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Hair mounting techniques for conservation of mammals-A review

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ABSTRACT

The skin of animals made up of two layers. One is epidermis other one is dermis, while the external layer is known as epidermis, while inner layer is known as dermis. The epidemics is made up of living and dead coating layers, one of the layer is called basal layer, its cells constantly divided and protect the epidermis. Basal layer is formed small hard plug with dermal Papilla. The outside of epidermis is thin and consists of dead cell, which is peel off constantly. Mammalian hair has four basic parts cuticle, cortex, pigment granules and medulla; different mammalian species have different microscopic morphological structure; which are helpful for the identification of the mammalian species. Mammalian hair is the excellent source to solve the biological problems i.e. species identification and diet analysis of all carnivores and also helpful for scientific research in fields of wildlife biology, hunting, game keeping, forensic research and natural management. Mammalian hairs are very important for human and used for purpose of cloth. Different methods are used to analysis the hair structure and microscopic morphology. It is concluded that the hair mounting technique is the best technique for the conservation of mammals. It helps investigating diet of mammals; and also helps us to know the competition among sympatric species and scale of human-mammalian conflicts.

Key words: Mammalian species, Forensic research, Wildlife biology, Natural management

INTRODUCTION

Mammalian hairs (i.e. marten, badger, and squirrel hairs) are very important for human and used for purpose of cloth (Twigg, 1975; Szarzyńska, 2002). This study gives us to scientific knowledge in fields of wildlife biology, hunting, game keeping, forensic research and natural management (Ciucci and Boitani, 1998). Mammalian hair can be obtained from the feces of the carnivores (Twigg, 1975; Nickoloff, 2013; Chattha *et al.*, 2015). Tupinier (1973) extensively worked on morphological arrangement of mammalian hair. Wildman and Association (1954) performed his work on different types of hairs, particularly those hairs which is widely used in textile industry; also observed hair morphology as well as hair growth, did not only prepared cross-sections of cuticula, and medulla of hair but also give sketch of cuticular and medullar patterns.

Scientists were worked on the internal structure of hair (Tupinier, 1973; Keller, 1978; Keller, 1980; Keller, 1992); while Debrot *et al.* (1982) give photographs of medulla and cuticula alongwith sketches of cross section of mammals. All of these researches (Keogh, 1983; Hillary and Buys, 1984; Taylor, 1985; Teerink, 2004; Chattha *et al.*, 2011; Boitani and Powell, 2012) give greatest significant for structures and morphology of mammals hairs.

Sometime identification of animals is tough, by using the morphology of hairs such as length, color, from as well as structure of medulla, cross section and cuticula, we can easily generate accurate distinguished between animals, by using combination of these few data. It also give information about different animals have different hairs morphology and structure. The photo atlas is not enough for identification but also character data is insufficient and not well-defined. It is necessary the information about text and pictures of hairs must be accurate (Teerink, 2004).

HAIR GROWTH

Many scientist explained growth and development method of hair (Wildman and Association, 1954). The following is a simplified summary of the process. The skin of animals made up of two layers. One is epidermis other one is dermis, the external layer is known as epidermis as well as inner layer is known as dermis. The epidemics is made up of living and dead coating (layer), one of the layer called basal layer, its cells constantly divided and preserved the epidermis. The outside of epidermis is thin. The coating of horn consists of dead cell, which is peel off constantly (Teerink, 2004). The basal layer starts growing at shallow down-side, which is into the dermis, while basal layer form minor hard plug with dermal Papilla. Then dermis cells form a lesser blood capillaries and sheath of connective-tissue, so that transfer the nutriment to anew prepared tissue, around the developing follicle (Wildman and Association, 1954).

The next outcome develop on the follicle-neck and produce a gland called wax gland, as well as in some animals erector muscle grow, which authorize the hairs arrangement. Hair is made up of layers; generally hair has three different types of layers i.e. cortex, medulla, and cuticula. These layers play most essential and important role for understanding and identification of hair. In most animals, the follicle of hairs are organized in grouped, different animals have different organization and size of these group. When the follicle formation is start, sometime two, three, or more follicle seem at the primordial follicle side. Starting a three some group, later this further hair follicle grows (Teerink, 2004).

In many groups of mammalian species, subordinate follicle develop through bumps on the internal side of hair follicle, after this similar growing steps passed and using the same method to initially arise; for example in Merinos 9 follicles present in a bundle by common orifice (Lyne, 1966).

HAIR PROFILE

The hair shaft has 4 structural units, (i) the medulla, (ii) cortex, (iii) pigment granutes, and (iv) cuticle (Hausman, 1920).

Medulla: Medulla built up from variously disposed and many shrunken cells, showing cornified and dried epithelial structures associated by a branching filamentous network, which occasionally fully fills the medullary column, and interrupted in a lot of cases (Debelica and Thies, 2009).

Cortex: Cortex shell outside the medulla that is consists of fusiform cells (hair spindles), elongate combined together into a homogenous, hyaline mass, horny and forming, in numerous cases where the medulla is reduced, a larger proportion of hair shaft.

Pigment Granules: Pigment granules structures mainly responsible for the hair color; in few mammals pigment is diffuse instead of granular. Granules are dispersed between or within the hair spindles, and in few hairs they are arranged in specific patterns (Debelica and Thies, 2009).

Cuticle: Cuticle outermost covering of a hair shaft consists of hyaline, thin, colorless scales of different dimensions and forms (Debelica and Thies, 2009).

HAIR CLASSIFICATION

Hair are divided into two major groups i.e. first hairs with sensory function, and second group has normal hair. Normal hair are further divided into three subgroups: (i) heavy over hairs that are usually straighter, longer and more strong all their length than the general coat in the most mammals; (ii) curly over hairs that are often enlarged only in the distal half or third of their total lengths, the basal part being distinctly more flexible and weaker; while (ii) fur hairs that are uniformly flexible and weak except at the base and tip (Williams, 1938), Both (i) and (ii) are together recognized as guard hair (Debelica and Thies, 2009).

HAIR MOULTING

Moulting process is recorded in different seasons, some species are depending of season and while other species are independent of seasons (e.g. brown rat, *Rattus norvegicus* has no moulting season) recorded in wild as well as laboratory (Becker, 1952). In *Apodemus* and *Microtus* moulting is reported in spring and autumn (Stein, 1960).

It is noted that moulting is recorded in less winter; while more recorded in the summer e.g. *Clerthrionomys glareolus*, (bank vole) less than 2% moulting occur in winter; while more than 37% moulting occur in summer (Stein, 1960). The *Apodemus agarrius* (Striped field mouse) hairs are thick in wintertime; while thin in summer (Haitlinger, 1968).

The hair is divided into different kinds, for example bristle hairs (domestic pig), under-hairs, Over-hairs, and vibrissae (whiskers), and in these categories two or more kind of hair is might be present in the similar species. Vibrissae hairs are quickly identified, because vibrissae hairs arrangements are identical in different animals. Many vibrissae hairs are spherical in cross-section, and these vibrissae hairs, fully matched from tip to base, so that importance of vibrissae hair for identity is incomplete. The western hedgehog have needle like hairs called spines, and these spines are importantly extend and powerfully adopted hairs. Similarly most of the species are changed due to food, lifestyle, diseases, atmosphere, season, ecosystem, and habitat etc (Teerink, 2004).

HAIR MOUNTING PROCEDURES

Mathiak Method: Unclean hairs should be cleaned with alcohol or carbon tetrachloride. During this method hairs are dipped in xylene and then kept at slide and covered with cover glass (Mathiak, 1938).

Teerink Method: Hairs were cleaned and stored in ethanol (70%) e.g. slides, hairs were dipped in paraffin oil and then kept on slide and covered with cover glass: the oil penetrates the medulla and makes visualization of the medulla (Teerink, 1991).

Twigg Method: The hair was dipped in ether for few minutes to remove natural oil and then dipped in the transparent nail polish and put hair on slide and see under microscope (Twigg, 1975).

Robertson Method: Whole mount method is the method of wet mount, in which many hair filaments set in parallel shape on the slide of microscope then, using 2 drops of chemical called (CCl_4) carbon tetrachloride, then drop of carbon tetrachloride is placed on the hair, after this cover slip is used to fixed the hair, and examine the hair by scanning. By using the compound microscope (EM) examine morphological characteristic of hair, under 100x to 400x magnitude. With the help of this method, easily understand the morphology of medulla and cuticle as well as pigment scattering or spreading in cortex (Robertson, 1999).

Polaroid Film-print Coater Method: Ogle and Mitosinka (1973) create a very fast and easiest process in which scale cast formed rapidly with the help of Polaroid film-print coater. The Polaroid print coater is move 2 to 3 times on the glass slide of microscope, now the slide has thin coating of Polaroid print coater. Then hair sample is gently pushed on the Polaroid film-print coater and wait for a while, and allow the film to dehydrate. After this hair is dragged from the coated slide and the hair cast present on the slide, which is easily examined under the microscope.

Scale Replicate Method: The scale replicate method is used to understand the scales arrangement in hairs of different species. In this method it is very important to formed scale cast of hair sample to understand scale pattern easily, mostly in the observing of some species hairs.

Scale pattern of hairs is not directly examined on slide; therefore, with the help of nail polish making a cast of hair to get brand of scales. The small layer of nail polish is distributed on the slide of microscope, and then put a hair in the center of slide. After this, wait for fifteen minutes hence the nail polish cause to harden the hair on the slide. And the hair on the slide, softly detached from the nail polish with the help of forceps. The scale arrangement of cuticular could be examined on casts. The casts for understanding the hair pattern, is also prepared with glue or resin. When casts is prepared, then hair is put gently on the slide, which is coated with vinyl adhesive. Left the slide and wait for 30 minutes until paste dehydrated. After this the hair is detached from the slide, and it left the cuticular scale pattern which is observable (Day, 1966; Gurini, 1985).

Conclusion: The hair mounting technique is the simplest and best technique for the conservation of mammalian species. It helps investigating foraging ecology and diet of mammalian species; and also helps us to know the competition among sympatric species and magnitude of human-mammalian conflicts.

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