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## Comparative hair morphology of the giant flying squirrels *Petaurista petaurista*, *Petaurista magnificus* and *Petaurista philippensis* (Sciuridae: Rodentia: Mammalia)

**Manokaran Kamalakannan****Abstract**

The microscopic hair characteristics of three giant flying squirrel species namely, *P. petaurista*, *P. magnificus* and *P. philippensis* were examined using the optical light microscope at the Zoological Survey of India, Kolkata during January–July 2016. The microscopic characteristics (cuticula and medulla) of hair of three species studied showed similar characteristics, however, the three species can be differentiated by their cross-section of hair viz., ‘oval’, ‘biconvex’ and ‘oblong’ in *P. petaurista*, *P. magnificus* and *P. philippensis*, respectively. The high-resolution photo-micrographs and key characteristics of hair were presented here can be used as an appropriate reference for species identification.

**Keywords:** *Petaurista*, hair characteristics, dorsal guard hair, multicellular in rows, multiserial ladder

**1. Introduction**

Mammals belonging to the family Sciuridae of order Rodentia are poached mainly for the local bushmeat consumption and for their skins <sup>[1]</sup>. In general, identification of mammal is difficult through morphological characters, if only small part of the skin or its derivatives is available, but when a few hairs of skin or derivatives of mammal are available, the species can be identified through hair study *i.e.*, tricho-taxonomic study <sup>[4, 5, 11]</sup>.

In India, the significant studies on the hair of Indian mammals were made by Chakraborty and De (Carnivores) <sup>[5]</sup>; Sarkar (Rodents and Primates) <sup>[10]</sup>. Kamalakannan (Artiodactyls and Lagomorphs) <sup>[7]</sup>. However, hair characteristics studies on genus *Petaurista* is little known except the study of Bahuguna <sup>[2, 3]</sup>. In the present study, the three species namely, red giant flying squirrel *Petaurista petaurista* (Pallas, 1766), Hodgson’s giant flying squirrel *Petaurista magnificus* (Hodgson, 1836) and Indian giant flying squirrel *Petaurista philippensis* (Elliott, 1839) were examined to know their microscopic hair structure for species identification.

**2. Materials and Methods**

The dorsal guard hairs of *P. petaurista*, *P. magnificus* and *P. philippensis* were collected from the dry flat skins housed in the National Zoological Collections, Mammal and Osteology Section, Zoological Survey of India, Kolkata, India 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 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 <sup>[4]</sup>, Moore *et al.* <sup>[9]</sup> and Teerink <sup>[11]</sup>.

**3. Results and Discussion**

The microscopic characteristics (cuticula and medulla) were similar between the species except for the shape of cross-section (Table 1; Fig 1 - 3).

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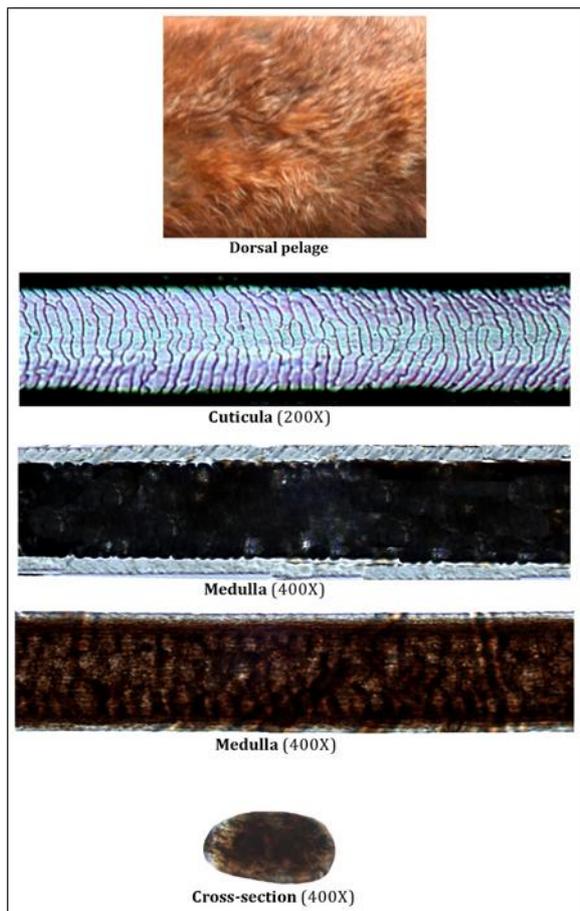
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The cuticular characteristics of hair were similar between the three species studied viz., the scale position was ‘transversal’, scale patterns is ‘regular wave’, the structure of scale margins was ‘smooth’ and the distance between scale margins- ‘close’. Similarly, the medullary characteristics hair of the also showed similar characteristics between the species as

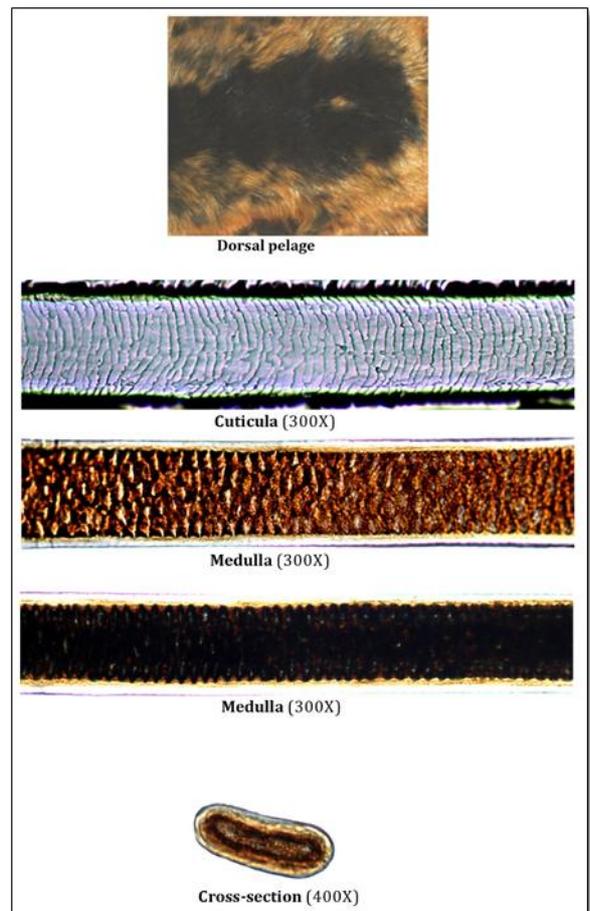
composition of medulla- ‘multicellular in rows’, the structure of medulla- ‘multiserial ladder’, and form of the medulla margins- ‘scalloped’. However, the cross-section of hair was varied among the three species as ‘oval’, ‘biconvex’ and ‘oblong’ shape in *P. petaurista*, *P. magnificus* and *P. philippensis*, respectively.

**Table 1:** Microscopic hair characteristics of three species of *P. petaurista*, *P. magnificus* and *P. philippensis*

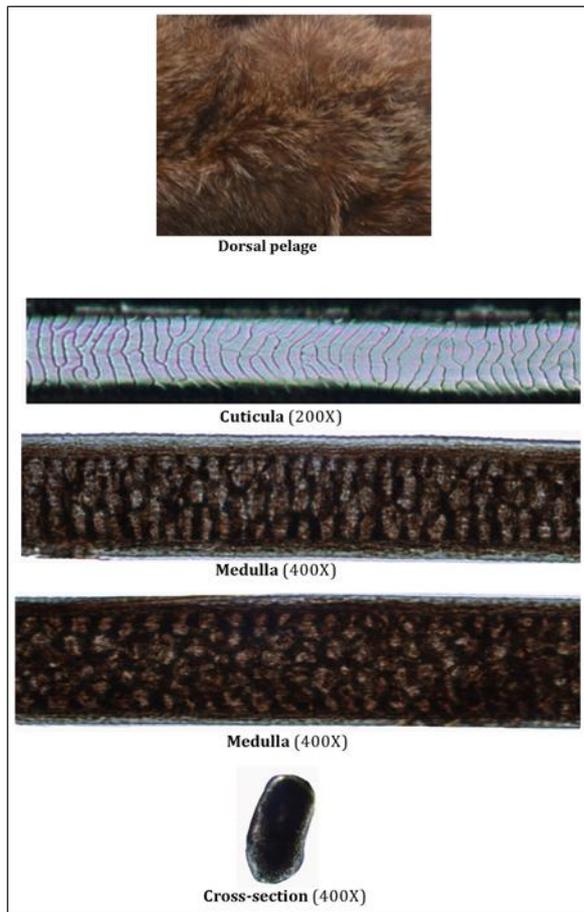
Microscopic hair characteristics	<i>P. petaurista</i>	<i>P. magnificus</i>	<i>P. philippensis</i>
Cuticular scale position	Transversal	Transversal	Transversal
Cuticular scale patterns	Regular wave	Regular wave	Regular wave
Cuticular Structure of scale margins	Smooth	Smooth	Smooth
Distance between cuticular scale margins	Close	Close	Close
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	Oval	Biconvex	Oblong



**Fig 1:** Photo-micrograph of hairs of red giant flying squirrel *Petaurista petaurista*



**Fig 2:** Photo-micrograph of hairs of Hodgson's giant flying squirrel *Petaurista magnificus*



**Fig 3:** Photo-micrograph of hairs of Indian giant flying squirrel *Petaurista philippensis*

The dorsal pelage of *P. petaurista* was characterised by a bright chestnut or dark red coloured with scattered creamy white guard hairs, *P. magnificus* by deep maroon having a bright yellow line with black and whitish grizzling hairs and *P. philippensis* by coffee-brown hairs [1, 8]. The microscopic characteristics of hair of three species studied showed almost similar characteristics, however, the three species can be differentiated by their cross-section of hair because the three species having three different shape characteristics such as 'oval', 'biconvex' and 'oblong'. Apart from this, the combination of microscopic hair characteristics can be used for identification of the species. So far, there is no specific hair studies have been conducted on these species except the study of Bahuguna [2, 3], in which the hair characteristics of *P. Petaurista*, *Funambulus pennantii* and genus *Callosciurus* were studied. Comparatively the genus *Petaurista* can be differentiated from the genus *Ratufa*, as the cuticular structure of hair of the genus *Ratufa* was observed 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' [6]. Based on comparative tricho-taxonomic studies by Chakraborty and De [5], Sarkar [10] and Kamalakannan [7], these giant flying 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 giant flying squirrels under the genus *Petaurista*.

#### 4. Conclusion

The three giant flying squirrels are protected under Schedule II of the Indian Wildlife (Protection) Act, 1972. These squirrels are poached mainly for bushmeat consumption and

for their skins. These squirrels are also be considered as 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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