DO THE SCALE PATTERN AND SCALE COUNT BE USED IN IDENTIFICATION OF DOG BREEDS?

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Abstract: Hairs, derived from epidermis, are the characteristic feature of Class-Mammalia. These are used for multitude of functions including camouflage, insulation, protection from predators, sensation, sexual selection etc. Hairs are often found at crime scene involving wildlife. Since dogs are used in wildlife crimes, the identification of dog breed involved in crime may help in limiting the number of suspects involved in crime. Scale count and scale pattern of 14 dog breeds was studied using SEM and GIMP software. All the breeds of dogs analysed had imbricate scale pattern. The scale count was found to be maximum in cross Pomeranian (6) while pugs have least scale count (1).

Keywords: Hairs**,** Dog breeds, Scale count, Scale pattern, SEM, GIMP Software.

Introduction:

Class Mammalia is characterised by the presence of hairs. The hair is epidermal outgrowth made up of keratin. The thickness of hair coat (fur) varies from climatic conditions and extent of domestication (Hardy, 1927). The hairs perform functions like protection, camouflage, sensorial, thermoregulation etc (Herrington, 1951).

Mammalian hair the best source to solve problems related to species identification, diet analysis of endangered carnivores, exposure to heavy metals, archaeological studies, food habit studies and suspect identification.

The hair consists of three main anatomical regions viz. medulla, cortex and cuticle from inward to outward. The outer, thin and transparent region is called cuticle. The cuticle exhibit scales oriented from root to tip of hair (Wildman, 1954) that protects underlying cortex (Hausman, 1930) from wear and tear. The thickness of cuticle varies from species to species and is determined by extent of overlapping of scales.

The cuticular scales are divided into two types; coronal and imbricate (Hausman, 1930). The coronal scales completely encircle shaft while imbricate scales don't. The coronal scales are further divided into three types as simple, serrate and dentate while the imbricate scales are further divided into crenate, flattened, elongate, acuminate and ovate on the basis of contour of free margins of scales. The imbricate scales are found most commonly in all but chiropterans. The cuticular scale pattern is directly related to the diameter of shaft (Hausman, 1930). The scale pattern is, however, is independent of age (Wynkoop, 1929).

A single hair may have variety of scale patterns so (Hardy and Plitt,1940) four region analyses of hair shafts is performed to avoid ambiguity in cuticular scale pattern. The four regions studied for scale pattern include, 1. Base or proximal end, 2. Part adjacent to base, 3. Widest part of shaft and 4.Tip or distal end.

Materials and Methods:

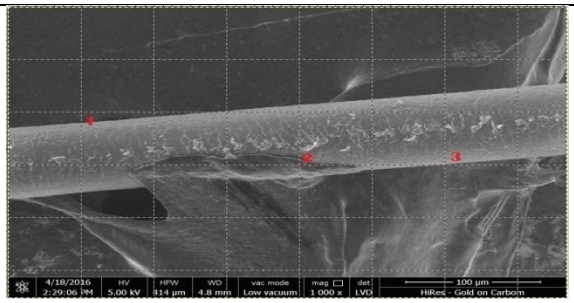
Hair samples were collected randomly from different regions of breeds of dogs. Samples were kept in zip lock bags and stored in refrigerator till further analysis. The samples were washed in acetone to remove dirt and grease followed by 2-3 washes by distilled water. The samples were air dried and fixed on stage of scanning electron microscope (Model: Nova Nano SEM 450, FEI) using carbon tape. The images were captured at fixed magnification in most of the samples and the grids were drawn using GIMP (GNU Image Manipulation Program Version 2.8) software. The scale count from three clearly visible grids was measured and mean was calculated. Only complete scales were used during enumeration.

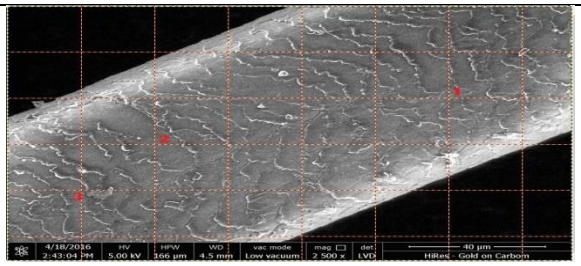
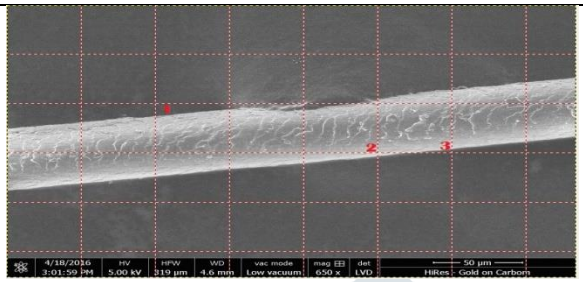
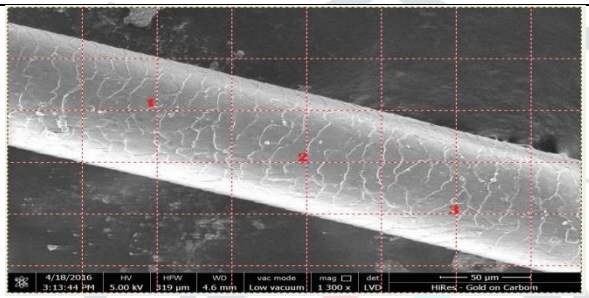
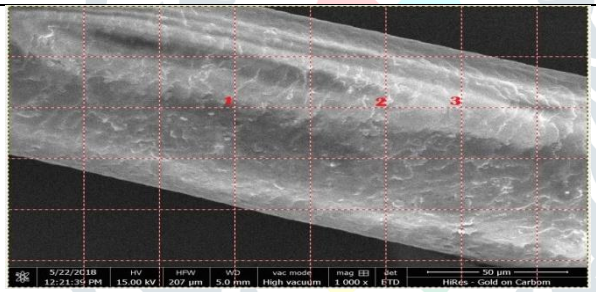
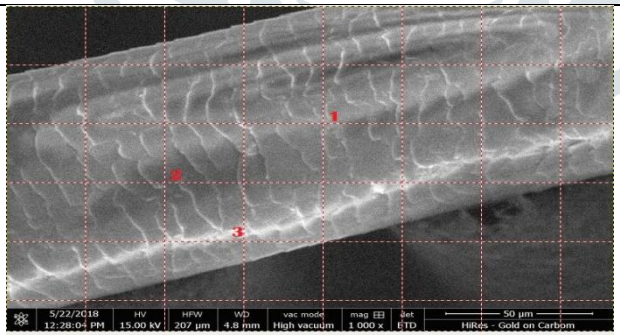
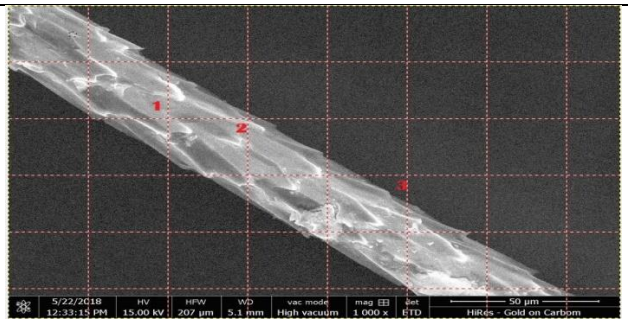
Results:

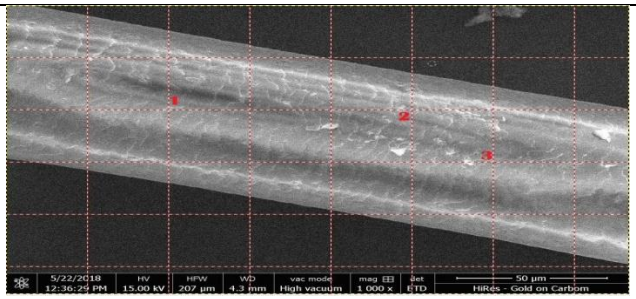
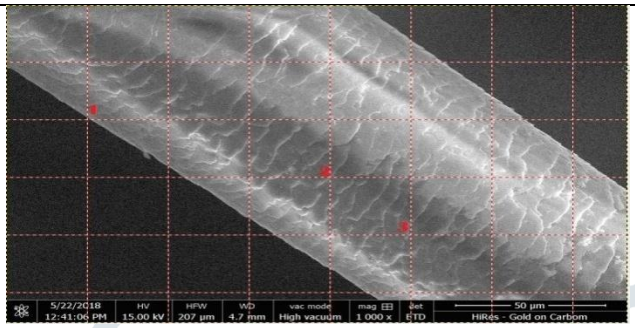
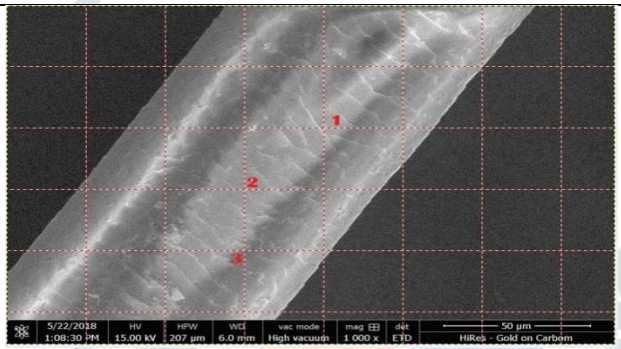
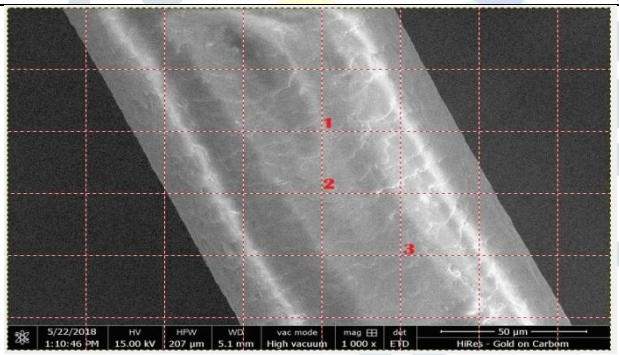
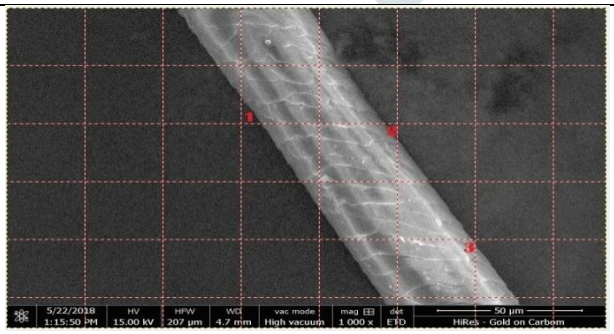
Of the fourteen breeds of dog analysed for their scale pattern and scale count, all have imbricate type of cuticular scale pattern. Crenate subtype is more common (10 out of 14 breeds) followed by flattened (3 out of 14 breeds) while acuminate pattern is observed in only one breed (pug). Mean scale count was found to be maximum (6) in cross Pomeranian while minimum mean scale count (1) was found in pug. The mean scale count in crenate scale pattern was found to be between 2-4 while it was ranged between 3-4 in flattened scale pattern.

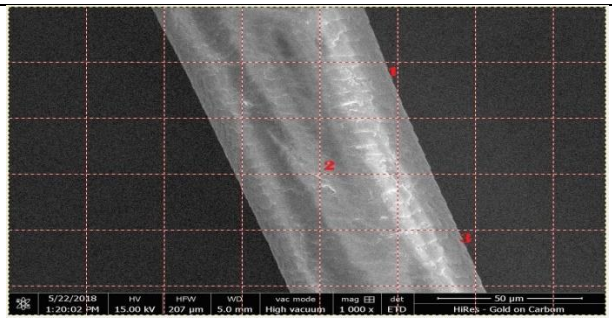
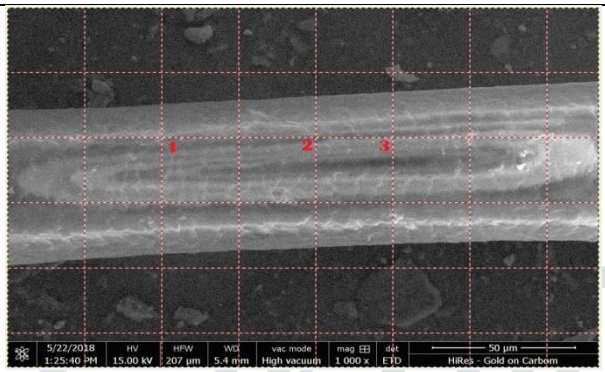
Table:1-

The scale pattern and scale count as observed and measured using SEM and GIMP software respectively from 14 breeds of dogs.

Sr. No	Name of Breed	Observation under SEM	Scale Pattern	Scale Count
1	Cross Pomeranian		Crenate (Imbricate)	6

2	German Shepherd		Crenate (Imbricate)	4
3	Pomeranian		Crenate (Imbricate)	4
4	Great Dane		Crenate (Imbricate)	4
5	Golden Retriever		Flattened (Imbricate)	3
6	Cross Labrador		Flattened (Imbricate)	3
7	Pug		Acuminate (Imbricate)	1

8	Dalmatian		Crenate (Imbricate)	3
9	Boxer		Flattened (Imbricate)	4
10	French Mastiff		Crenate (Imbricate)	3
11	Rottweiler		Crenate (Imbricate)	2
12	Labrador Retriever		Crenate (Imbricate)	2

13	Doberman		Crenate (Imbricate)	3
14	Saint Bernard		Crenate (Imbricate)	2

Discussion:

Detailed microscopic examination of hairs does have some taxonomic value but cuticular scales alone cannot be used for comparative analysis of mammalian hairs due to similarities in cuticular scales across unrelated animals (Wandhare and Bhosale, 2017). So cuticular scales also exhibit variation across the entire hair shaft limiting its taxonomic value (Lyne and McMohan, 1951). This difference in cuticular scales of a single hair is attributed to activities of hair papilla, gradual drying out of shaft and wearing of distal ends of shaft (Hausman, 1930). The differences in cuticular scale are more prominent at proximal and distal ends while the middle of the shaft shows more uniformity.

The changes in scale form are innate and genetic rather than due to dehydration or attrition (Wildman and Manby, 1938). Cross sectional shape along with other microscopic attributes may be of greater taxonomic values than individual characters (Lyne and McMohan, 1951).

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