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Study of Micrometry of Dog Hair of Different Breeds

Shakera Inamdar, Sagar Kandelkar, Snehal Baravkar, Anisha Potale, Shivani Shinde

Department of Zoology, Modern College of Arts, Science and Commerce, Ganeshkhind, Pune, Maharashtra, India

ABSTRACT

Dogs which belongs to different climatic conditions, different breeds or genetic makeup they have different structure of hair which is related to its thickness and length and other morphological characteristics. Following data is useful for the easy identification of dog breeds form the single hair follicle. Every breed has different characters with respected to its hair these different characters are related to its thickness of hair, size of medulla, size of cortex. These study is helpful for forensic investigations, in some situations of crime scenes forensic team get animal hair through these hair follicle they can detect the dog breed which is provide good clue for crime cases. In both micrometric & histological study of hair of different dog breeds it results particular identities for every dog breed and these identities will be greatly helpful for identification of different dog breed through the single hair follicle of dog.

Keywords : Micrometry, Morphology, hair follicle.

I. INTRODUCTION

When we think of dogs, we tend to think of animals that were selected for behaviour performed in a service of people. Dogs pull sledge, guard property, protects herds of sheep, guides the blind, track and retrieve game and so on. We also think of dogs in terms of breeds often try to identify to breeds. Some think of breeds as if they were ancient species separately derived from different strains of wolves, jackals or even coyotes. But breeds of dogs are most part of modern invention. Like other domesticated animals dogs may have originated as scavengers and been domesticated for use of food and fibre or use for daily routine work like protection of domesticated goats from predators, hunting of wild animals like pigs, deer ,rabbits and many more.

The dog Canis familiaris is a direct descendent of wolf, coyotes and jackals they also belongs to canine family. In other words 'dogs as we know them are domesticated wolves not only their behaviour changed domestic dogs are different in form from wolves mainly smaller and with shorter muzzles and smaller teeth.

Darwin was wrong about dogs. He thought their remarkable diversity must be reflecting interbreeding with several types of wild dogs. But DNA finding say differently. All modern dogs are descendents of wolves, thought this domestication happened twice, producing groups of dogs descended from two unique common ancestors.

Classification of Dog:-

Kingdom: -	Animalia
Phylum: -	Chordata
Sub-Phylum:-	Vertebrata
Class: -	Mammalia
Order:-	Carnivora
Family:-	Canidae
Genus :-	Canis
Species:-	familiaries

Dogs are classified as Canis familiaries under Linnaeus published in systema nature a characterization of species which include Canis species. Canis is a Latin word meaning dog (Harper) and the list include the dog like carnivores: domestic dogs, wolves, foxes and jackals. The dog was classified as Canis familiaris which means dog family or family dog .In 1982 the first edition of Mammal species of the world listed Canis familiaries under Canis lupus (Honaki.at.el)

The hair bulb is a structure of actively growing cells which eventually produce hair. Cells continually divide in the lower part of the bulb and push upwards, gradually hardening. When they reach the upper part of the bulb they arrange themselves into six cylindrical layers.

The three inner layers become the hair, made up of the cuticle, the cortex and the medulla
– although the medulla isn't always present, especially in hairs with a thinner diameter. The outer three layers become the lining of the follicle and form the inner root sheath and basement membrane, around which lie undifferentiated cells. Specific cells in the hair bulb, called melanocytes, make thepigment called melanin that gives your hair its colour.(Anka Lungu at. el.(2003)). Hair is made of the protein keratin and dead epidermal or skin cells and it grows from follicles in the dermis or inner layer of the skin. Some hair is densely packed into stiff, fibrous outgrowths that, depending on species and location on the body, become horns, fingernails, and toenails. Dogs have three types of hair: soft downy undercoat that is especially abundant in northern breeds but exists in most breeds that developed in cool or cold climates; stiffer and often longer guard hair that form a protective layer to protect undercoat and skin from harsh weather and cold water; and whiskers, those specialized hair that grow in clumps on the face. Medulla of animals is found in many shapes and this is also one of the major difference between two different animal spesies or organism which is from same species but divided into different breeds.following types of medulla's found in animal hair which is catagorised with its different shape

1. Discon= oval shape medulla is present.
2. Globular= medulla is not continuous and present in bunches.
3. Continuous= medulla looks like continuous thread like in structure.
4. Fragmental= medulla is present in fragments of irregular shapes.
5. Lattice= clump of medulla is present
6. ladder= square or ladder shape of medulla is occur.
7. Branched= medulla get divided like branching of trees.
8. Aeroform=small portions of medulla is get stick to cortex wall. medulla is not contiuous.

On the basis of medullary index and corticular index and other important micrometric characteristics we can differentiate and identify individual dog breed which can help in forensic point of view and other scientific study

II. METHODS AND MATERIAL

The present study was carried out in the department of Zoology, Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-411016. The study material includes hair samples of different Dog Breeds, collecting hair samples by the method of plucking, combing, rubbing & cutting. Dog Hair including 10 different types of Dog Breeds, Which are 1) Saint Bernard 2) French Mastiff 3) English Cocker Spaniel 4) Golden Retriever 5)

Rottweiler 6) Caucasian Shepherd 7) German Shepherd 8) Pitbull 9) Chow Chow 10) Siberian Husky. The entire region of Hair follicle containing tip and root portion and shaft region was selected for Micrometric examination or study. All the samples

were stored in serially marked collecting small zip plastic bags.

Preparation:-Each Hair sample was cleaned before Micrometric examination 2-3 times by water because of that all dust and chemicals get removed from the hair. Then hair sample is deep into 30% Hydrogen peroxide (H2O2) solution for 3 hours or as per requirement of bleaching to differentiate between cortex and medulla lucid; then such hair samples are washed by water again and afterwards hair sample are deep into the 100% Ethanol or Absolute Alcohol for preservation of sample. Then hair samples are ready for micrometric and histological study by removing ethanol by water or other removing agents like Xyline, Toluene, chloroform, benzene petrol.

Mounting of Hair Strand:-Each dried hair samples were cleaned in water and mounted on microscopic slide by placing Hair samples on slide in drop of Water. A cover slip placed on hair allowing the water or medium to spread under cover slip-encasing hair. Each slide labelled by marker and examined appropriately.

III. OBSERVATION

The mounted slides were examined for morphological characteristics and micrometry. The characters of hair examined are 1) Hair Length 2) Colour 3) Tip 4) Scale Type 5) Hair Scale Height 6) Root length 7) Medulla Type 8) Hair Position and Structure 9) Shaft Diameter 10) Medulla Diameter 11) Cortex Diameter 12) Medullary index 13) Corticular index. These observations are done for 2 to 3 times. Medullary index= Maximum Diameter of Medulla /Maximum Diameter of Shaft Corticular Index=Maximum Diameter of Cortex/ Maximum Diameter of Shaft.

Morphological characteristics of Hair of Dog Breeds

No.	Dog Breed	Medullary index	Corticular index
1	Saint Bernard	3	3
2	French Mastiff		5
3	English Cocker Spaniel	3	9
4	Golden Retriever		5
5	Rottweiler		5
6	Caucasian Shepherd	3	3
7	German Shepherd		
8	Pitbull		
9	Chow Chow		5
10	Siberian Husky	3	3

Table-Scale Height of dog hair

Sr. No.	Name of Dog Breed	Scale height in (μm)
1	Saint Bernard	1.5
2	Rottweiler	2.5
3	Caucasian Shepherd	3.0
4	German Shepherd	2.0
5	Golden Retriever	2.5

Medullary index and corticular index of hair of different Dog Breeds.

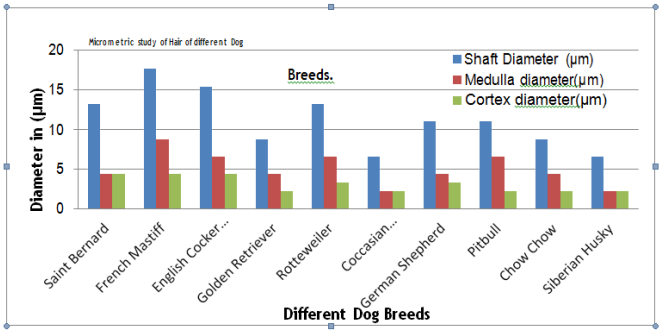
Table-Scale Height of dog hair

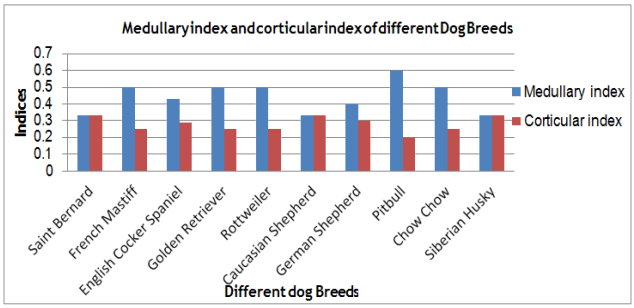
Sr. No.	Name of Dog Breed	Scale height in (μm)
1	Saint Bernard	1.5
2	Rottweiler	2.5
3	Caucasian Shepherd	3.0
4	German Shepherd	2.0
5	Golden Retriever	2.5

Sr. No.	Name of Dog Breed	Length In cm	Colour	Tip	Scale type	Root Length (µm)	Medulla type	Position & structure	Shaft Diameter (µm) at 10X	Medulla Diameter (µm) at 10X	Cortex Diameter (µm) at 10X
1	Saint Bernard	4.5	White & Brown	Thin Tapering	Irregular Wave	79.2	Amorphous less Dense Stacked	Less cure, Wavy With Slope	13.2	4.4	4.4
2	French Mastiff	1.7	Brown & White Patch	Thin Tapering	Smooth Regular Wave	132.0	Continuous Dense Stacked	Straigh	17.6	8.8	4.4
3	English Cocker Spaniel	4.5	Red with Brown	Tapering or Narrow	Smooth	121.0	Light Dense Stacked Continuous	Shiny with Slope	15.4	6.6	4.4
4	Golden Retriever	6.0	Faint Brown	Wavy, Thin, Transparent	Regular wave	Not done	Amorphous Packed like Vacuoles	Silky Straight & Curve	8.8	4.4	2.2
5	Rottweiler	4.0	Black	Wavy, Dense, Thin	Regular petal	Not done	Highly dense Stacked	Straight & Slight Curve	13.2	6.6	3.3
6	Caucasian Shepherd	6.5	Brown	Wavy transparent	Irregular Wave Mosaic	77.0	Stacked	Wavy with Slope	6.6	2.2	2.2
7	German Shepherd	3.5	Brown & Black	Thin Wavy and Transparent	Irregular Wave	132.0	Discon	Wavy With Slope	11.0	4.4	3.3
8	Pitbull	1.5	Black & White patch	Tapering	Regular Wave	99.0	Continuous	Straight & Plane	11.0	6.6	2.2
9	Chow Chow	11.0	Brownish White	Tapering Thin	Single Chevron	55.0	Fragmental & Interrupted	Shiny with Curve	8.8	4.4	2.2
10	Siberian Husky	5.0	White With Gray	Tapering	Regular Petal	77.0	Stacked & Less Dense Pigmentation	Wavy With Slope	6.6	2.2	2.2

Medullary index and corticular index of hair of different Dog Breeds.

No.	Dog Breed	Medullary index	Corticular index
1	Saint Bernard	3	3
2	French Mastiff		5
3	English Cocker Spaniel	3	9
4	Golden Retriever		5
5	Rottweiler		5
6	Caucasian Shepherd	3	3
7	German Shepherd		
8	Pitbull		
9	Chow Chow		5
10	Siberian Husky	3	3





IV. RESULT

As shown in following table

1) Saint Bernard

In the present micrometric study, Saint Bernard having 4.5 cm long hair having White and Brown colour. Hair tip is thin and tapering. Scale type is irregular wave. Root length of hair is 79.2 µm. Medulla type is amorphous, less dense stacked. Position and structure of hair is wavy with slope. Shaft diameter of hair is 13.2 µm. Medulla diameter of hair is 4.4 µm. Cortex diameter of hair is 4.4 µm. Medullary index and corticular index of hair is 0.33 and 0.33 respectively. Scale height of hair is 1.5 µm.

2) French Mastiff

Micrometric study of hair shows, French Mastiff having 1.7 cm long hair having Brown and White colour. Hair tip is thin tapering. Scale type is smooth regular wave. Root length of hair is 132.0 µm. Medulla type is continuous, dense stacked. Position and structure of hair is straight. Shaft diameter of hair is 17.6 µm. Medulla diameter of hair is 8.8 µm. Cortex diameter of hair is 4.4 µm. Medullary index and corticular index of hair is 0.5 and 0.25 respectively.

3) English Cocker Spaniel

In micrometric study of hair, English Cocker Spanial having 4.5 cm long hair having Brown or Red colour. Hair tip is tapering. Scale type is smooth. Root length of hair is 121.0 µm. Medulla type is continuous, light dense stacked. Position and structure of hair is shiny with slope. Shaft diameter, medulla diameter & cortex diameter of hair is 15.4 µm, 6.6 µm & 4.4 µm respectively. Medullary index and Corticular index of hair is 0.43 and 0.29 respectively.

4) Golden Retriever

Micrometric study of hair shows Golden Retriever having 6.0 cm long hair having faint Brown colour. Hair tip is wavy, thin, and transparent. Scale type is regular wave. Medulla type is amorphous, packed like vacuoles. Position and structure of hair is straight, silky and curve. Shaft diameter, medulla diameter and cortex diameter of hair is 8.8 µm, 4.4 µm and 2.2 µm respectively. Medullary index and corticular index of hair is 0.5 and 0.25.

5) Rottweiler

Micrometric study of hair shows Rottweiler having 4.0 cm long thick hair having Black colour. Hair tip is dense pigmented, wavy and thin. Scale type is regular petal. Medulla type is highly dense stacked. Position and structure of hair is straight and slight curve. Shaft diameter, medulla diameter and cortex diameter of hair is 13.2 μm, 6.6 μm and 3.3 μm respectively. Medullary index and corticular index of hair is 0.5 and 0.25 respectively. Scale height of hair is 2.5 μm.

6) Caucasian Shepherd

Micrometric study of hair shows Caucasian Shepherd having 6.5 cm long hair having Brown colour. Hair tip is wavy and transparent. Scale type of hair is irregular wave mosaic. Root length of hair is 77.0 μm. Medulla type is stacked. Position and structure of hair is wavy with slope. Shaft diameter, medulla diameter and cortex diameter of hair is 6.6 μm, 2.2 μm and 2.2 μm respectively. Medullary index and corticular index of hair is 0.33 and 0.33 respectively. Scale height of hair is 3.0 μm.

7) German Shepherd

Micrometric study of hair shows German Shepherd having 3.5 cm long hair having Brown and Black colour. Hair tip is thin, wavy and transparent. Scale type is irregular wave. Root length of hair is 132.0 μm. Medulla type of hair is discon. Position and structure of hair is wavy with slop. Shaft diameter, medulla diameter and cortex diameter of hair is 11.0 μm, 4.4 μm and 3.3 μm respectively. Medullary index and corticular index of hair is 0.4 and 0.3 respectively. Scale height of hair is 2.0 μm.

8) Pitbull

Micrometric study of hair shows that Pitbull having 1.5 cm long hair having Black colour and White patch on chest. Hair tip is tapering. Scale type is regular wave. Root length of hair is 99.0 μm. Medulla type is continuous. Position and structure of hair is straight and plane. Shaft diameter, medulla diameter and cortex diameter of hair is 11.0 μm, 6.6 μm and 2.2 μm respectively. Medullary index and corticular index of hair is 0.6 and 0.2 respectively.

9) Chow Chow

Micrometric study of hair shows that Chow Chow having 11.0 cm having faint Brownish colour. Hair tip is thin tapering. Scale type is single Chevron. Root length of hair is 55.0 μm. Medulla type is fragmented and interrupted. Position and structure of hair is shiny with curve. Shaft diameter, medulla diameter and cortex diameter of hair is 8.8 μm, 4.4 μm and 2.2 μm respectively. Medullary index and corticular index of hair is 0.5 and 0.25 respectively.

10) Siberian Husky

Micrometric study of hair shows that Siberian Husky having 5.0 cm long hair having White and Gray colour. Hair tip is tapering. Scale type is Regular petal. Root length of hair is 77.0 μm. Medulla type is stacked with less dense pigmentation. Position and structure of hair is wavy with slope. Shaft diameter, medulla diameter and cortex diameter of hair is 6.6 μm, 2.2 μm and 2.2 μm respectively. Medullary index and corticular index of hair is 0.33 and 0.33 respectively.

V. DISCUSSION OR CONCLUSION

The present study observe that the medullary index of Dog Breed ranges between 0.5 to 0.43 and the corticular index of Dog Breed ranges between 0.2 to 0.33.Study was conducted by the microscopic observation including Colour, Tip pattern, Scale type, Medulla type, Root length of hair, position and structure of hair, Scale height of hair, and also shaft diameter, medulla diameter, & cortex diameter and other micrometric characteristics. In colours of Dog Breed hair is Brown, White, Black and Mixed. According to Dog Breeds specification-hair position and structure of hair also differs among the breeds i.e. the diameter of Medulla and cortex and the other important microscopic characteristics are useful parameters to differentiate between Breeds. So this studies helpful in Investigation of Dog Breeds.

Following data is useful for the easy identification of dog breeds form the single hair follicle. Every breed has different characters with respected to its hair these different characters are related to its thickness of hair, size of medulla, size of cortex.

This study is helpful for forensic investigations, in some situations of crime scenes forensic team get animal hair through these hair follicle they can detect the dog breed which is provide good clue for crime cases.

This study is helpful for restriction to animal poaching from wild as well as domestic level, in the case of dogs many breeds are banned or illegal e.g. Fighter dog.
If these type of studies get occur widely and add as data in the software format then it will be the good key for identification and benefits of these key is we need only single hair follicle of organism, it's much better than capturing and observing to organism.

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