STRUCTURE OF MID-DORSAL GUARD HAIRS OF HUNTING LEOPARD, ACINONYX JUBATUS VENATICUS (GRIFFITH) AND LESSER PANDA, AILURUS FULGENS F. CUvier (MAMMALIA : CARNIVORA)

RINA CHAKRABORTY AND J. K. DE
Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

Knowledge about the structure of dorsal guard hairs has not only become the most significant in the study of mammalian taxonomy and food habit but in the mammal survey, forensic science and control of illegal trade also (Brunner and Coman 1974, Koppiker and Sabnis 1976, 1977, Teerink 1991, Chakraborty et al., 1996, 1999). Hair structure of quite a number of mammalian species of India as well as abroad have been worked out (Hausman 1920, Brunner and Coman 1974, Moore et al., 1974, Koppiker and Sabnis 1976, 1977, Keller 1981, Debrot et al., 1982, Teerink 1991, Wallis 1993, Venkatraman et al., 1994, De and Chakraborty 1995, Chakraborty et al., 1996, 1999, De et al., 1998). However, no information is available as regard the structure of dorsal guard hairs of two threatened species of carnivora, viz., Hunting Leopard, Acinonyx jubatus (Schreber) [Carnivora : Felidae] and Lesser Panda, Ailurus fulgens F. Cuvier (Carnivora : Ursidae). Hunting Leopard was last recorded in India in 1952 and considered as extinct in the country (Ghosh 1994), while Lesser Panda, within Indian limit, is found in Darjeeling (West Bengal), Sikkim and Arunachal Pradesh and considered as endangered (Chakraborty 1994). Both the species are included in the Schedule I of the Indian Wildlife (protection) Act, 1972. In India A. fulgens is represented by the nominate subspecies, while A. jubatus was represented by the subspecies venaticus (Griffith). In the present paper an attempt has been made to reveal the structure of dorsal guard hairs of the above mentioned species.

MATERIAL AND METHODS

Five tufts of guard hairs were collected from the mid-dorsal region of four dry preserved specimens of each species present in the National Zoological Collection of the Zoological Survey of India, Kolkata. Samples were processed for study according to the method of Chakraborty et al., (1996). Surface structure, medullary configuration and cross sectional details of dorsal guard hairs were studied microscopically followed after Brunner and Coman (1974), Teerink (1991) and Chakraborty et al., (1996).
Nomenclature of colour is followed after Ridgway (1891) and structural nomenclature of cuticular as well as medullary configuration is followed after Brunner and Coman (1974) and Moore et al., (1974). Classification was followed after Wozencroft (1993).

**OBSERVATIONS**

1. *Ailurus fulgens* F. Cuvier

   A. Physical Characters:
   - Colour: Basal – Cinnamon or Fawn
     - Distal – Brunt Umber
   - Profile: Straight, Shielded, Spatulate
   - Length (mm): 47–56 (50.4 ± 3.07)
   - Diameter (µ): Basal : 50–60 (54.5 ± 1.29)
     - Subshield : 70–80 (76.3 ± 3.358)
     - Shield : 110–130 (116.4 ± 2.449).

   B. Surface structure (Plate I, Fig. 1)
   - Scale count (per mm of hair length) : 498–535 (522 ± 5.23)
   - Scale type: Petaloid
   - Scale pattern : Diamond Petal
   - Scale margin : Smooth
   - Scale margin distance: Distant
   - Side to side scale length (SS) : 3.1–4.4µ (4 ± 0.23)
   - Proximo-distal scale length (PD) : 10–14.4µ (13.12 ± 0.36).

   C. Medulla (Plate I, Fig. 2)
   - Medullary configuration: Unbroken cellular
   - Medullary index: 0.61–0.649 (0.63 ± 0.011).

   D. Cross section: Circular (Plate I, Fig. 3).

2. *Acinonyx jubatus* (Schreber)

   A. Physical characters :
   - Colour: Basal – Usually Buff
     - Middle – Tawny
     - Tip – Brown
   - Remark: Shades are greatly varied, sometimes whole hair is light Brown or dark Tawny or sometimes more darker.
   - Length (mm) : 37–47 (43.7 ± 2.07)
   - Profile: Very thin, straight, rod like
   - Diameter (µ) : 50–65 (56 ± 3.56).
CHAKARBORTY & DE: Structure of mid-dorsal guard hairs of Hunting Leopard

B. Surface structure (Plate II, Fig. 1)
- Scale count: 435–538 (489 ± 6.38)
- Scale type: Imbricate, Crenate
- Scale pattern: Irregular wave
- Scale margin: Irregularly Rippled
- Scale margin distance: Intermediate
- Side to side scale length (SS): 7.5–21.87 μ (14.81 ± 4.31)
- Proximo-distal scale length (PD): 3.12–9.39 μ (5.25 ± 2.24).

C. Medulla (Plate II, Fig. 2)
- Medullary configuration: Simple unbroken amorphous
- Medullary index: 0.62–0.66 (0.638 ± 0.014).

D. Cross section: Almost circular (Plate II, Fig. 3)
- Remark: Cuticular scales are very much irregular in shape and size.

DISCUSSION

Structure of dorsal guard hairs of all the five species of large cats of Indian territory belonging to the genus Panthera Oken have been studied (Chakraborty et al. 1996). On comparison with the species of the genus Panthera, it has been found that scale count in A. jubatus is much higher (489 ± 6.38) than that of all the five species of the genus Panthera, where highest is 300 in P. tigris. Moreover, ‘SS’ (14.81 ± 4.31) and ‘PD’ (5.25 ± 2.24) in A. jubatus are on average, much lower than those in the species of the genus Panthera, where ‘SS’ and ‘PD’ are lowest in P. tigris being (18 ± 6) and (7 ± 2) respectively. When compared with the hair structure of the 11 species of Indian lesser cats (Chakraborty et al. 1999), it has been found that hair structure of A. jubatus has no single characteristic by which it may be separated from all of them. However, from the combination of characters like scale count, scale structure, scale margin, scale type, medullary configuration, A. jubatus can be distinguished from all the species of lesser cats occurring in India.

Genus Ailurus is monotypic and its family placement is much controversial. It has been included under Ailuridae (Pocock 1939), Procyonidae (Ellerman and Morrison Scott 1951), Ailuropodidae (Honacki et al., 1982) and Ursidae (Wozencroft 1993). On the basis of biochemical and molecular evidence, Ailurus was considered as intermediate between procyonids and Ursids (O’Brien et al. 1985, Tagle et al. 1986, Wayne et al. 1989). Todd and Pressman (1968), Zhang and Shi (1991) regarded it as closer to procyonids, while reverse opinion was held by Goldman et al. (1989).

Hausman (1920) observed ‘Diamond Petal’ scale pattern and ‘Smooth’ scale margin in Ursus americanus like A. fulgens, but in Ursus arctos scale pattern is ‘Irregular wave’ with ‘Crenate’ scale
margin. Moore et al. (1974) studied the hair structure of two species of Ursids viz., Ursus americanus cinnamomum, Ursus arctos imperator and two species of Procyonids viz., Procyon lotor hirtus and Bassariscus astutus crizonensis. On comparison of the findings of present study it has been found that Ailurus differs from all the four species in having the maximum diameter of hair as low as 60 µ against 153 µ, 148 µ, 154 µ and 83 µ in U. americanus cinnamomum, U. arctos imperator, P. lotor hirtus and B. astutus crizonensis respectively. Further, it has been found that medullary configuration is similar being ‘Unbroken cellular’ in both species of Ursus, A. fulgens and B. astutus crizonensis, but in P. lotor hirtus it is different being ‘Unbroken vacuolated’

Thus, so far the hair structure is considered, genus Ailurus is distinct from all the studied species of Ursids and Procyonids in respect of diameter, while its medullary configuration is similar to both the Ursid species and one Procyonid species. As such, consideration of Ailurus as intermediate between Ursids and Procyonids (O’Brien et al. 1985, Tagle et al. 1986, Wayne et al. 1989), appears to be more justified.

**SUMMARY**

Mid-dorsal guard hairs of Hunting Leopard, Acinonyx jubatus (Schreber) and Lesser Panda, Ailurus fulgens F. Cuvier have been studied. Acinonyx jubatus may be distinguished from other species of large cats of the genus Panthera Oken by higher scale count, lower ‘SS’ and ‘PD’ Ailurus fulgens is distinguished from all the studied species of Ursidae and Procyonidae by higher diameter of the hair. Further, as regard hair structure it is intermediate between Ursids and Procyonids.

**ACKNOWLEDGEMENTS**

Authors are thankful to Dr. J. R. B. Alfred, Director, Zoological Survey of India for giving facilities and also to Dr. S. Chakraborty, Scientist ‘E’ for critically going through the manuscript.

**REFERENCES**

Brunner, H. and Coman, B. 1974. The Identification of mammalian hair. Inkata press, Victoria, Australia. 196 p.

Chakraborty, S. 1994. The Red data book on Indian animals, Part 1 : Vertebrata. pp. 61-63, Ed. and Pub. Zoological Survey of India, Calcutta.

Chakraborty, R., De, J. K. and Chakraborty, S. 1996. Identification of dorsal guard hairs of Indian species of the genus Panthera Oken (Carnivora : Felidae). Mammalia, 60 : 473-480.

Chakraborty, R., Chakraborty, S. and De, J. K. 1999. Identification of dorsal guard hairs of the species of Indian lesser cats (Carnivora : Felidae). Mammalia, 65 : 93-104.
De, J. K. and Chakraborty, R. 1995. Structure and pattern of guard hairs of crab eating mongoose, *Herpestes urva* (Hodgson) (Mammalia : Carnivora : Herpestidae). *Proc. zool. Soc.*, Calcutta, 48(1) : 33-36.

De, J. K., Chakraborty, S. and Chakraborty, R. 1998. Identification of dorsal guard hairs of five Indian species of Mongoose, *Herpestes Illiger* (Mammalia : Carnivora). *Mammalia*, 62 : 285-295.

Debrot, S., Fivaz, G., Mermod, C. and Weber, J. M. 1982. *Atlas des Poils de Mammiferes d' Europe*. Institut de Zoologie de l' Université de Neuchâtel.

Ellerman, J. R. and Morrison-Scott, T. C. S. 1951. *Checklist of Palaearctic and Indian Mammals*. Brit. Mus. Nat. Hist. London. 810 p.

Ghose, R. K. 1994. *The Red data book on Indian animals, Part 1 : Vertebrata*. 87-89 p., Ed. and Pub. Zoological Survey of India, Calcutta.

Goldman, P., Giri, R. and O'brien, S. J. O. 1989. Molecular genetic distance estimates among the Ursidae as indicated by one and two dimentional protein electrophoresis. *Evolution*, 43(2) : 282-295.

Hausman, L. A. 1920. Structural characteristics of the hair of mammals. *Am. Nat.*, 54 : 496-523.

Honacki, H. J., Kinman, E. K. and Koepp, W. J. 1982. *Mammals species of the world*. Allen Press. Inc. and Assoc. Syst. Collns., Lawrence, Kansas, U.S.A. 694 p.

Keller, A. 1981. Determination des mammiferes de la Suisse par leur pelage : V. Carnivora, VI. Artiodactyla. *Revue Suisse de Zoologie. Annales de la Société Suisse de Zoologie et du Museum d'Histoire Naturelle de Genève*. 88 : 803-820.

Koppiker, B. R. and Sabnis, J. H. 1976. Identification of hairs of some Indian mammals. *J. Bombay nat. Hist. Soc.*, 73 : 5-20.

Koppiker, B. R. and Sabnis, J. H. 1977. Further studies on the identification of hairs of some Indian mammals. *J. Bombay nat. Hist. Soc.*, 74 : 50-59.

Moore, T. D., Spence, L. E. and Dugnolle, E. E. 1974. Identification of the dorsal guard hairs of some mammals of Wyoming. *Wyoming Game and Fish Dept. Bull., No. 14* Cheyenne. 77 p.

O'Brien, S. J., Nash, W. G., Wildt, D. E., Bush, M. E. and Benveniste, R. E. 1985. A molecular solution to the riddle of the giant panda’s phylogeny. *Nature*. 317 : 140-144.

Pocock, R. I. 1939. *The Fauna of British India including Ceylon and Burma. Vol. I. Primates and Carnivora (in part)*. Taylor and Francis, London. 463 p.

Ridgway, R. 1886. *Nomenclature of colors*. University Press. John Wilson and son, Cambridge. 129 p.

Teerink, B. J. 1991. *Hair of West European mammals*. Cambridge University Press. Cambridge. 223 p.
Todd, N. B. and Pressman, S. R. 1968. The karyotype of the lesser panda (Ailurus fulgens) and general remarks on the phylogeny and affinities of the panda. *Carnivora genetics Newsletter.* 5: 105-108.

Tagle, D. A., Miyamuto, M. M., Goodman, M., Hoffmann, O., Graunitzer, G., Goltenboth, R. and Jalanka, H. 1986. Haemoglobin of pandas: phylogenetic relationships of carnivores as ascertained with protein sequence data. *Natur wissenschaften.* 73: 512-514.

Venkatraman, K., De, J. K. and Tandon, S. K. 1994. Ultrastructural studies of hair of seventeen Carnivores using Scanning electron micrographs. *Rec. zool. Surv. India.* 94: 145-158.

Wallis, R. L. 1993. A key for the identification of guard hairs of some Ontario mammals. *Can. J. Zool.* 71: 587-591.

Wayne, R. K., Benveniste, R. E. and O'Brien, S. J. 1989. *Phylogeny and evolution of the carnivora and carnivore families,* pp. 465-494, in Carnivore behavior, ecology and evolution (J. L. Gittleman, ed.) Cornell University Press, Ithaca, Ny. pp. 620.

Wozencroft, C. W. 1993. *Order Carnivora.* In *Mammal species of the world* (Eds. D. E. Wilson and D. M. Reeder). Smithsonian Instn. Press, Washington and London. 279-348 p.

Zhang, Ya-Ping. and Shi, Li-Ming. 1991. Riddle of the giant panda. *Nature.*