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Study on the Guard Hair of Some Domesticated Ungulate Species of the Saurashtra Region of the Gujarat, India

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ABSTRACT

The study was carried out to recognize the domesticated species belonging to the family Bovidae by their specific macro-microscopic features of dorsal guard hair characteristics. Nowadays the domesticated animals play a vital role in the dairy industry and in providing easy prey-base for the various top predators which found to occur throughout the Gujarat area including protected and non-protected areas. In this study, we collected control hair samples from the various cattle owners distributed in the whole Saurashtra region of the Gujarat State in the year 2018. Total randomly picked up one hundred twenty guard hairs from a dorsal region of the four different cattle species were analyzed under microscopes to avail authenticated and the photographic evidence for the further carnivore scat analysis through this key. In this study, we used the recognizable qualitative and quantitative features of the cuticle as well as the medulla of the hair. Medullary Index (MI) found higher in domesticated Sheep 0.93±0.01, followed by Water Buffalo 0.9±0.02, followed by domesticated Goat 0.77±0.01, which further followed by domesticated cow 0.5±0.10 µm with lower MI. In this study, we used the identifiable qualitative and quantitative features of Cuticle as well as Medulla.

Key-words: Domesticated Bovid, Guard Hair, Predatory Carnivore, Protected Areas, Qualitative and Quantitative, Ungulates

INTRODUCTION

Mammal hairs play a significant role in thermoregulation, body shape maintenance, waterproofing and protection from the variety of pollution. The scientific study of the hair is called as trichology and this field originated in the mid-1800s. In fact, identification of mammal hair was earlier performed by [1]. There are mainly two types of mammalian hair found: Guard hairs that are usually thick and bristly and fine hairs which are curled and thin comparatively [2].

Hair analyses through their morphological cuticular scale and medullary features have been widely used to distinguish among mammalian species of interest largely in the different field of Science. The domesticated ungulates comprise the order Artiodactyla (even-toed) and family Bovidae.

It was one of old but become advanced with the latest instrument and technology of this modern era. It is the best effective techniques widely used in the forensic as well as in the field of ecology. The distinctive MI for each species is very much suitable for species confirmation and useful to identify unknown hair samples as well as for the study of the feeding ecology of large carnivore animals by their scat analysis within and around the protected areas. The scale count and scale pattern also found to be species-specific and therefore beneficial to identify the hair of unknown species with the help of all external and internal morphological features of the hair [3].

MATERIALS AND METHODS

In the existing study, guard hairs of the four different domesticated bovine animals were thoroughly evaluated in the RFSL, during the year of 2018. The guard hairs

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were selected from animal species belonging to the family Bovidae with the different genus (Jafrabadi water buffalo, Gir cow, Gohilwadi goat, and Patanvadi sheep). For almost a century, compound and comparison microscopes remained the only reliable tools for the microscopic identification of characteristics found in animal hair [4].

All the control guard hairs were collected separately and labeled further from the different cattle owners. After collection of hairs of each species were properly washed in running water for few times to remove dirt. Accordingly, total one hundred twenty hairs of four domesticated bovine species were cleaned and degreased with acetone. Then randomly picked up thirty hairs from each species were examined. First, each hair was embedded in Gelatin layered microscopic slide (or Nail paint) for scale imprinting. Then it was analyzed for microscopic features using ZEISS, Fluorescence light microscope. The microscope has inbuilt measurement software with the camera attachment namely: Axiocam Imager. First studied under 10X view, then in 40X view for detailed morphometric study.

The morphological external features of the hair shaft were recorded with suitable details and measurement. Later internal morphological features of the hair medulla were studied previously and recorded separately in the data book. On the basis of all external and internal morphological as well as quantitative features of the guard hair, each species confirmation was made. To distinguish the species, several differencing aspects of hair were to be considered to achieve the confidence limit.

RESULTS

Various morphological and quantitative features of the guard Hair of four domesticated species of the family Bovidae studied in detail. The mean value as well as standard deviation regarding various features of hair shaft and medulla are given in below Tables.

Table 1: Systematic position and conservation status of four domesticated cattle

S. No.	Species	Order	Family	Genus
1	Gir cow	Artiodactyla	Bovidae	*Bos*
2	Jafrabadi water buffalo	Artiodactyla	Bovidae	*Bubalus*
3	Gohilwadi goat	Artiodactyla	Bovidae	*Apra*
4	Patanvadi sheep	Artiodactyla	Bovidae	*Ovis*

Table 2: Different factors of Hair of the four domesticated ungulate species of Saurashtra

S. No.	Species	Mean length of hair (cm)	Average diameter of hair shaft (µm)	Average diameter of medulla (µm)	Medullary Index (µm)
1	Gir cow	1.11	19.75	10.97	0.5 ±0.10
2	Jafrabadi buffalo	7.63	51.6	45.9	0.9±0.02
3	Gohilwadi goat	2.33	45.01	34.66	0.77±0.01
4	Patanvadi sheep	4.13	36.93	19.4	0.93±0.01

Different Medullary Index (MI) of the four domesticated ungulate species along with the standard error given (Fig. 1).

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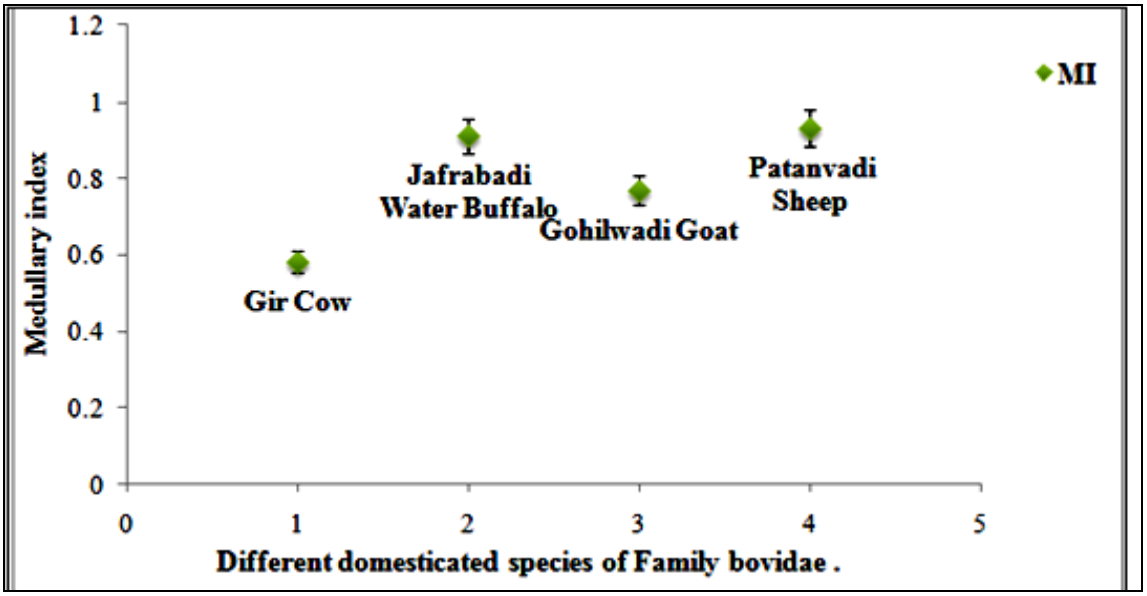

Fig. 1: Medullary Index (Mean±SE) of hairs domesticated ungulates of Saurashtra

Various morphological and quantitative features of the guard Hair of four domesticated species of the family Bovidae studied in detail. The mean value, as well as standard deviation regarding various features of hair shaft and medulla are given in Table 3 (Fig. 5).

Table 3: Morphological features of Hair of the four domesticate Bovine species

S. No.	Species	Medulla pattern	Scale pattern	Color of hair	Hair surface
1	Gir cow	Simple medulla (Amorphous)	Regular & irregular wave	White, brown /black	Smooth
2	Jafrabadi buffalo	Simple medulla (Amorphous)	Streaked	Black	Rough
3	Gohilwadi goat	Narrow medulla	Regular & irregular wave	White, brown /black	Smooth
4	Patanvadi sheep	Wide medulla	Regular wave	White & brown	Smooth

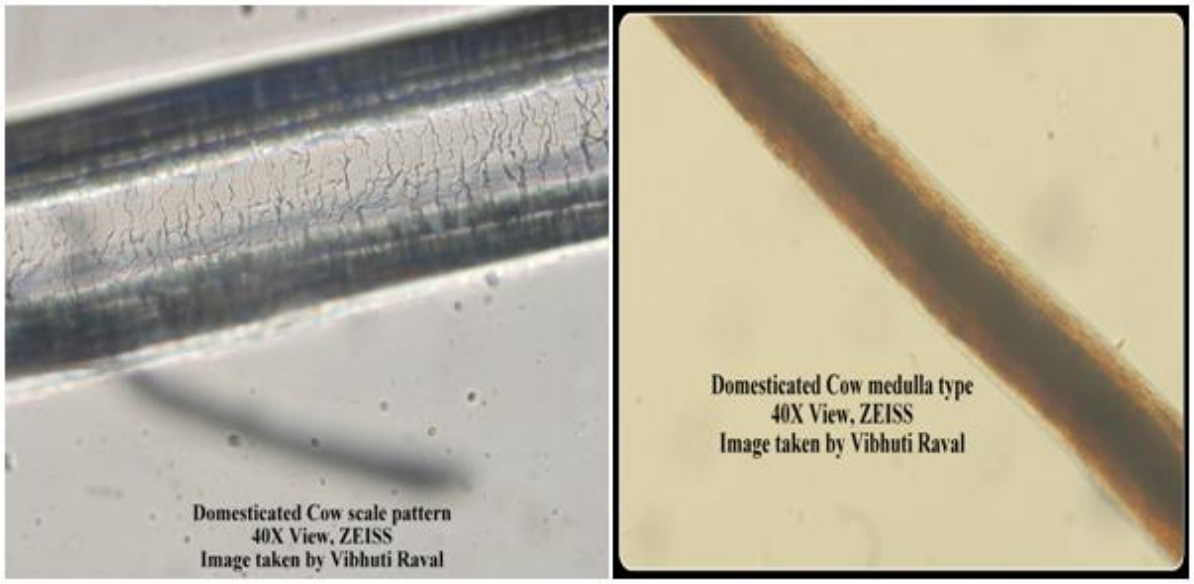

Fig. 2: Scale and Medulla pattern of the hair of Gir cow

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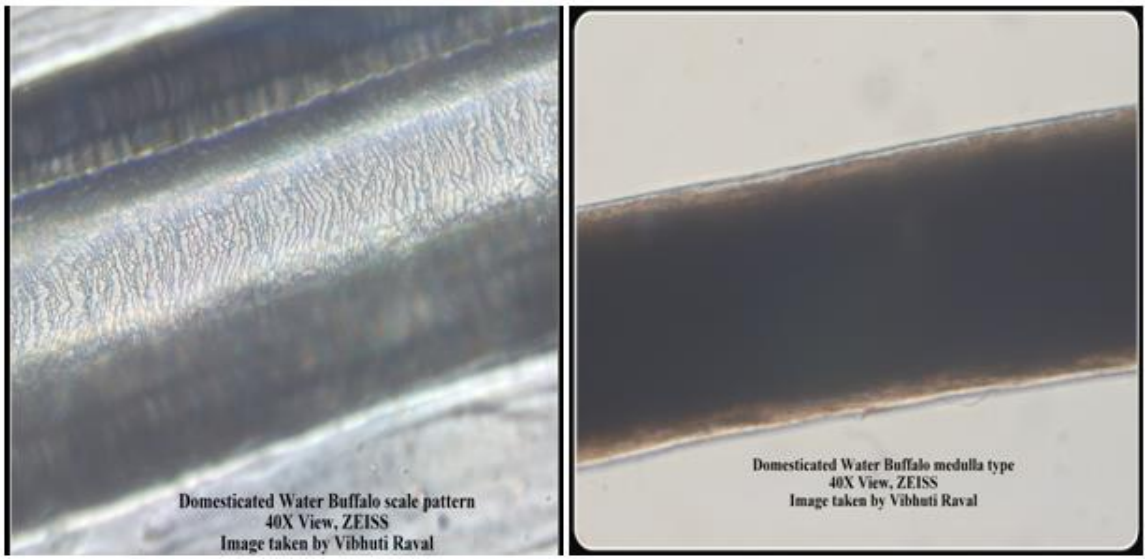

Fig. 3: Scale and Medulla patterb of the hair of Jafrabadi buffalo

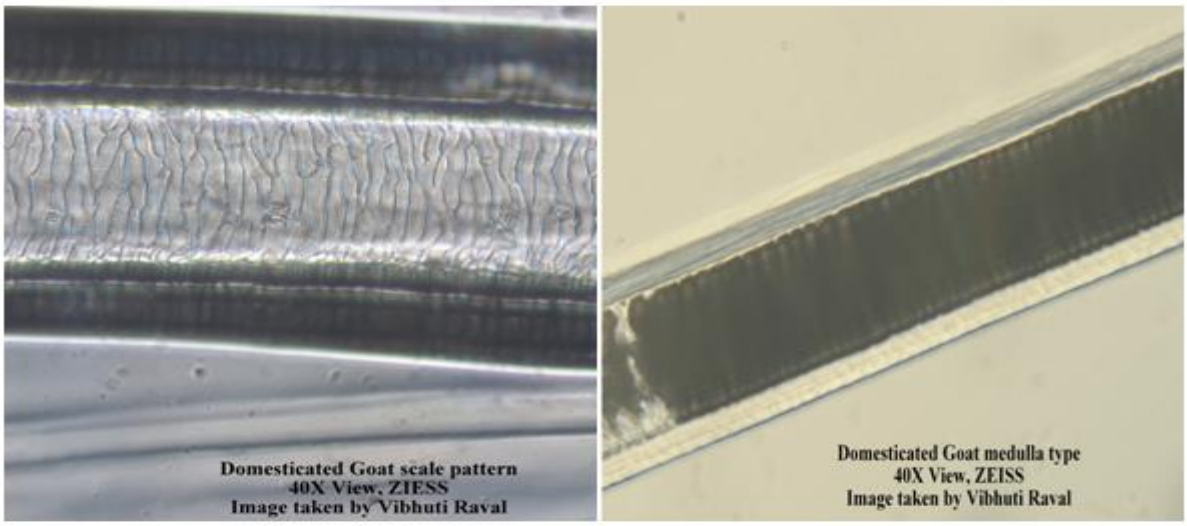

Fig. 4: Scale and Medulla pattern of the hair of Gohilwadi goat

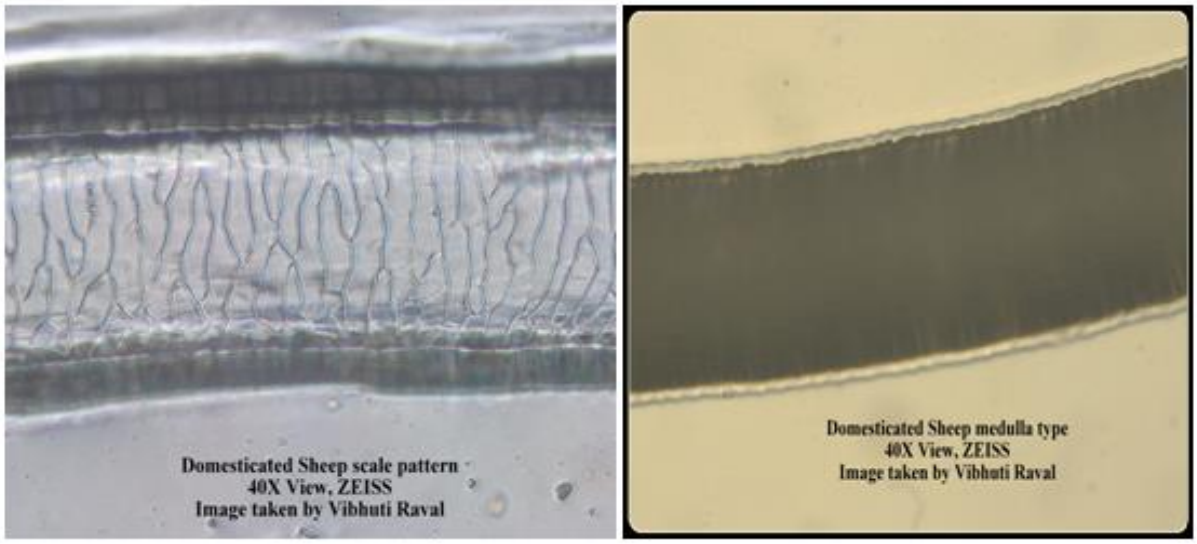

Fig. 5: Scale and Medulla pattern of the hair of Patanvadi sheep

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DISCUSSION

Systematic position and conservation status- All the four domesticated species belonging to the single order Artiodactyla and similar family Bovidae. All four domesticated cattle species acquire different genus and species. The Gir Cow belongs to genus *Bos* and Jafrabadi Water Buffalo belong to genus *Bubalus,* while Gohilwadi Goat belongs to *Apra* genus and Patanvadi Sheep belong to genus *Ovis* respectively. Further randomly picked thirty dorsal guard hairs of each species thoroughly evaluated under the microscope (Table 1).

Mean value of MI, Shaft, Medulla and whole hair- The medullary index is the specialized feature of the hair. Every species of the mammals can be identified on the basis of their medullary features (Table 2 & Fig. 1). Maximum MI found in Patanvadi sheep (0.93±0.01 µm) followed by Jafrabadi water buffalo (0.9±0.02 µm) followed by Gohilwadi goat (0.77±0.01 µm), which further followed by Gir cow (0.5±0.10 µm) as lowest comparatively. MI is the specialized feature of the guard hair. Each and every species of the mammals can be identified on the basis of their medullary index (Table 2 & Fig. 1).

Morphological features of the hair- There is a number of important morphological features to be considered for the identification and confirmation of the hair for an unknown species**.** The Gir cow and Jafrabadi buffalo have simple type of medulla whereas Gohilwadi goat has narrow medulla and Patanvadi sheep has wide medulla comparatively (Table 3 & Fig. 2 to Fig. 5). The scale pattern of the Gir cow and Gohilwadi goat found to be similar but Patanvadi Sheep had a regular wave pattern instead. The Jafrabadi buffalo has a unique streaked scale pattern, which was completely distinguishing it from other three domesticated species [4].

CONCLUSIONS

On the basis of morphological features like hair color, 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 four different domesticated bovine species. Mostly from the above four bovids, Jafrabadi Water buffalo had streaked scale pattern with Simple and wide medulla, while Gir Cow and Gohilwadi Goat shown similar Regular and irregular wave pattern. In Patanvadi, Sheep had regular wave pattern of the scale with wide medulla. Whereas Gir cow had Simple amorphous medulla and Gohilwadi goat shown narrow medulla type. On the other hand the quantitative features of the guard hair of animal species were distinctive and species-specific. On the basis of medulla type, only water buffalo showed distinctive scale type out of four species of the domesticated bovine. The maximum MI percentage found in Patanvadi sheep, followed by Jafrabadi water buffalo, followed by Gohilwadi goat, followed by Gir cow with lowest comparatively. The quantitative features of the guard hair of animal species were distinctive and species-specific. These differential features of the hair were largely suitable and authenticated, hence broadly used in the various field, namely: ecology, field of forensic science, field of wildlife and Ethology for the hair identification of species of interest. By using this hair identification key, it can be easier and suitable to identify and confirm the species largely to know feeding ecology of carnivore animals in both protected and non-protected areas. It can be easily applicable to hair identification in case of human-carnivore conflict study.

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