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IDENTIFICATION OF DORSAL GUARD HAIRS OF FOUR INDIAN SPECIES OF BEAR (MAMMALIA : CARNIVORA : URSIDAE)

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INTRODUCTION

The Indian species of the bears belonging to the family Ursidae are included in the Appendix I of CITES as well as in the Schedule I, Part I of Indian Wildlife (Protection) Act., 1972 ammended in 1991 except *Selenarctos thibetanus* which is placed in the Part II of Schedule II. The population of bears are deteriorating day by day due to man-bear interaction and habitat destruction as well as illegal hunting for its skin, flesh and gallbladder of which later is supposed to have a medicinal value (Chakraborty, 1994; Mondal, 1994). Out of 7 subspecies of *Ursus arctos* only *isabellinus* is found in India (Ellerman and Morrison-Scott, 1951). So, hairs of *Ursus arctos* studied is of *isabellinus*.

Now-a-days, trichotaxonomy study is one of the outstanding disciplines in science not only for mammal survey and identification of prey species from the gut contents and scats of large predators but also in forensic science and in different enforcement agencies engaged for management of wildlife. Earlier studies revealed that the structure of hair has definite taxonomic values in the different systematic categories at least for some groups of mammals (Day 1966, Brunner and Coman 1974, Debrot *et al*., 1982, Teerink 1991, Wallis 1993, Chakraborty *et al*., 1999, Chakraborty and De 2001, 2002, De and Chakraborty 2002).

Knowledge on hair structure of the family Ursidae is still wanting and only Hausman 1920, Ishizu *et al*., 1973, Moore *et al*., 1974 have enlighted the field a little. Identification keys for the different species of the family Ursidae have been provided by Pocock(1941) and Corbet and Hill (1992) on the basis of external and cranial features but no identifying key is available to identify the skins of different bears. In this paper an attempt has been made to formulate an identifying key on the basis of the structure of dorsal guard hairs of the Indian species of the family Ursidae.

Key words : *Indian Bears, Ursidae, dorsal guard hairs, identification*

MATERIALS AND METHODS

Five tufts of hair of each species were collected from the five selected spots in the mid-dorsal region, keeping almost equidistance from each other. All the samples have been collected from the dry preserved skins housed in the National Zoological Collections of the Zoological Survey of India, Kolkata : *Ursus arctos*; 3 nos. (Kashmir 1; Zoo garden, Kolkata 2); *Selenarctos thibetanus* : 3 nos. (Zoo garden, Kolkata 3); *Helarctos malayanus* : 5 nos. (Arunachal Pradesh 2; Tundla, Uttar Pradesh 1; Zoo garden, Kolkata 2); *Melursus ursinus* : 4 nos. (Shillong, Meghalaya 2; Zoo garden, Kolkata 2). During collection, very often the woolly hairs would get mixed with the guard hair, which were sorted before processing them further. The sample size varied from 30–50 in number.

For macro and microscopic observations methodology given in Chakraborty *et al*., (1999) was followed. Cross sectional study technologies of Brunner and Coman (1974) and Teerink (1991) were followed. Medullary index was taken with the ocular micrometer and was calculated as $k = m/c$ where m = width of medulla and c = width of hair.

Hausman (1920), Brunner and Coman (1974) and Moore *et al*., (1974) were followed for the use of terminologies in the article. Nomenclature of colour is according to Ridgway (1886).

OBSERVATIONS

Findings have been summarized in Table 1 and 2.

RESULT AND DISCUSSION

Though all the bears are placed under a single family Ursidae (Pocock 1941) yet except cuticular scale position and scale type (Table 1), no such character could be considered definitely as family character. Hairs of the 4 ursid species studied are devoid of any banding pattern except in *U. arctos* which usually possess a single band but may rarely be absent (Table 1). All the studied samples are 'Black' in colour except *U. arctos* which is 'Seal' to 'Clove brown' with white tips and may give the coat a silvery tinge. Moore *et al.*, (1974) made comments on the hairs of *U. americanus cinnamonum*, that unbanded colours vary according to individuals and they are commonly 'Black' or various shades of 'Brown' or 'Yellow'. It was also stated that there are several colour phases in the hairs of *U. arctos imperator*, however typical dark brown is also found. It is also true in case of *U. arctos isabellinus* where the shades vary not only from individual to individual but in the same individual also. However, this intraspecific variation in pelage colour is negligible.

Though there is similarity in colour between the colour of all the three bears *viz. S. thibetanus*, *H. malayanus* and *M. ursinus* yet profile of *H. malayanus* is curly with unshield pattern.

The profile of *S. thibetanus* and *M. ursinus* is almost same but it differs greatly in length, which is (34.42 ± 4.39) mm and (69.44 ± 3.02) mm in average respectively but there is no significant difference in diameter (Table 1) between the four species studied.

According to Prater (1980), shorter and smooth coat of *S. thibetanus* distinguish it at once from *M. ursinus*. Present study also shows that average length of hair of *S. thibetanus* is (34.42 ± 4.39) mm, which is too less in comparison to that of *M. ursinus* (69.44 ± 3.02) mm. Moore *et al*., (1974) recorded that the average length of hair is 70 mm and 108 mm with 148 µ and 153 µ average diameter in *U. arctos imperator* and *U. americanus cinamonum* respectively. In the present study the length of hair noted in *U. arctos* is more or less similar with that of *U. arctos imperator* except in diameter which is (73.75 ± 9.15) µ in apical, (121.25 ± 16.02) µ in shield and (101.2 ± 9.27) µ in basal region. Diameter of both the subspecies of *U. arctos imperator* and *U. americanus cinamonum* is higher in comparison with *U. arctos isabellinus*. It may be due to geographical as well as seasonal variation. However, Hausman (1920) noted that diameter of hair of *Ursinus* (= *Ursus) americanus* is 27 µ and the same of *Thalarctos maritimus* is 68 µ. Thus, from the present and previous study, it can be said that the range of hair length and diameter varies greatly not only from species to species but in the same species also. At the same time scale count per millimeter of hair length also differs greatly in the four Indian species with minimum, (100 ± 0.25) in *H. malayanus* and maximum in *S. thibetanus*, (510 ± 20.05) (Table 1).

In the present study it is noted that the guard hairs of *U. arctos* possess 'irregular wave' scale pattern throughout except at shield region where it is 'irregular mosaic' (Table 2). The scale margin of the same is 'smooth' with 'intermediate' scale margin distance (Table 2, Plate I, Fig. 1). Similar type of observation was made by Moore *et al*., (1974) in the hair of *U. arctos imperator and U. americanus cinamonum* with slight variation in scale margin which is 'crenate-rippled'. However, Hausman (1920) noted 'imbricate–acuminate' cuticular scales in *Ursinus (=Ursus*) *americanus*. From the above discussion it may be concluded that the scale type of all the ursids studied so far are definitely of 'imbricate' type but may be of 'smooth', 'crenate' or 'acuminate' variety. The scale pattern of *S. thibetanus* is same as *U. arctos isabellinus* (Table 2, Plate I, Fig 4). The scale patterns of *H. malayanus and M. ursinus* are 'regular wave' with 'irregular mosaic' pattern at basal and shield region respectively and the scale type is 'imbricate-crenate' and imbricate smooth respectively (Table 2).

Scale margin is 'smooth' in *U. arctos* and *M. ursinus* and in other two species the same is 'crenate' (Table 2, Plate I, Fig. 1-4). Scale margin distance is intermediate in all the species except *S. thibetanus* where it is 'close'. From the above study it is clear that cuticular scaler characters could not be used alone as identifying character but may be considered along with other characters. The 'SS' does not vary greatly from species to species which is lowest in *U. arctos*, (34 ± 4.95) µ and highest, (47 ± 13.46) µ in *H. malayanus* (Table 1), whereas 'PD' in two species *i.e., S. thibetanus*

and *M. ursinus* is very less, (7 ± 1.58) µ and (7 ± 2.58) µ respectively and is much higher in *U. arctos* and *M. ursinus* i.e. (18 ± 5.44) µ and (17 ± 2.58) µ respectively.

The present study shows that the dorsal guard hair of *U. arctos isabellinus* is having an 'unbroken cellular' medulla like that of *U. arctos imperator*. Thus, it may be stated that medullary structure of *U. arctos* does not differ at least in the sub-specific level and may be used as an identifying character for *U. arctos* with other supporting characters. Medullary structure of *U. americanus* was also observed as 'Unbroken cellular' (Moore *et al*., 1974). Hairs of *S. thibetanus* also possese "unbroken vacuolated medulla". Thus it could be stated that the genus *Ursus* and *Selenarctos* are both possessing either 'unbroken cellular or 'unbroken vacoulated' medulla which are quite identical in structure. Hausman (1920) observed continuous 'nodose' medulla in *T. maritimus, H. malayanus and M. ursinus* possess 'Simple unbroken amorphous', medulla (Table 2, Plate II, Fig. 3 & 4). So, from the above observations it may be concluded that, medullary configuration of all the hair samples of ursids studied is either 'Unbroken amorphous' or 'unbroken cellular/vacuolated' in structure.

The cross section *of U. arctos* is noted as 'oval' (Table 2, Plate III, Fig. 1), which is quite alike with that of Moore *et al.*, (1974) in *U. arctos imperator and U. americanus cinamonum*. It is a strong evidence that the cross sectional structure does not differ at sub-specific level. From this cross sectional study, it may also be noted that hairs of the species belonging to the genus *Ursus* possess 'oval' type shaft configuration, whereas in case of other two species i.e. *S. thibetanus* and *H. malayanus* the cross section is 'circular' in structure. But the cross sectional structure of *M. ursinus* is 'oblong' (Table 2, Plate III, Fig. 4). It is also assumed that, further study on dorsal guard hairs of rest of the bear species may help to establish the taxonomic hierarchy of the ursids.

Considering the above discussion an identification key for the Indian species of the family *Ursidae* is being proposed as follows.

KEYS TO THE FOUR INDIAN SPECIES OF BEARS

1a. Medullary configuration 'unbroken vacuolated/unbroken cellular, medullary index < 0.50 2

1b. Medullary configuration 'simple unbroken amorphous', medullary index > 0.50 3

2a. Shielded; scale margin 'smooth'; scale margin distance `intermediate'; scale pattern 'irregular wave' with 'irrerugular mosaic' at shield region; medullary configuration 'unbroken cellular'; cross section; 'oval'; medullary index 0.33 ..... *Ursus arctos*

2b. Shielded; straight; scale margin 'crenate'; scale margin distance 'close'; scale pattern 'irregular wave' with 'irregular mosaic' at shield region; cross section 'circular'; medullary index 0.31 ..... *Selnarctos thibetanus*

3a. Shielded; scale margin 'smooth'; scale margin distance 'intermediate'; scale pattern 'regular wave' with 'irregular mosaic' at shield region; medullary configuration simple unbroken amorphous; cross section 'oblong'; medullary index 0.91 ..... *Melursus ursinus*

3b. Unshield; almost curly; scale margin 'crenate'; scale margin distance 'intermediate', scale pattern 'Regular wave' with 'irrregular mosaic' at basal; cross section 'circular'; medullary index 0.87 ..... *Helarctos malayanus*

SUMMARY

The dorsal guard hairs of four Indian species of bear *viz*. *Ursus arctos* Linnaeus, *Selenarctos thibetanus* (G. Cuvier), *Helarctos malayanus* (Raffles) and *Melursus ursinus* (Shaw) have been studied. The study reveals that *Ursus arctos* and *Selenarctos thibetanus* possess medullary index < 0.50 whereas *Melursus ursinus* and *Helarctos malayanus* possess medullary index > 0.50. An identification key is provided on the basis of combination of characters such as scale pattern, scale position, scale type, scale margin, scale margin distance, medullary configuration, medullary index, profile and cross section.

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Table 1 : Comparative account of the characteristics of the guard hairs of four Indian species of the family Ursidae (Mean & SD given in parenthesis).

SS : Side to side cuticular scale length; PD : Proximo distal scale length; A : Apical; B : Basal; M : Middle; S : Shield.

Name of species	Profile	Colour	No. of band	Length (mm)	Diameter (μ)	Scale count/ mm hair length	SS (μ)	PD (μ)
Ursus arctos Linnaeus	Shielded, spatulate, straight A : curly	Seal to clove brown	One or rarely absent	65–71 (68.8 ± 2.08)	A. 50–100 (73.75 ± 9.15) S. 100–150 (121.25 ± 16.02) B. 90–120 (101.25 ± 9.27)	290–360 (310 ± 9.25)	20–40 (34 ± 4.95)	10–30 (18 ± 5.44)
Selenarctos thibetanus (G. Cuvier)	Shielded, more or less straight A : Tapering	Black	Absent	25–40 (34.42 ± 4.39)	50–100 (73.75 ± 20.65) S. 100–200 (136.66 ± 34.96) B. 70–150 (106.25 ± 26.42)	450–600 (510 ± 20.05)	30–50 (40 ± 6.32)	2–10 (7 ± 1.58)
Helarctos malayanus (Raffles)	Unshield, Almost curly	Black	Absent	12–18 (15.5 ± 1.73)	A. 50–90 (62.5 ± 10.39) M. 90–100 (98.75 ± 3.3) B. 70–150 (70.25 ± 6.4)	95–120 (100 ± 0.25)	30–70 (47 ± 13.46)	10–20 (17 ± 2.58)
Melursus ursinus (Shaw)	Shielded, more or less straight	Black	Absent	59–73 (69.44 ± 3.02)	A. 100–170 (127.14 ± 26.57) S. 150–200 (170 ± 19.00) B. 100–160 (123.75 ± 19.07)	280–410 (380 ± 20.25)	30–60 (45 ± 10.25)	3–10 (7 ± 2.58)

Table 2 : Comparative account of the characteristics of the guard hair of four Indian species of the family Ursidae (Mean and SD given in parenthesis). B : Basal; S : Shield.

Name of species	Scale margin	Scale margin distance	Scale type	Scale pattern	Scale position	Medullary configu-ration	Medullary index	Cross section
Ursus arctos Linnaeus	Smooth	Intermediate	Imbricate smooth	Irregular wave S. Irregular mosaic	Transversal	Unbroken cellular	0.32–0.34 (0.33 ± 0.012)	Oval
Selenarctos thibetanus (G. Cuvier)	Crenate	Close	Imbricate crenate	Irregular wave S. Irregular mosaic	Transversal	Unbroken vacuolated	0.29–0.32 (0.31 ± 0.01)	Circular
Helarctos malayanus (Raffles)	Crenate	Intermediate	Imbricate crenate	Regular wave B. mosaic Irregular	Transversal	Simple unbroken amorphous	0.86–0.89 (0.87 ± 0.001)	Circular
Melursus ursinus (Shaw)	Smooth	Intermediate	Imbricate smooth	Regular wave S. Regular mosaic	Transversal	Simple unbroken amorphous	0.91–0.92 (0.91 ± 0.008)	Oblong