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## Identification of hairs of *Ratufa bicolor* (Sparrman, 1778), *Ratufa indica* (Erxleben, 1777) and *Ratufa macroura* Pennant, 1769

**Manokaran Kamalakannan****Abstract**

Characteristics of hair of three giant squirrel species namely, *Ratufa bicolor*, *R. indica* and *R. macroura* was evaluated using the optical light microscope for its species identification. This study was conducted at the Mammal & Osteology section of Zoological Survey of India, Kolkata during January – July, 2016. Although the microscopic hair of three species studied showed almost similar characteristics, the cuticular scales and shape of cross-section of hair of *R. bicolor* was varied among the species. The other two remaining species can be differentiated by combination of other hair characteristics. The high-resolution photo-micrographs and key characteristics of hair were presented in the present study can be used as an appropriate reference for species identification.

**Keywords:** *Ratufa bicolor*, *Ratufa indica*, *Ratufa macroura*, hair characteristics

**1. Introduction**

There are three species of giant squirrels found in India namely black giant squirrel *Ratufa bicolor* (Sparrman, 1778), Indian giant squirrel *Ratufa indica* (Erxleben, 1777) and grizzled giant squirrel *Ratufa macroura* Pennant, 1769 [1]. These giant squirrels differentiated from other squirrels by its size and richest colour pelage [5]. The pelage colour varies among the three species, the *R. bicolor* is having a deep brown or blackish coat on upperparts with buff-coloured underparts; *R. indica* is having the mixture of maroon and blackish coat with cream on dorsal side and the underparts and the front legs are usually cream coloured; the *R. macroura* having a grey, grizzled with white colour on dorsal surface and tail and the underparts, cheeks, patch of neck, arms and legs are buffy white in colour [1, 5].

In India, the significant studies on the hair of Indian mammals were made by Chakraborty and De (Carnivores) [3]; Sarkar (Rodents and Primates) [7]. Kamalakannan (Artiodactyls and Lagomorphs) [4]. However, hair character studies on genus are *Ratufa* is little known. In the present study, the hair three species namely, *R. bicolor*, *R. indica* and *R. macroura* was analysed to know their microscopic hair structure for species identification.

**2. Materials and Methods**

The dorsal guard hairs of *R. bicolor*, *R. indica* and *R. macroura* were collected from the dry flat skins housed in the National Zoological Collections, Mammal and Osteology Section, Zoological Survey of India, Kolkata, India. The laboratory study was conducted at the Mammal & Osteology section of Zoological Survey of India, Kolkata during January – July, 2016. The samples were washed thoroughly with acetone ((CH<sub>3</sub>)<sub>2</sub>CO = 58.08) and carbon tetrachloride (CCl<sub>4</sub> = 153.82) to remove the dirt of exogenous materials. The cuticular characters of hair such as scale position, scale patterns, structure of scale margins and distance between scale margins and medullary characters such as width composition, structure and form of margins of the medulla, and shape of cross-section of hair were examined under 400 X magnification with help of the digital camera fitted on optical microscope (Olympus BX41) and the observed microscopic characters of hair were photographed.

The methodology and nomenclature of cuticular, medullary and cross-sectional characteristics of dorsal guard hairs were followed according to the descriptions provided by Brunner and Comman [2], Moore *et al.* [6] and Teerink [8].

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### 3. Results and Discussion

The cuticular characteristics of hair were similar between the *R. indica* and *R. macroura* such as the scale position was ‘transversal’, scale patterns is ‘irregular wave’, the structure of scale margins was ‘rippled’ and the distance between scale margins- ‘near’, but the cuticular characteristics of hair varied in *R. bicolor* and observed as ‘transversal’, scale patterns was ‘regular wave’, the structure of scale margins was ‘smooth’

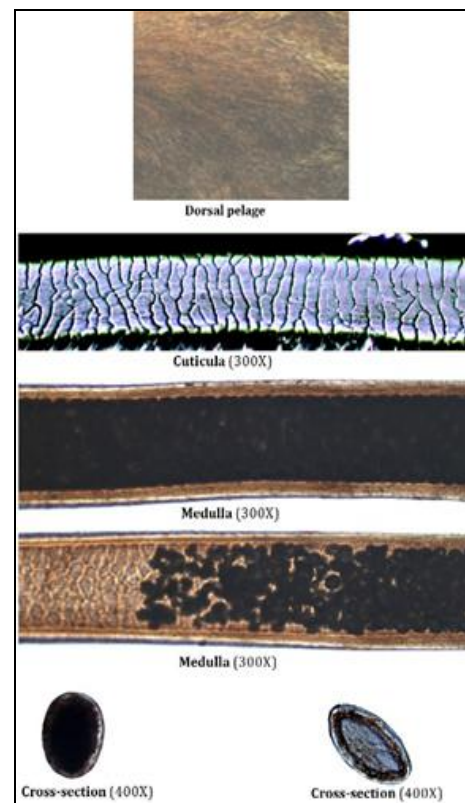
and the distance between scale margins- ‘near’. However, the medullary characteristics hair of three species studied shown similar characteristics between the species as: composition of medulla- ‘multicellular in rows’, the structure of medulla- ‘multiserial ladder’, and form of the medulla margins- ‘scalloped’. Similarly, the cross-section of hair was varied among the three species as ‘oval’ shape in *R. indica* and *R. macroura*, and ‘oblong’ shape *R. bicolor*.

**Table 1:** Microscopic hair characteristics of three species of *R. bicolor*, *R. indica* and *R. macroura*

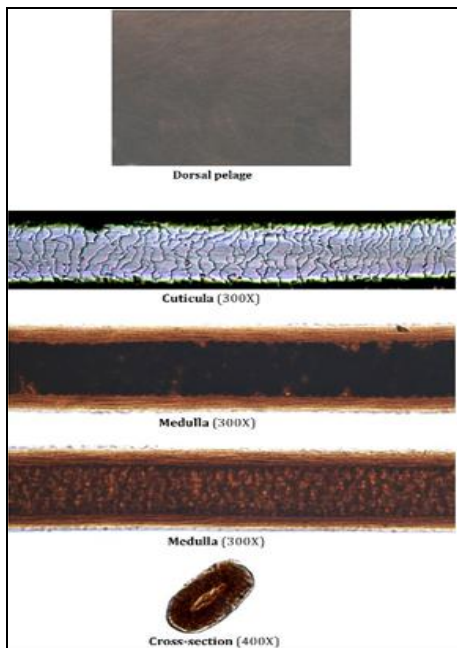
Microscopic hair characteristics	<i>R. bicolor</i>	<i>R. indica</i>	<i>R. macroura</i>
Cuticular scale position	Transversal	Transversal	Transversal
Cuticular scale patterns	Regular wave	Irregular wave	Irregular wave
Cuticular Structure of scale margins	Smooth	Rippled	Rippled
Distance between cuticular scale margins	Near	Near	Near
Composition of medulla	Multicellular in rows	Multicellular in rows	Multicellular in rows
Structure of medulla	Multiserial ladder	Multiserial ladder	Multiserial ladder
Margins of medulla	Scalloped	Scalloped	Scalloped
Shape of cross-section	Oblong	Oval	Oval



**Fig 1:** Photo-micrograph of hairs of black giant squirrel *R. bicolor*



**Fig 3:** Photo-micrograph of hairs of grizzled giant squirrel *R. macroura*



**Fig 2:** Photo-micrograph of hairs of Indian giant squirrel *R. indica*

So far, there is no specific hair studies have been conducted on these species except a study by Sarkar [7], in which all three species of Indian giant squirrels were studied and similar observation has been made. Although the microscopic hair of three species studied showed almost similar characteristics, the cuticular scales and shape of cross-section of hair of *R. bicolor* was varied among the species. The other two remaining species can be differentiated by combination of other hair characteristics [3]. Based on comparative trichotaxonomic studies by Chakraborty & De [3], Sarkar [7] and Kamalakannan [4], these giant squirrels can easily be diagnosed from another group of mammals using these microscopic hair characteristics. This study provides a complete combination of characters of hair of three Indian giant squirrels under genus *Ratufa*.

#### 4. Conclusion

The three giant squirrels are protected under the Schedule I (*R. macroura*) to Schedule II (*R. bicolor* and *R. indica*) of the Indian Wildlife (Protection) Act, 1972. These squirrels are poached mainly for their fur and bushmeat. On the other hand, they are chief prey of small and large carnivores in the wild. Therefore, the photo-micrographs presented here can be used in forensic science as well as prey-predator food analysis as an appropriate reference for the species identification.

#### 5. Acknowledgements

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