ZOO VOLUNTEER REPORT

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HIGH ALTITUDE HERBIVORE HAIR KEY

Mammalian hair is the best source to solve the biological problems like species identification and diet analysis of endangered large carnivores because it is difficult to examine the intestinal contents of the large carnivores. Mammalian hair has the three basic parts cuticle, cortex and medulla. These parts undergo labs for the mounting technique. In mounting technique hairs are placed on glass slide and mount is pasted on them then observed under photomicroscope to examine hair cuticle and medullary structure under the high magnification. 100x to 400x magnification is considered best for hair mounting technique. Take the sketch under photomicroscope then compare it with reference book. This technique can be applied on large and small carnivores, rodents and birds. By this study we can explore not only diet but species identification, habitat analysis, predator-prey relationship and human-carnivores conflict can also be assessed. Hair identification is not only employed solely by forensic scientists but is also an important tool used by wildlife biologists, archeologists, anthropologists, and textile conservators. Many researchers have investigated the morphological characteristics of hair, devised keys, and reviewed the science of animal-hair identification (Appleyard, 1960; Day, 1966; Mathiak, 1938; Mayer, 1952; Moore, 1974; Oyer, 1939; Stains, 1958, 1962; Wildman, 1954, 1961; Williams, 1938). These works have aided in ecological studies, food-habit studies, and law enforcement investigations by providing descriptions, keys, and photographs of the microscopic characteristics of animal hairs. Hair characters used in the respective study are scale length, scale width, hair length, and scale forms (Benedicts, 1957; Elgmork and Riiser, 1991). There are some example from the literature i.e. (Brown, 1942) attempted to develop a technique for identifying hairs and wools from various types of materials recovered from archeological works. Hausman (1930) used hair examination in his laboratory to perform archeological work, examine stomach remains, identify fur, and conduct legal proceedings. Animal-hair studies also have been conducted within the field of forensic science. Peabody et al. (1983) determined that the medullary fraction could be used to reliably distinguish between dogs and cats. Hicks (1977), Deedrick and Koch (2004) described the microscopic characteristics that can be used to discriminate between animal hairs that are most likely to be encountered in forensic casework. The purpose of the present study is to use various method to identify the animal hair of different high altitude herbivore species.
MATERIAL AND METHODS

Study Area: Padmaja Naidu Himalayan Zoological Park, Darjeeling, West Bengal.

Duration of study: 03.01.2016 - 15.01.2016

Sample Type: Hair

Hair samples were collected for the back portion of the following herbivores; **HIMALAYAN GORAL**, **BLUE SHEEP**, **HIMALAYAN Tahr** and **MARKHOR** and stored in Zip-lock plastic bags.

Method:

1. Slide Preparation: Dry and Wet Mount. For the laboratory analysis dry mount is more convenient for preparation of slides. However, degree of curl and twist cannot be observed due to constraints in the mounting process.
2. Exterior texture and the overall colour of the hair was observed. This observation may be useful before the wet mount.
3. Several hairs were placed in parallel on the slide, to observe their texture and color so that they can be compared easily.

The **wet mount** is essential in hair analysis because of the refractive index of XYLENE is close to that of the keratin in the hair. If the dry mount provides a view of texture and color, wet mount provides the interior structure of the hair, such as inclusion and pigment granules. Because the refractive index of mounting medium plays the most significant role in viewing internal details.

**Whole mount method**: In whole mount method (1) several strands of hair were placed in parallel on a microscope slide. (2) Two drops of XYLENE were added over the hairs in order to clear the hair. (3) A cover slip was placed over the hairs and they were scanned along their length at 100x, 200x and 400x under a compound microscope to observe the morphological characteristics of the cuticle and medulla, and the distribution of pigment in the cortex.
RESULTS AND DISCUSSION

1. HIMALAYAN GORAL (*Nemorhaedus goral*)

Cuticular pattern: Smooth at shaft and evenly crenate at tip. Cortex is thick.
Medulla characteristics: Multicellular composition, partially filled amorphous structure, continuous pattern at shaft and fragmental pattern at tip and irregular margins.
The hair is variably pigmented along the length but densely at the tip.
2. BLUE SHEEP *(Pseudois nayaur)*

Cuticular pattern: Smooth at shaft and evenly crenate all throughout the shaft and tip. Cortex is very thin all throughout the length of the hair. Medulla characteristics: Multicellular composition, multiseriate partially filled towards shaft and tip and filled lattice structure, continuous pattern at shaft and fragmental at root and tip. The hair possess nodes at certain sites along the shaft.
3. HIMALAYAN TAHR (*Hemitragus jemlachius*)

Cuticular pattern: Smooth at shaft and densely serrated throughout the rest of the hair. Cortex is moderately thick.
Medullary pattern: Multicellular composition, multiseriate partially filled lattice structure in shaft region and amorphous partially filled lattice at tip and root, continuous pattern along the whole root and shaft and fragmental at tip, smooth margin at root and tip and irregular in shaft.
Pigmentation varies along the length of the hair with root usually non-pigmented.
4. MARKHOR (*Capra falconeri*)

Cuticular pattern: Smooth in root and tip region and evenly serrated in shaft region. Cortex is thin.

Medullary pattern: Multicellular composition, multiseriate partially filled lattice structure along the shaft and amorphous partially filled structure at root and tip, continuous pattern along the shaft and fragmented at the tip, medullary margin is variable along the length of the shaft ranging from irregular, straight and scalloped. Pigmentation varies along the length of the hair but generally root is non-pigmented.
CONCLUSION

The current study was undertaken with the objective of developing rapid morphological markers for differentiation of species based on their hair pattern that can be used in forensic investigations as well as predator scat analysis. Poor to Moderate amount of variation was found in studied hair parameters between species. Traits like colour & cuticular pattern showed a good variation species but medullary pattern & cortex varied very less between Himalayan Tahr, Bharal and Markhor. These findings indicates that it is very hard to differentiate between related species based on any one trait of hair, instead all the characters must be considered, it also underscores a need to further investigate hair patterns in same & related species on a much larger scale, covering different geographical areas to document the variations within hair patterns, so that definitive markers could be established. Similar studies are essential for other species such as Carnivores and species in trade. Other methods of microscopic analysis of Hair should be undertaken like:

“Scale replicate method: It may be necessary to make a scale cast of the hair specimen in order to see the scale pattern more clearly, particularly in the identification of some animal hairs. It is often very difficult to directly observe scale patterns from hair strands on a slide. Hence, (1) a cast was made using nail polish to obtain the impression of the scales. (2) A thin layer of nail polish was spread on a microscope slide and a hair was placed in the middle of the slide. (3) It was allowed to stand for 15 minutes so that the nail polish could harden and the hair was then gently removed using forceps, (4) the scale pattern was observed under a compound microscope at 100x and 400x. Cuticular scale patterns were observed on casts (Day, 1966; David and Katz, 2005). Casts can be made by placing hairs over a thin layer of vinyl adhesive on a slide and left until the adhesive became dry (approximately 30 min). Then the hair was removed leaving a visible pattern of cuticular scale (Gurini, 1985).”

- HAIR MOUNTING TECHNIQUE: HELPFUL IN CONSERVATION OF CARNIVORES: SOHAIL ARIF CHATTHA, KHALID MAHMOOD ANJUM, MUHAMMAD ALTAF AND MUHAMMAD ZUBAIR YOUSAF.
REFERENCES

- APPLEYARD, H.M. (1960). GUIDE TO THE IDENTIFICATION OF ANIMAL FIBRES. WOOL INDUSTRIES RESEARCH ASSOCIATION, LEEDS, ENGLAND, PP. 188.
• KENNEDY, A.J. AND L. N CARBYN. IDENTIFICATION OF WOLF PREY USING HAIR AND HEATHER REMAINS WITH SPECIAL REFERENCE TO WESTERN CANADIAN NATIONAL PARKS. CANADIAN WILDLIFE SERVICE.
• OYER, E.R. (1939). A STUDY OF THE STRUCTURE OF HAIR AS A MEANS OF MAMMAL IDENTIFICATION. MASTER’S THESIS, FORT HAYS KANSAS STATE COLLEGE, KANSAS, UNITED STATES.
• WILDMAN, A.B. (1954). THE MICROSCOPY OF ANIMAL TEXTILE FIBRES, WOOL INDUSTRIES RESEARCH ASSOCIATION, LEEDS, ENGLAND.
• WILLIAM O. OGARA ET AL- DETERMINATION OF CARNIVORES PREY BASE BY SCAT ANALYSIS IN SAMBURU COMMUNITY GROUP RANCHES IN KENYA-AFRICAN JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY VOL. 4(8), PP. 540-546, AUGUST 2010.
• GURINI, L.B. (1985). VALOR DIAGNÓSTICO DEL PELAJE Y SU APLICACIÓN AL ESTUDIO DE LAS INTERACCIONES TÓFICAS, CON REFERENCIA A ESPECIES DEL DELTA BONAERENSE. DOCTORAL TESIS. UNIVERSIDAD NACIONAL DE LA PLATA. LA PLATA.
RECOMMENDATIONS

A] The current study was done only for FOUR species of high altitude herbivores but similar studies are needed to be undertaken for other species of high altitude herbivores and also for other animals found in the high altitude areas including carnivores which may aid in WILDLIFE CRIME INVESTIGATION (Eg. Trafficking and skin trade) and also for research purpose.

B] The Bengal Natural History Museum boasts of a large number of specimens and ANIMAL SKELETON MOUNTS would only enrich the collection. Skeleton preparation could be done with Maceration method or by use of Dermestes Beetles method.

C] Having observed the Conservation Breeding Program for Snow Leopards and Red Pandas especially their management I would like to stress the need for advanced diagnostic techniques and alternative techniques involved with breeding of endangered species like Snow Leopard and Red Pandas which can be done by following means-

1. Outsourcing tissues for HISTO-PATHOLOGICAL and MOLECULAR studies to obtain a detailed microscopic evaluation and CONFIRMATORY DIAGNOSIS.
2. MEAT, WATER and SOIL testing for heavy metals and metabolites which could affect the reproductive efficiency of the animals.
3. Setting up a culture of PLEURIPOTENT STEM CELLS of High Pedigree animals with the prospect of recent advances in GAMETE DEVELOPMENT from stem cells.

D] With the level of work being done at the PNHZP&CBC, Darjeeling it is crucial to have a large Veterinary Hospital with minimum standard requirements.
RED PANDA AT PNHZP

SNOW LEOPARD AT TOPKEY DARA
RUFOUS SIBIA (*Heterophasia capistrata*)

HIMALAYAN BLUETAIL (*Tarsiger rufilatus*)
SNOW LEOPARD ‘ZIMA’ AT CBC SHOWING FLEHMEN’S REACTION

SNOW LEOPARD ‘MORNING’ AT CBC
RED PANDA CUB AT PNHZP

THE KANCHENJUNGA AS SEEN FROM PNHZP GUESTHOUSE AREA