



REFINED MACRO-MICROSCOPIC TECHNIQUES OF THE GUARD HAIR IDENTIFICATION FOR TWO WILD SPECIES OF CERVIDAE FAMILY FROM THE SAURASHTRA REGION OF THE GUJARAT STATE, INDIA

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ABSTRACT

The current study was carried out to identify the two different wild ungulate species of Cervidae family: Spotted deer and Sambar found to distribute though out the Saurashtra region of the Gujarat State, much common in the protected forest areas of the Gir and Girnar Wildlife Sanctuaries through their macro and microscopic features of dorsal guard hair characteristics. In these we collected control hair samples from the Sakkarbaug Zoo of Junagadh district which were further analyzed microscopically. We analyzed total thirty random guard hairs from dorsal region of the each species, thus in total sixty hairs studied under the microscope to avail authentic and the photographic evidences for further carnivore scat analysis using such references. In this study we used the recognizable qualitative and quantitative features of cuticle as well as medulla. Medullary Index (MI) found in Sambar is $0.92 \pm 0.01 \mu\text{m}$ followed by spotted deer $0.67 \pm 0.01 \mu\text{m}$.

KEYWORDS : Hair Identification, Wild Ungulates, Scat, Carnivore Scat Analysis.

INTRODUCTION:

Trichology is the branch of the science since mid-1800s dealing with scientific study on hair structures. Mammalian hair plays a significant role in thermoregulation, body shape maintenance, waterproofing and protection from the variety of pollution. Indeed the identification of mammal hair was earlier achieved in 1920 [7]. Hair is a thin fiber approximately around 0.1 mm in diameter with an oval or a circular cross-section. Hair mostly composed of three concentric regions namely the outer layer of the cuticle which is a thin coating covered by tilted scales, the central constitute being cortex contributing to almost 90% of the total weight of the hair made up of differently shaped cells specific to the hair type and the keratin fibers are organized in a honeycombed arrangement of cell structure enclosing air pockets continuously or discontinuously known as medulla [8].

The Spotted deer also known as chital within the Saurashtra region and are widely distributed throughout India. There are mainly two types of hairs found in mammals: Guard hairs that are usually thick and bristly and fine hairs which are curled and comparatively thin [6]. Hair analysis through their morphological cuticular scale characteristics and medullary features in have been widely used to distinguish among mammalian species of interest largely in the field of wildlife biology, ethology, conservation ecology, veterinary and forensic science [1].

The wild ungulates comprise the order Artiodactyla (even-toed) which also known as ruminants. It was one of old but become advanced with new age instrument and technology now days. The peculiar medullary index for each species is very much important for species confirmation and useful to identify unknown hair samples as well as for the study of feeding ecology of large carnivores through scat analysis within and around the protected areas [1]. The scale count and scale pattern also found to be specialized for each and every species studied and therefore helpful to identify the hair of unidentified species with the help of their all external and internal morphological factors of the hair utilized by Ashvinkumar et al in 2017 [4]. The guard hair study for various species identification was done by many workers with different aspects to be considered [10].

Table 1 Systematic Position And Conservation Status Of Two Wild Ruminants.

SPECIES	ORDER	FAMILY	GENUS	SPECIES	IUCN STATUS	IWPA	CITES
Spotted Deer	Artiodactyla	Cervidae	Axis	axis	Least Concerned (LR)	Schedule-III (5)	NONE
Sambar	Artiodactyla	Cervidae	Cervus	unicolor	Least Concerned (LR)	Schedule-III (16)	NONE

MATERIALS AND METHODS:

In this study guard hair of the two different wild animal species were thoroughly evaluated. The guard hairs were preferred from wild ungulate belonging to the family Cervidae (Spotted deer and Sambar).

All control fallen guard hairs were collected separately in the polythene bags and labeled further from the Sakkarbaug Zoo, Junagadh. After collection of hairs of each species were properly washed in running water for several times to remove dirt. Then washed hairs were cleaned and degreased in acetone. Then randomly picked up thirty hairs from each species were examined. Total sixty hairs from both the species were studied in detailed. First each hair was embedded in Cellulose sheet or by using nail paint imprint technique for scale impression. Then it was analyzed for microscopic features using ZEISS, Fluorescence light microscope. The microscope has integral measurement software with the add-on camera namely: AxioCam Imager. Initially hair studied under 10X view, then in 40X view for detailed morphometric study.

Morphological features of the hair shaft were recorded with relevant details and measurement [3]. First the length and colour were measured and recorded for each hair samples. Afterward internal features of the hair medulla and shaft were studied precisely and recorded separately. Medullary index calculated through the standard formula (medulla/cortex) and the standard deviation calculated in the Microsoft excel tool. On the basis of all external and internal features along with the quantitative measurement (mean \pm SD) of the guard hair for each species were summarized in table 3. To attain confidence limit for distinguish the species; several differencing features of hair were to be considered.

RESULTS AND DISCUSSION:

Different morphological and quantitative features of the guard hair of two wild species of family Cervidae studied in detail. The mean value as well as standard deviation regarding various features of hair shaft and medulla are summarized in given tables.

Table 2 Morphological Features Of Hair Of The Two Wild Species Of The Family- Cervidae.

SR. NO.	SPECIES	MEDULLA PATTERN	SCALE PATTERN	COLOUR OF HAIR (NAKED EYE)	SCALE MARGIN	TIP
1	Spotted Deer	Wide medulla lattice	Regular wave	White-Brown/Black	Smooth	Not Split
2	Sambar	Wide medulla lattice	Regular & irregular wave	White-Brown/Black	Smooth	Not Split

Spotted deer has regular wave scale pattern whereas Sambar has regular and irregular wave scale pattern. Both the species have similar type of wide medulla pattern (Fig 1, 2) [3]. The morphology of hair tip also confers it and differentiated it from other family species [2].

Photographs Showing Scale And Medulla Pattern Of The Two Species Of Family-Cervidae.

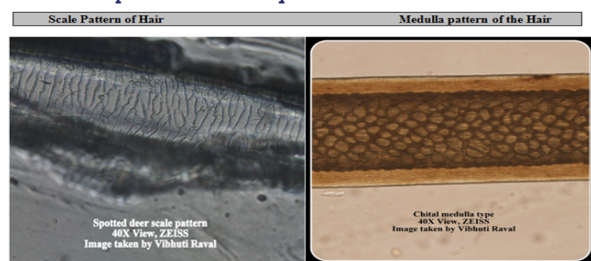


Fig. 1 Scale and medulla pattern of the hair of *Axis axis*

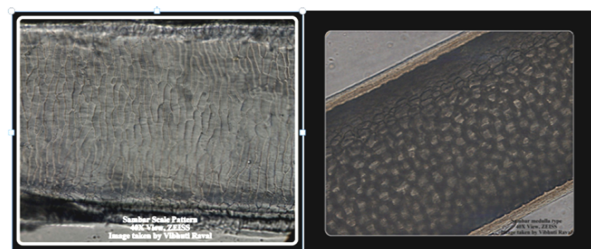


Fig. 2 Scale and medulla pattern of the hair of *Cervus unicolor*

Table 3 Different Factors Of Hair Of The Two Wild Species Of The Family- Cervidae.

SPECIES	WHOLE HAIR LENGTH [AVERAGE (cm)]	AVERAGE SHAFT LENGTH [AVERAGE (μm)]	AVERAGE MEDULLARY LENGTH [AVERAGE (μm)]	MEDULLARY INDEX [AVERAGE (MI)]	STANDARD ERROR
Spotted deer	4.02	23	16	0.67 ± 0.01 μm	0.005
Sambar	4.18	29	26	0.92 ± 0.01 μm	0.004

Medullary index is the unique and specialized feature of the hair. Each and every species of the mammals can be identified on the basis of their medullary features (Table 3). The maximum Medullary Index (MI) found in Sambar (0.92 ± 0.01 μm) followed by spotted deer (0.67 ± 0.01 μm). Medullary index study of the wild species of Cervidae

family revealed that the both spotted deer and Sambar shown comparative difference.

CONCLUSION:

On the basis of morphological features like hair colour, texture, cuticle scale type and medulla type along with the several measuring features of the hair such as medulla diameter, shaft diameter and MI to identify and confirm the hair of the species from wild species of Cervidae family. Out of the above two wild species; spotted deer shows scale pattern of regular wave type in their three region (proximal, medial, & distal) hair whereas Sambar shows irregular wave type in medial and at end portion only (proximal or distal) of the hair.

On other hand the quantitative features of the guard hair of animal species are distinctive and species specific. On the basis of medulla type both species share similar scale pattern of cuticle. Both species shares similar type of medulla pattern [1, 2] as well which made little confusing to specify species but with the help of MI it can be resolved (as they different significantly with each other) and confirms the species without difficulty (As Sambar has higher (0.92) MI compare to that of Spotted deer (0.67). Both species have unique scale pattern which enables to distinguish these both with other wild ruminants easily.

It can be easily applicable for diagnosis of human hair in case of human-carnivore conflict study [5]. By using this hair identification key it can be easier to identify and confirm the species largely to know feeding ecology of carnivore animals in both protected and non-protected areas. So, current technique of hair study (identification) provides very much effective baseline for hair study in various field of science.

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