

## On the hair cuticle structure of the rodent *Laonastes aenigmamus* (Mammalia: Rodentia: Diatomyidae)

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### > Abstract

The hair cuticula structure of guard hairs of *Laonastes aenigmamus* is briefly described. On average the hairs are 17.13 mm long and 42.63  $\mu\text{m}$  wide below the shield. The cuticle scales show smooth free edges and are crenate only at the tip of the hairs. Some parameters including height, width and area of scale are measured.

### > Zusammenfassung

Die Haarkutikelstruktur von *Laonastes aenigmamus* ist kurz beschrieben. Im Durchschnitt sind die Primärhaare 17,13 mm lang und 42,63  $\mu\text{m}$  weit unter dem Shield. Die Kutikularschuppen zeigen glatte, freie Kanten und sind nur in der Haarspitze gezackt. Einige Parameter wie Höhe, Breite und Fläche der Schuppen wurden gemessen.

### > Key words

Hair cuticle structure, Laotian rock rat.

## Introduction

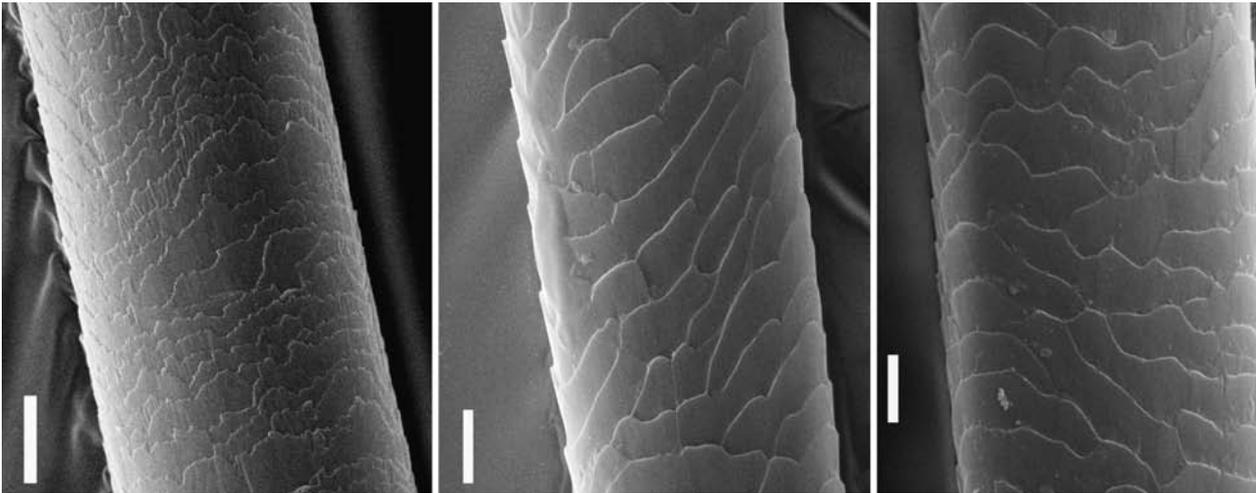
*Laonastes aenigmamus*, the Laotian rock rat has only recently been described as a new genus and species and originally assigned also to a new family, the Laonastidae (JENKINS *et al.*, 2005). DAWSON *et al.* (2006) assigned it to the otherwise extinct family Diatomyidae, known from Pakistan, India, Thailand, China and Japan in the early Oligocene to late Miocene. Molecular analyses of the Laotian rock rat indicated a sister group relationship to the gundis (family Ctenodactylidae) and indicated that it does not belong to the hystricoganthi (HUCHON *et al.* 2007). So far some aspects of the species morphology and anatomy have been described including peculiarities of skull and muscular system (JENKINS *et al.*, 2005, HAUTIER & SAKSIRI, 2009) and most recently the digestive system has been described (SCOPIN *et al.*, 2011). *Laonastes aenigmamus* has a somewhat rat-like appearance with a more acute snout though

and a furred squirrel like tail. The pelage is dark, slate grey and the tail is more blackish.

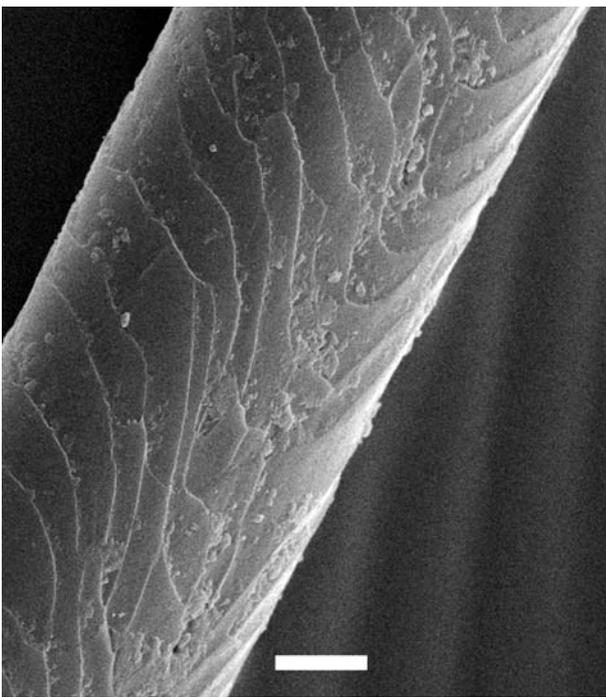
The hair cuticle structure has been studied for several taxonomic groups and in different regions and is used in comparative determination of wild animals e.g. in the analysis of scats to determine food items. Some comparative studies particularly of the hair cuticle structure of European mammals are given by DEBROT *et al.* (1982), TEERINK (1991) and MEYER *et al.* (2002). The hair cuticle structure of primates is hardly studied besides of *Homo sapiens*.

In this paper the hairs and the hair cuticle structure of *Laonastes aenigmamus* is briefly described.

The fur of mammals basically consists of two types of hair: primary or guard hairs also called overhair and secondary hairs, which are usually curled and form the insulating wool hair coat and are therefore also called underhair. To study the cuticle struc-



**Fig. 1.** Hair cuticle structure of guard hairs of *Laonastes aenigmamus*; a) at the tip, b) medium part below the shield and c) basal part by scanning electron microscopy. Scale bar = 10  $\mu\text{m}$ .



**Fig. 2.** Arrangement pattern of hair cuticle scales in the medium part of a guard hair of *Laonastes aenigmamus* showing a single chevron pattern. Scale bar = 10  $\mu\text{m}$ .

ture guard hairs are used. The shaft (part of the hair that extends beyond the skin surface) is divided into three regions: the apical part or tip that often shows a spindle-shaped or flattened thickening, the shield; below that the medial part and the basal part that thins towards the base of the hair. The cuticle structure varies in the parts and the medial part shows the most constant cuticle pattern (MEYER *et al.*, 2002; TEERINK, 1991).

The study is based on the hairs of 3 specimens of *Laonastes aenigmamus* from Laos. All specimens are in the Senckenberg Naturhistorische Sammlungen Dresden, Museum für Tierkunde (MTD). Primary hairs from the back were cut from the skins at their very base, cleaned in warm tepid water and first fixed on cardboard. Here the length of the hairs was measured. Then short pieces from the apical part, the basal part and medium part were taken and mounted on aluminum stubs, coated with platinum for 120 seconds for the study in the scanning electron microscope (SEM). Pictures of the hairs were taken in the SEM. Measurements of the cuticle structures were done on the photos using the program “Image J” on a personal computer. The parameters: hair diameter, height of cuticles ( $x$ ), width of cuticles ( $y$ ), cuticle area,  $y/x$ -feret and number of cuticles per  $\text{mm}^2$  were determined in the medium part only.

The guard hairs of the back show a clear shield in the upper half or third of the hair. The hairs were on average 17.13 mm in length and had a diameter of 42.63  $\mu\text{m}$  in the middle part below the shield (Table 1). The cuticle scales usually have smooth free edges and show an intermediate distance from each other. Only at the tip the edges of the scales are crenate and with less distance to each other (Fig. 1). This pattern might also occur in the upper part of the medium part of the hair. Scales in all regions of the hair are basically rectangular to the long axis of the hair, but there are deviations. In some areas they show a single chevron arrangement (Fig. 2).

The other representatives of the family Diatomyidae are only known from fossils, so comparisons of the hair structure with really close relatives are not possible. The closest living groups related to *Laonastes* are hystricomorphs and sicurids (HUCHON *et al.*,

**Table 1.** Descriptive statistic of the hair and hair cuticle structure of the hairs of *Laonastes aenigmamus*.

	N	Range	Minimum	Maximum	Mean	Standard deviation	Variance
length of hair (mm)	17		17.13	27.29	21.53		
hair diameter ( $\mu\text{m}$ )	55	9.19	37.82	47.01	42.63	2.55	6.48
height of scale ( $\mu\text{m}$ )	165	15.87	1.377	16.86	6.59	1.9576	3.8321
height of scale ( $\mu\text{m}$ ), x	59	8.14	3.648	11.784	6.92	1.4954	2.2361
width of scale ( $\mu\text{m}$ ), y	59	24.834	6.672	31.506	18.84	6.2206	38.6954
y/x-Feret ( $\mu\text{m}$ )	59	4.08	1.2473	5.3276	2.80	1	1
scale area ( $\mu\text{m}^2$ )	56	162.71	26.827	189.537	98.60	42.2458	1784.7098
Scales /mm <sup>2</sup>	11	8706.653	7984.446	16691.099	10776.06	2431.9224	5914246.476

2007) and therefore brief comparisons to the hair of the hystricomorphs *Dasyprocta punctata* (Dasyproctidae) and *Myocastor* (Myocastoridae) and the sciurids *Sciurus vulgaris* and *Tamias sibiricus* are made. Also few remarks in comparison to the more distantly related muroid *Rattus norvegicus* are given. Hairs of *Dasyprocta* are in the same width range of about 40  $\mu\text{m}$  and show scales with a regular rim. Scales are at right angle to the long axis of the hair but in some regions inclined like in *Laonastes* (fig. 1b) (CERNOVA & TSELKOVA, 2004). Hairs of *Myocastor coypus* have narrow and regular scales rectangular to the long axis of the hair in the area below the shield. Like in *Dayprocta* and *Laonastes* in the tip of the hair the scales are narrower and crenate. The scales of *Sciurus vulgaris* are intermediate in height and with a smooth rim in the area below the shield. Here they appear very regular and ordered (TEERINK, 1991, CERNOVA & TSELKOVA, 2004). At the tip and in the upper part of the shield the scales are crenate and irregular. Scales of *Tamias sibiricus* show greater heights and are more crenate in the area below the shield and are very crenate and irregular at the tip (TEERINK, 1991; CERNOVA & TSELKOVA, 2004). The cuticle structure of *Rattus norvegicus* differs particularly in the basal and middle part of the hair where it shows a broad petal pattern of scales. Here the free scale edges are also smooth. In the apical part they are slightly crenate and with less distance but not as close as in *Laonastes*. Few comparative average values for the medium part of the hairs of *R. norvegicus* are given by MEYER *et al.*, (2002): scale area 265  $\mu\text{m}^2$  and y-/x-Feret 46  $\mu\text{m}$ , which is more than in *Laonastes*. So far only few hairs and scales of the Laotian rock rat have been studied, so the overall variation might not have been depicted yet.

It is not within the scope of this brief study to draw any evolutionary conclusions based on the hair structure, particularly as only few individuals have been studied and because the variability of scale shape and size along the hairs. So this only gives a

brief description of the hair cuticle structure of the Laotian rock rat for further studies.

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