Morphological studies on the hair of Sloth Bear (*Melursus ursinus*) under different microscopes

Shambhulingappa Baddi\(^a\), Prasad RV\(^a\)*, Jamuna KV\(^a\), Byregowda SM\(^b\), Suguna Rao\(^a\) and Ramkrishna V\(^a\)

\(^a\)Veterinary College, Hebbal, Bangalore-560024 (Karnataka), India.
\(^b\)Joint Director, I A H & V B Bangalore, Karnataka, India.

Abstract

The sloth bear (*Melursus ursinus*) have long been endangered, but now face the threat of extinction as a result of shrinking forest cover to accommodate growing human settlements, rampant poaching and illegal domestic and international trade of these animal products. In the present study, we attempt to catalog and use distinct morphological features of sloth bear hair samples to establish their identity, distinguish them from other legally traded animal products and ultimately to strengthen the wildlife conservation effort in India. Hair samples collected from 30 sloth bears were processed in petroleum ether and then mounted on a slide with glycerol. The prepared samples were examined in detail for the cuticle, cortex and medulla patterns with a light microscope, dark field microscope, phase-contrast microscope and polarizing microscope under ×100, ×200 and ×400 magnifications. Our observations revealed that the hair samples of sloth bear had an irregular mosaic cuticle pattern with wavy scale edges. The cuticular scales’ arrangement was semblance to the epidermal scales of the snake. The medulla appeared amorphous with fine pigment granules evenly distributed; however, the medullary cells were not distinct.

Keywords: Sloth bear, endangered, hair, morphological features, medullary cells, cuticle pattern.

Introduction

The sloth bear (*Melursus ursinus*), is also known as the Stickney bear or labiated bear. Historically, humans have drastically reduced their habitat and diminished their population by hunting them for food and their products such as bacula and claws. An estimated 20,000 sloth bears exist in the wilds of South Asia (Pepelko and Kristina, 2014). The sloth bear is protected animal and is listed in Schedule I of the Indian Wildlife Protection Act, 1972. The sloth bear is prohibited in International Trade as it is listed in Appendix I of the Convention on International Trade on Endangered Species (CITES).

Published literature report a definite pattern of arrangement of cuticle, cortex and medulla of hair in the domestic animals like ox, sheep, goat, dog and cat which are species-specific (Trautmann and Fiebig, 1957). In forensic science, investigators determine the medullary index of hair as the ratio of width of the medulla to the width of the cortex, which is expressed as a fraction (Kristen, 2005). Thus, there is an urgent need for establishing a database of these features which will serve as a guide in identifying the specific species of animal in disputes of Veterolegal origin.

The identification of hair is uncomplicated, simple and fast, providing excellent information (Houck, 2003). Sahajpal et al. (2007) studied the hair structure of Indian bear by using only light microscope. However in the present study to differentiate and study the detailed morphology of cuticle, cortex and medulla of sloth bear using the light, dark field, phase contrast and polarizing microscopes was attempted. Until now, very few comprehensive references are available for sloth bear hair. Hence, an attempt is made to record morphological features of hair structures of sloth bear.

Materials and Methods

The present study was carried out in the Department of Veterinary Anatomy and Histology, Veterinary College, Hebbal, Bangalore-560 024, for a period of 2 years i.e. 2007 to 2009. The hair samples of sloth bear were obtained from the following sources.

- The Bannerghatta Biological Park, Bangalore.
Micrometry of hair: Micrometry of hair was done with the help of ProgRes CapturePro 2.5-JENOPTIK software under Nikon trinocular microscope. The Cortico-Medullary Index (CMI) was calculated by dividing the average width of the medulla by the average width of the cortex in the mid-hair region. The average width (μm) was calculated using 15 measurements of the diameter of the cortex and medulla.

Results
The morphological features of the hair samples were studied under four different microscopes including light, dark field, phase-contrast and polarizing microscope. The cuticle morphology was best observed under light, dark field and phase contrast microscope but the cortex appeared best only under the dark field microscope and the medulla showed best under the polarizing and dark field microscopes.

In sloth bear hair the cuticle was irregular mosaic pattern and scale edges were wavy in nature. The arrangement of cuticular scales appeared like epidermal scales of the snake. Individual scales met at acute angle with adjacent scales (Fig 1). Cortex cells were rectangular box-like structure (Fig 2). The medulla was amorphous with fine pigment granules evenly distributed throughout the hair (Fig 3). Ovoid bodies appeared towards cortex but medullary cells were not distinct (Fig 4). The Cortico-Medullary Index (CMI) was 1.387.

Discussion
Hair is the elastic keratinized thread that develops from the epidermis. Hair is chemically stable, especially when compared to other physiological materials such as blood, semen, or any other body fluid since hair is strongly resistant to decomposition. These properties make the hair an ideal material of physical evidence, capable of preservation for several decades.

Fig1: Photo micrograph of the cuticle of sloth bear showing irregular mosaic pattern with wavy edge (arrow) and epidermal scales of the snake like appeared cuticular scales (Light microscope- X400).

Fig 2: Photo micrograph of the hair of sloth bear showing rectangular boxes like cortical cells (Dark field microscope- X200).

Fig3: Photo micrograph of the hair of sloth bear showing amorphous medulla with evenly distributed fine pigment granules (Polarizing microscope- X200).

In the present study we report the feasibility of identifying the most endangered wildlife species, sloth bear based on detailed microscopic examination of distinct morphological features of hair samples. The
wildlife species we studied belong to the Order Carnivora and Family Ursidae in the animal kingdom. The cuticle presented irregular mosaic pattern and wavy edges of scales in the present study. Keogh (1983) also described the presence of irregular mosaic pattern in the cuticle of rodents.

A significant observation was made on the cuticular scale arrangement which appeared like epidermal scales of the snake. Individual scales were meeting at acute angle with adjacent scales. Cortical cells were seen as rectangular boxes. However no such references were encountered during the study. Medulla was present and amorphous in nature. Sahajpal et al (2007) described narrow and amorphous with very low medullary index in bear. However in the present study the medulla was broad and amorphous with a high medullary index. This variation could be due to the hair samples collected from different regions. Fine pigment granules were evenly distributed throughout the hair and ovoid bodies were seen more towards cortex. These observations could be comparable to observation made by Anon (2003) in dog.

**Cortico-Medullary Index (CMI):** CMI of sloth bear hair was obtained and the value was 1.387 in the present study. However CMI of cat and dog were 1.571 and 1.415 respectively (Baddi, 2010). Although Trautmann and Fiebiger (1957) utilize the ratio of the width of the medulla and the width of the cortex of the hair for the identification of some of the domestic species, this can be used little extent for the identification of the different species.

**Conclusion**

Data generated by this study will be useful for identifying the fake and original specimens and help in solving the veterolegal cases. Collection of hair samples from the forests and their identification will help in the census of different wild animals in the area.

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**References**


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