

## Cyto-Morphological Particularities of the Hair Cuticle in *Canidae* and *Felidae* Families

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**Abstract.** The hair cuticle has particularities depending on domestic and wild species, breeds, age and sex of individuals and also on anatomical regions. For comparison between domestic and wild species we used a unique classification of hair cuticle types (Hausman, 1980; Pauliu *et al.*, 1979). Investigating only some *Canidae* and *Felidae* families we was interested, besides identification of cuticle morphological type, if does exist any correlation between domestic species and their wild ascendance in this regard. As concerns the shape, size and disposition of corneous cells of hair cuticle, we considered all eleven-hair cuticle types of domestic and wild mammals described for the first time by Paliu *et al.* (1979).

There were collected primary hair fibers from shoulder blade anatomic region from some domestic and wild *Canidae* family species (*Canis lupus familiaris*, *Vulpes vulpes*, *Vulpes lagopus*) and from *Felidae* family species (*Felis catus* and *Felis silvestris*). The hair fibers were prepared to being examined in fluorescent microscopy. Examination and microphotography were done using fluorescent microscopy, optical variant with Ultropac, in the research microscope MC-1 (IOR-Bucharest), and adaptor for Canon PowerShot A95 camera.

As conclusion, we do not observed any correspondence of hair cuticle between domestic and wild studied species.

**Keywords:** hair cuticle, cyto-morphological particularities, *Canidae* and *Felidae* families

### INTRODUCTION

The form, sizes, disposition and color of hair vary depending on breed, age, sex and body region (Hausman, 1980).

In the microscopic structure of hair fibers are described at least 10 types of distinctive cells, which appear very similar in different mammals (Mihail, 2006), but are excepted the hair cuticle cells. These ones, always very thin (0.2-0.7 µm), by sizes, shape, disposition manner and especially by their free margins' outline present particularities depending on species, breed and even individual (Păiş, 1983).

In this study we followed, observing the hair cuticle cyto-morphology in optical microscope, to establish if exist any morphological correlation between the hair of some domestic *Canidae* and *Felidae* and their wild ascendance.

### MATERIALS AND METHODS

There were collected primary hair fibers from shoulder blade anatomic region from some *Canidae* family species (*Canis lupus familiaris* -4 cases, *Vulpes vulpes* -3 cases, *Vulpes lagopus* -3 cases) and from *Felidae* family species (*Felis catus* -4 cases and *Felis silvestris* -2 cases).

The domestic animals were adult male patients of a private veterinary clinic from Cluj city, and the wild ones were residents in a zoo from Oradea city. All the studied animals were healthy and in very good maintenance condition.

The making evident of hair cuticle cells' outline was done by an own proceeding, which consisted in hair degreasing treatment with alcohol-ether mixture, retention of a fragment of approximate 2 cm from proximal portion of hair fiber rod, which was maintained 2 minutes in an aqueous solution of 0.25% auramine and finally was mounted in a non-fluorescent medium. Examination and microphotography were done using fluorescent microscopy, optical variant with Ultropac, in the research microscope MC-1 (IOR-Bucharest), and adaptor for Canon PowerShot A95 camera.

## RESULTS AND DISCUSSIONS

In order to characterize the hair cuticle cyto-morphology, depending on shape, outline, disposition and sizes of its keratinocytes, we used the cuticle types proposed by Pauliu *et al.* (1979) in a study of hair structure in domestic and wild mammals from Pyrenéens Department from South of France. These authors proposed 11 hair cuticle types: coronarian, imbricate, rectangular, oval, lanceolate, interpenetrated, undulated, squamous, denticulate, crenellated and reticulated.

The hair fibers collected from the dogs of German shepherd breed presented cuticle of interpenetrated type. The cuticle cells are large in majority and different as shape. Characteristic is the presence of some cellular prolongations, which interpenetrate with adjacent cells (*Fig. 1*).

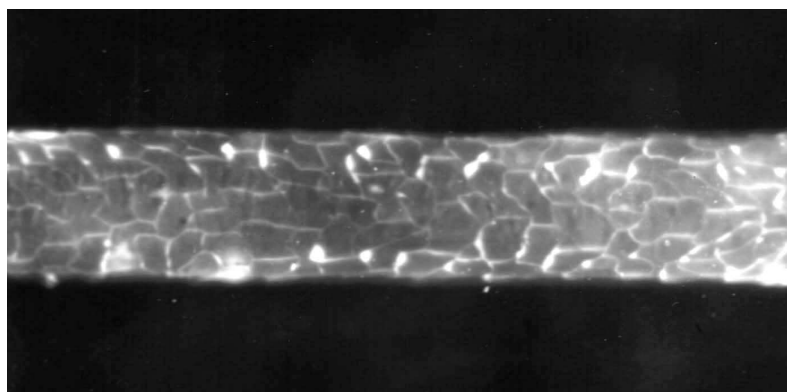


Fig. 1. Hair cuticle in dog of German shepherd breed. Microphoto 200x.

A similar cuticle type has being described by Webb and Calhoun (1954) in many crossbred dogs.

In wolf the hair cuticle is of undulated type, with narrow cells, very oblong transversally given to hair fiber axe and light curved thus per assembly offer a waves' aspect.

The fact that wolf and its domestic relative, German shepherd breed, possess hair cuticle of different type, could be explained admitting a different phylogenic origin. In this point of view the Austrian zoologist Lorenz Konrad (2000, laureate of Nobel Prize in 1973) affirmed: "It is doubtless that the ancestor of majority of our dogs I not the Nordic wolf, as was believed far away, but is the golden jackal. There are only few breeds (Eskimo dogs, American Indians' dogs, Russian Laika and Chow-Chow), which have in great proportion wolf blood and are only physically similar to the wolf. In general, many domestic animals have ancestors in more than one wild animal".

In Red fox (*Vulpes vulpes* sp.) the hair cuticle is of crenellated type having relatively large cells, dimensionally unequal, polygonal and oblong in transversally sense. But, characteristic is their outline light sinuous and crenellated. In the Polar fox (*Vulpes lagopus* sp.) the hair cuticle is also of crenellated type, but are its cells are narrower and more oblong in transversally sense than those ones from hair cuticle of Red fox.

We observed that also the hair of investigated domestic Felidae do not presented a cuticle of same type with that of wild ones. Thus, the hair fibers collected from domestic cats (*Felis catus*, sp. Common breed) present the cuticle of denticulated type (Fig. 2). Its cells are narrow and oblong in transversally sense and characteristic is the presence of some cellular expansions, short and thin, which appear to form inter-prolongations with adjacent cells. A similar description of hair morphology in domestic cat has being communicated by Strickland (1963) and Baker (1971). Contrary, the hair fibers collected from Lynx (*Felis silvestris* sp.) have cuticle of oval type, its cells are large of approximate oval shape and their outline being well linear marked.

However, the identification of a certain cuticle type is not a sufficient element to establish the belonging of a hair fiber. Thus, a cuticle of interpenetrated type, as those one of hair collected from dog of German shepherd breed, is observed also in *Leporidae* family (wild and domestic rabbit species). A cuticle of undulated type, as those one of hair collected from wolf is also present in *Carnivorae* (coyote) precum și la *Mustelidae* (mink, ferret), and the hair fiber from Brown bear presents a cuticle of crenellated type, similar to those one from Red and Polar foxes. The denticulated type cuticle, as those one presents in domestic cat, is described also for the *Suidae* hair fibers.

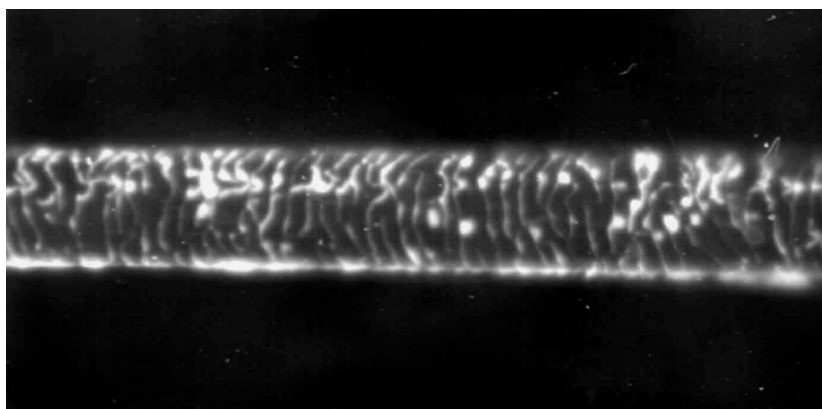


Fig. 2. Hair cuticle in domestic cat (*Felis catus* sp.). Microphoto 200x.

Nevertheless, some additional methods may be useful for the hair strands examination. Accordingly, for a high accuracy in establishing to which species belong a hair fiber are necessary also some micrometric measurements for hair fiber diameter (D), medullar diameter (M) and cortical diameter (C), cuticle cells' length (E), medullar index (M/D) and cuticle index (E/D) (Cadaru, 2009).

Morphological details of lamellar cells from hair cuticle, which could have value of some species or even individual particularities, can be observed only in Scanning Electron Microscope. Dobrilă *et al.* (1978) cited by Păiș (1983) appreciated that "Two identical human hair fibers could be found in about 10,000 individuals, from where the importance that is conferred, with some reserves, in forensic medicine".

As concerns the method for making out the cells of hair cuticle, we tested the examination in fluorescent microscopy because the other recommended methods (Mureșan *et al.*, 1974; Bancroft, 1996), as examination through oblique illumination or examination of hair impress on gelatin film, do not offered satisfactory images. We presume that amorphous substance with intercellular “cement” role, derived from lamellate granules of keratinocytes (Mihail, 2006), with great affinity for osmium acid and silver nitrate, retains selectively the fluorescent substance (auramine).

## CONCLUSION

Examining the hair cuticle cyto-morphology in some mammal species from two families (*Canidae* and *Felidae*) we have identified 5 cuticle types characterized by cells' size, shape, outline and arrangement.

The fact that animal species from same family present different types of hair cuticle could plead for the conception according to a domestic species do not has a single wild ancestor.

The hair cuticle examination done in fluorescent microscopy and completed with micrometric data can be used in certain human or veterinary forensic expertise.

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