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SHORT COMMUNICATION

The cuticular profile of the aristiform hair as a characteristic feature of *Abrawayaomys* (Rodentia: Cricetidae)

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ABSTRACT. The cuticle is the outermost of the three cellular layers of the mammalian hair. It comprises numerous keratinized scales, whose morphology, combined with other microscopic characteristics of the hair, confers characteristic signature traits to various different species. This study aimed to analyze whether the cuticular patterns of the aristiform hair had any signature implications for the two species of the genus *Abrawayaomys* Cunha & Cruz, 1979. We identified the cuticular profiles of *A. ruschi* and *A. chebezi*. Both species have similar hair pattern. The base of the hair shows "irregular waved" scales with smooth and continuous edges, and the apex showed "transversal waved" small-sized scales with continuous and ornamented edges. The middle portion of the hair exhibits different cuticular patterns on different sides of a single hair follicle: "transversal waved" on the dorsal side and "narrow losangled" on the ventral side. This distribution pattern of the cuticular scales is an unprecedented record for any mammal, and it is an important generic feature that allows the identification of single samples, such as those found in predators' gastrointestinal contents. The species in question are considered rare due to the restricted number of specimens deposited in scientific collections. Our findings may contribute to expanding the species' geographic range by making it possible to identify it in various situations. These results highlight the relevance of studies pertaining the identification of the micromorphology of the aristiform hair, which can be used as a tool to accurately identify rodents.

KEY WORDS. Micromorphology; Sigmodontinae; spines; taxonomy; tricology.

A hair is a filamentous epidermal outgrowth characteristic of mammals (Pough et al. 2008). The structure of the hair is polymorphous and many of its characteristics are taxonomically important, since they vary significantly among phylogenetically similar species (Chernova 2002). The basic hair structure comprises three concentric layers of keratinized cells with biochemically distinct compositions (Teerink 1991). The outermost layer, also called cuticle, is formed by numerous transparent scales resulting from the production and deposition of keratin on the epithelial cells (Meyer et al. 2002, Quadros & Monteiro-Filho 2006a). The cuticular scales and their diversity of forms have been the subject of many studies (Benedict 1957, Moore et al. 1983, Brunner & Comman 1974, Quadros & Monteiro-Filho 2006a). Each species or group of species has its own cuticular profile, which, combined with other microscopic features of the hair, enable the rapid identification of biological specimens. This technique has been extensively used in numerous taxonomy and ecology studies (Meng & Wyss 1997, Peurach 2003, Cavia et al. 2008, Sato et al. 2010, Sarkar et al. 2010, Yates et al. 2010, Martin et al. 2009, Silveira et al. 2013, Vanstreels et al. 2010).

The guard-hair is widely used in the area of trichology-related taxonomy. However, there is limited information on the micromorphology of other varieties of hair such as the aristiform hair found in Echimyidae and Cricetidae rodents. Hoey et al. (2004) studied aristiform hairs from *Niviventer fulvescens* (Gray, 1847), *Maxomys surifer* (Miller, 1900), *Hoplomys gymnurus* (Thomas, 1897) and 17 species of *Proechimys* Allen, 1899, and Pardiñas et al. (2009) used aristiform hairs in the identification of *Abrawayaomys chebezi*. Focusing on the paucity of knowledge about the characteristic features of hair, we conducted this study in order to determine whether cuticular patterns of aristiform hairs of two species of *Abrawayaomys* Cunha & Cruz, 1979 are diagnostic features.

We analyzed 75 aristiform hairs from *A. ruschii* collected from fifteen specimens that were deposited into the mammal collections of the Museu de Zoologia João Moojen at the Universidade Federal de Viçosa (MZUFV – 3562, 3565, 3569), Universidade Federal de Ouro Preto (UFOP – 057R, 058R, 059R, 206R, 326R), Pontifícia Universidade Católica de Minas Gerais (MZPUC/MG – 1874, 1971, 2163, 2157, 2282) and Museu Nacio-

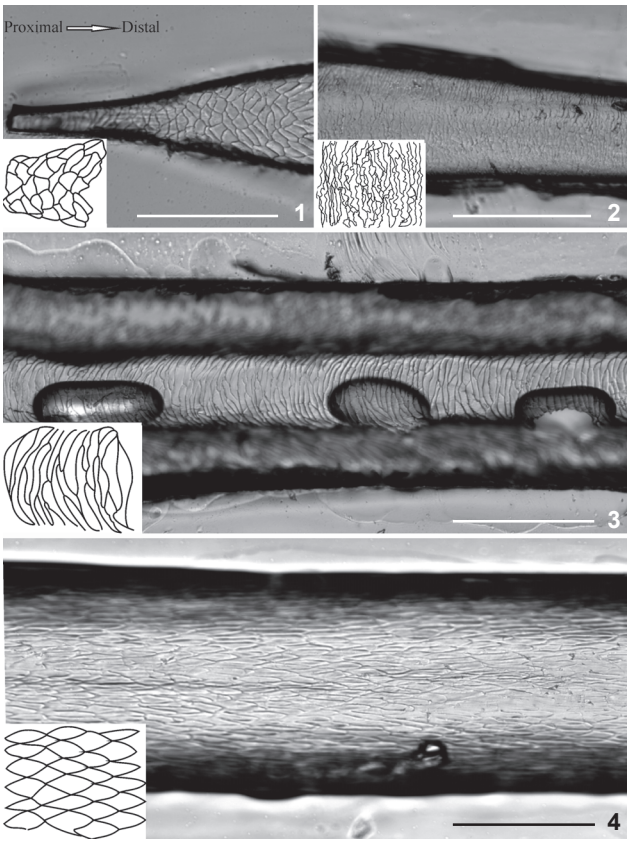
nal at Universidade Federal do Rio de Janeiro, including from the holotype (MN – 23075, 675572). We also observed five hairs from one specimen of *A. chebezi* located at the Museo Argentino de Ciencias Naturales Bernardino Rivadavia (MACN – 20253), Buenos Aires, Argentina. The microscope slides were prepared using the method proposed by Quadros & Monteiro-Filho (2006b). Accordingly, the hair samples were pressed onto a thin layer of commercial enamel (used for nails) resulting in an imprint of the cuticular scales. The corresponding micromorphologies were carefully studied based on the enamel-generated imprints. Because they are flat, the aristiform hairs were schematically divided into ventral and dorsal sides, and into proximal (near to the hair bulb), middle, and distal (apex) regions. We adopted the nomenclature system proposed by Quadros & Monteiro-Filho (2006a). The observations and photographs were taken using the Olympus optical (light) microscope AX70 TRF equipped with the U-PHOTO system, and linked to a digital camera (Spot Insightcolour 3.2.0, Diagnostic Instruments Inc.), and a microcomputer with an image capturing software (Zeiss AxioVision).

The not imbricated pattern of the cuticle was observed in all samples. The "irregular waved" scales were observed near the base of the fibers, and they possessed smooth and continuous edges (Fig. 1). The distal portion of the hairs showed "transversal waved" scales with continuous and ornamented edges (Fig. 2). Both these patterns were similar on the ventral and dorsal sides. In the middle portion, we could observe two sides of the same hair showing distinct morphological patterns of cuticular scales. The dorsal surface displayed the "transversal waved" wide scales with continuous and unornamented edges (Fig. 3), whereas the ventral surface exhibited "narrow losangic" patterns (Fig. 4). We refer to this arrangement as "overlapped cuticular" because, two type of scales were visualized simultaneously under the microscopic slides with the hair still attached to the enamel.

This "overlapped cuticular" arrangement on the scales of the middle region is an unprecedented observation for any mammal. While characterizing *A. chebezi* Pardiñas et al. (2009) also identified the same patterns, "transversal waved" and "narrow losangic" However, in their results, these patterns occurred in tandem and corresponded only to the characteristic features we found on the dorsal side of the hair. This divergence was probably due to the differences between the methods of preparation and analysis of the hair samples. In the aforementioned study is not clear whether the ventral and dorsal sides of the hairs were individually observed, which we consider fundamental to the analysis of this kind of hair because it is dorsoventraly flat.

There are only few records of *Abrawayaomys*, which are found in the Atlantic Forest of Brazil in a continuous from the state of Espírito Santo through the states of Rio de Janeiro, Minas Gerais, São Paulo, Paraná, and Santa Catarina, in Brazil, to Argentina in the province of Misiones (Amori & Gippoliti 2003, Pardiñas et al. 2009, Passamani et al. 2011, Cerboncini et al. 2014, Maestri et al. 2015). Specimens were captured using live-traps, or and osteological remains were collected from the pellets of owls (Pardiñas et al. 2009). Hairs are also found in the gastrointestinal contents of predators quite frequently, and these hair samples were not in any way damaged in their microstructure (Quadros & Monteiro-Filho 1998). Thus, besides being a novelty, the overlapping cuticular pattern is a characteristic feature of the genus as it allows the species to be identified even when they are not captured alive. Analyzes of hair samples can consequently expand the knowledge on the distribution and ecology of species of sigmodontinae rodents since they are important food items for predators (Rocha et al. 2004, Sousa & Bager 2008, Rocha-Mendes et al. 2010).

Although the qualitative analysis of the aristiform have not allowed specific identification their characteristics were the same in all specimens and we consider them as diagnostic for the genus. Nevertheless, this absence of variation differs



Figures 1-4. Cuticular patterns of the aristiform hair of *Abrawayaomys*, represented by the cuticle imprinting of *A. chebezi* (MACN 20253): (1-2) proximal and distal patterns, respectively; (3-4) overlapping patterns on the dorsal and ventral sides, respectively. Scal bars: 100 µm.

from other morphological features of *Abrawayaomys*, for which Pardiñas et al. (2009) indicate a substantial variety of conditions among the specimens from different collection sites, even suggesting the possible existence of a third species. This contrast demonstrates that the analysis of different traits is necessary to elucidate the taxonomy of this group.

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