagh, Azad Jammu and Kashmir's mammals. Although the broad use of this method in the explanation of diet in mammalian species especially carnivores, it has not been utilized in Azad Jammu and Kashmir up to this, thus this is the first research for utilizing this method in ecological research and conservation of wild species and diversity in Azad Jammu and Kashmir. During current study, hair structures of six mammalian species showing four orders such as common leopard, musk deer; house rat, Small Kashmir flying squirrel, house mouse and long-eared desert hedgehog were studied. The hair microscopic structure was documented utilizing the external patterns of hair. The structural characteristics of hair for each mammalian species were relatively utilized to prepare a photographic as well as descriptive identification key of hair.

Keywords: Hair mounting, Bagh, Leopard, Deer

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INTRODUCTION

Mammalian hairs (i.e. marten, badger, and squirrel hairs) are very important for human and used for purpose of cloth (Twigg, 1975; Szarzyńska, 2002; Altaf, 2016; Altaf *et al.*, 2017). In conclusion this topic gives us to study in scientific research in fields of wildlife biology, hunting, game keeping, forensic research and natural management (Ciucci and Boitani, 1998). Mammalian hair can be obtained from the feces of the carnivores (Twigg, 1975; Nickoloff, 2013; Chattha *et al.*, 2015). Tupinier (1973) extensively worked on morphological arrangement of mammalian hair. Wildman and Association (1954) performed his work on different types of hairs, particularly those hairs which is widely used in textile industry; also observed hair morphology as well as hair growth, did not only prepared cross-sections of cuticula, and medulla of hair but also give sketch of cuticular and medullar patterns.

Scientists were worked on the internal structure of hair (Tupinier, 1973; Keller, 1978; Keller, 1980; Keller, 1992), while Debrot *et al.* (1982) give photographs of medulla and cuticula and sketches of cross section of mammals. All of these researches(Keogh, 1983; Hillary and Buys, 1984; Taylor, 1985; Teerink, 2004;

Chattha *et al.*, 2011; Boitani and Powell, 2012) give greatest significant for structures and morphology of mammals hairs.

Sometime identification of animals is tough, by using the morphology of hairs such as length, color, from as well as structure of medulla, cross section and cuticula, we can easily generate accurate distinguished between animals, by using combination of these few data. It also give information about different animals have different hairs morphology and structure. The photo atlas is not enough for identification but also character data is insufficient and not well-defined. It is necessary the information about text and pictures of hairs must be accurate (Teerink, 2004).

Many scientist explained growth and development method of hair (Wildman and Association, 1954). The following is a simplified summary of the process. The skin of animals made up of two layers. One is epidermis other one is dermis, the external layer is known as epidermis as well as inner layer is known as dermis. The epidemics is made up of living and dead coating (layer), one of the layer called basal layer, its cells constantly divided and preserved the epidermis. The outside of epidermis is thin. The coating of horn consists of dead cell, which is peel off constantly (Teerink, 2004). The basal layer starts growing at shallow down-side, which is into the dermis. Here basal layer form minor hard plug with dermal Papilla. Then dermis cells form a lesser blood capillaries and sheath of connective tissue, so that transfer the nutriment to anew prepared tissue, around the developing follicle (Wildman and Association, 1954).

The next outcome develop on the follicle-neck and produce a gland called wax gland, as well as in some animals erector muscle grow, which authorize the hairs arrangement. Hair is made up of layers; generally hair has three different types of layers i.e. cortex, medulla, and cuticula. These layers play most essential and important role for understanding and identification of hair. In most animals, the follicle of hairs are organized in grouped, different animals have different organization and size of these group. When the follicle formation is start, sometime two, three, or more follicle seem at the primordial follicle side. Starting a threesome group, later this further hair follicle grows (Teerink, 2004).

In many groups of mammalian species, subordinate follicle develop through bumps on the internal side of hair follicle, after this similar growing steps passed and using the same method to initially arise; for example in Merinos 9 follicles present in a bundle by common orifice (Lyne, 1966). The hair shaft consists of four structural units, the medulla, cortex, pigment granutes, and cuticle (Hausman, 1920). Medulla built up from many shrunken and variously disposed cells or chambers, representing dried and confide epithelial structures connected by a branching filamentous network, which sometimes completely fills the medullary column, but is interrupted in many cases (Debelica and Thies, 2009).

It is noted that moulting is recorded in less winter; while more recorded in the summer e.g. bank vole less than 2% moulting occur in winter; while more than 37% moulting occur in summer (Stein, 1960). The Striped field mouse hairs are thick in wintertime; while thin in summer (Haitlinger, 1968).

The hair is divided into different kinds, for example bristle hairs (domestic pig), under-hairs, Over-hairs, and vibrissae (whiskers) in these categories two or more kind of hair is might be present in the similar species. Vibrissae hairs are quickly

identified, because vibrissae hairs arrangements are identical in different animals. Many vibrissae hairs are spherical in cross-section, and these vibrissae hairs, fully matched from tip to base, so that importance of vibrissae hair for identity is incomplete. The western hedgehog have needle like hairs called spines, and these spines are importantly extend and powerfully adopted hairs. Similarly most of the species are changed due to food, lifestyle, diseases, atmosphere, season, ecosystem, and habitat etc (Teerink, 2004). Main objective of the study was to prepare the identification key for mammalian species of Bagh, Azad Jammu and Kashmir, Pakistan.

MATERIALS AND METHODS

The hair structure was documented in six mammalian species observed in Bagh, Azad Jammu and Kashmir. During this study noted the structures of hair of six species showing 4 orders and 5 families i.e., *Muridae, Sciuridae, Erinaceidae, Moschidae* and *Felida* (Table 1 and Figure 1). Hairs are significant for identification of mammalian species as they show trustworthy characteristics. The hairs were collected from dorsolateral body of each mammalian species.

Figure 1: These pattern are used to identifying the hairs of wild-mammals (Teerink, 1991).

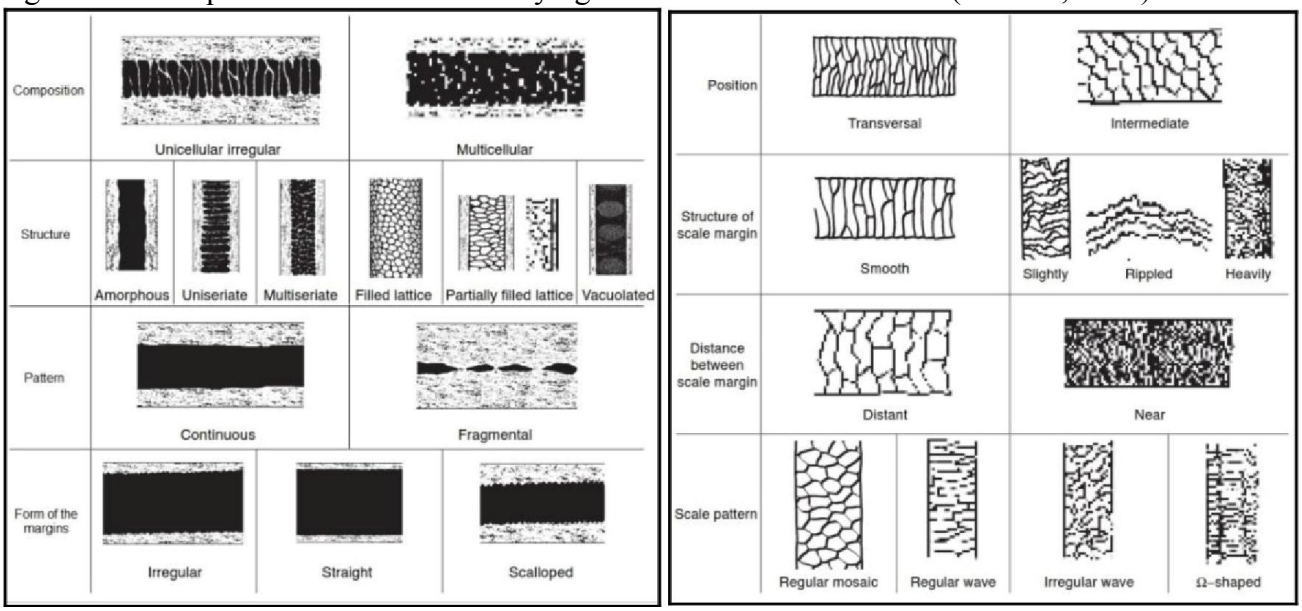

Table 1: Studied mammalian species in his research.

Order	Family	Scientific Name	English Name
Rodentia	Muridae	*Rattus rattus*	House Rat
		Mus musculus	House Mouse
	Sciuridae	*Eoglaucomys fimbriatus*	Small Kashmir flying squirrel
Eulipotyphla	Erinaceidae	*Hemiechinus collaris*	Long-eared desert hedgehog
Artiodactyla	Moschidae	*Moschus Chrysogaster*	Musk deer
Carnivora	Felidae	*Panthera pardus*	Common leopard

Hairs were collected from district Bagh. By using the ethanol clean the microscope parts to get the perfect result. First clean the slides by using the ethanol, and then place the hair with the help of forceps. On the hair put a drop of water and then place under the microscope.

RESULTS AND DISCUSSION

The hair mounting technique is very helpful in research, with the help of hair mounting technique we examined hairs structure rapidly and also help in economically as well as used in wildlife research. This method is useful for wildlife researchers to identify the species. We studied the external structure of six species representing four orders such as *Rodentia, Eulipotyphla, Artiodactyla* and *Carnivora* and six families including *Muridae, Sciuridae, Erinaceidae, Moschidae* and *Felidae*. The examination or observation characteristics were developed by the using of pattern external structure of hairs (Table 2 and Figure 2).

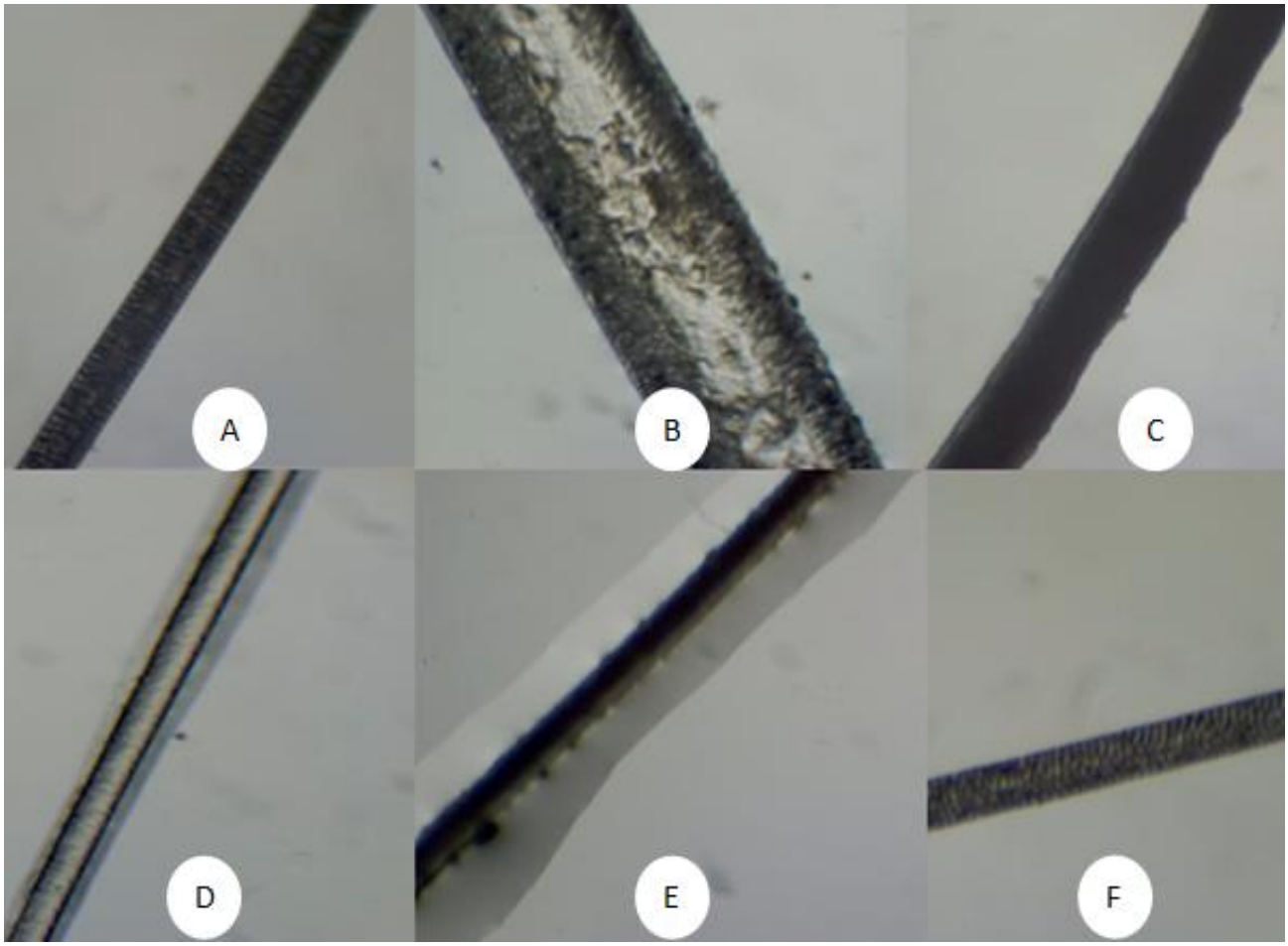

Figure 2: A- House Rat (*Rattus rattus*), B- House Mouse (*Mus musculus*), C- Small Kashmir Flying Squirrel (*Eoglaucomys fimbriatus*), D- Musk Deer (*Moschus Chrysogaster*), E- Common Leopard (*Panthera pardus*), F- Long-eared desert hedgehog (*Hemiechinus collaris*).

Table 2: Hair pattern of observed specimen.

Sr.	Common name	Scientific name	Hair Structure
1	House Rat	*Rattus rattus*	Regular wave
2	House Mouse	*Mus musculus*	Heavily
3	Common Leopard	*Panthera pardus*	Continuous
4	Musk Deer	*Moschus Chrysogaster*	Continuous
5	Small Kashmir Flying Squirrel	*Eoglaucomys fimbriatus*	Amorphous
6	Long-eared desert hedgehog	*Hemiechinus collaris*	Transversal

CONCLUSION

No work created to identify the external structure of hair pattern till now this time in AJK, Pakistan. The mammal's species made examination characteristics present in ecosystems like grasslands, jungles, prairies, mountain, pastures, streams, and high altitude knowledge an extensive varieties of threats. Due to partial information about classification, diversity, ecology, states and population size of these species are uncertain. With the help of hair mounting technique of mammalian species simply and perfectly identifies the external structure of hairs sample which help in research and field study and also helpful to obtained complete information about ecosystems. Our hair mounting technique help in identification base on the external structure of mammal's hairs. This current work providing a fundamental benefit for understanding the prey and predator's population as well as also help in research field i.e. wildlife ecology. We are using the very simplest techniques, this technique is simply, swiftly, and easily and economically useful in monotonous surveys, it is useful and suitable for research and wildlife studies. It is not easy to identify and determined the species, by hair observing or examined with naked eyes, excluding few animals hairs are dense, tough and unbreakable due to changing in the hairs structures between animals. By the using of this hair mounting technique it is helpful to identify the animals, and also help in conservation of species, status, diversity, and Population size.

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