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A new subspecies of *Proechimys iheringi* Thomas (Rodentia: Echimyidae) from the state of Rio de Janeiro, Brazil

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Abstract

Described a new subspecies of *Proechimys iheringi* based on specimens collected in the coastal sand plains of the state of Rio de Janeiro, southeastern Brazil. This new subspecies can be distinguished by a combination of traits that include an absence of cinnamon ground color in the subapical zone of setiform hairs, tail longer than head and body with a whitish brush in the tip, bullae large and well inflated, and by the structure of the septum of the incisive foramen, where the vomer is visible ventrally between the premaxillae and maxillae.

Introduction

Proechimys iheringi was originally described by THOMAS (1911) on the basis of specimens from the Island of São Sebastião, off the coast of the State of São Paulo in southeastern Brazil. Later in 1948, MOOJEN reviewed the systematics of the Brazilian forms of the genus *Proechimys* and, in particular, greatly expanded the known distribution of *P. iheringi*. The population samples of *P. iheringi* that he examined ranged in distribution from the State of Bahia to the State of São Paulo; an area spanning approximately 2000 km. MOOJEN (1948) analysed variation in craniodental and pelage characters in this sample and described six subspecies in *P. iheringi*, viz. (Fig. 1): *P. i. denigratus* from Itabuna, State of Bahia; *P. i. panema* from Campinho, *P. i. paratus* from Capela de São Braz, and *P. i. graciosus* from Floresta da Caixa D'água, all in the State of Espírito Santo; *P. i. bonafidei* from Teresópolis, State of Rio de Janeiro; and *P. i. iheringi* from Island of São Sebastião, State of São Paulo.

Since the publication of MOOJEN's (1948) monograph the taxonomy of *P. iheringi* has not been reviewed. We have recently started, detailed studies of the taxonomy, systematics, and evolution of the taxa allocated to *P. iheringi* (PESSÔA 1989, 1992; PESSÔA and REIS 1991; REIS et al. 1992), and during the course of our work, have examined specimens collected in the coastal plains of the State of Rio de Janeiro that can be assigned to *P. iheringi* on the basis of dental, cranial, and pelage traits. These specimens, however, cannot be allocated to any of the previously recognized subspecies of *P. iheringi*, and are thought to represent a new subspecies described herein.

Material and methods

The identification of subspecies of *P. iheringi* was confirmed by comparison with types deposited in the Museu Nacional (Rio de Janeiro) and with the aid of diagnoses provided by MOOJEN (1948). Descriptions of hair characteristics are based on MOOJEN (1948), and hair measurements were taken (in mm) with an eyepiece micrometer. Capitalized color definitions follow RIDGWAY (1912). Seventeen cranial measurements (Tab. 1) were obtained with digital calipers accurate to 0.01 mm.

The specimens examined in this study are housed in the Museu Nacional (MN) and Museu de

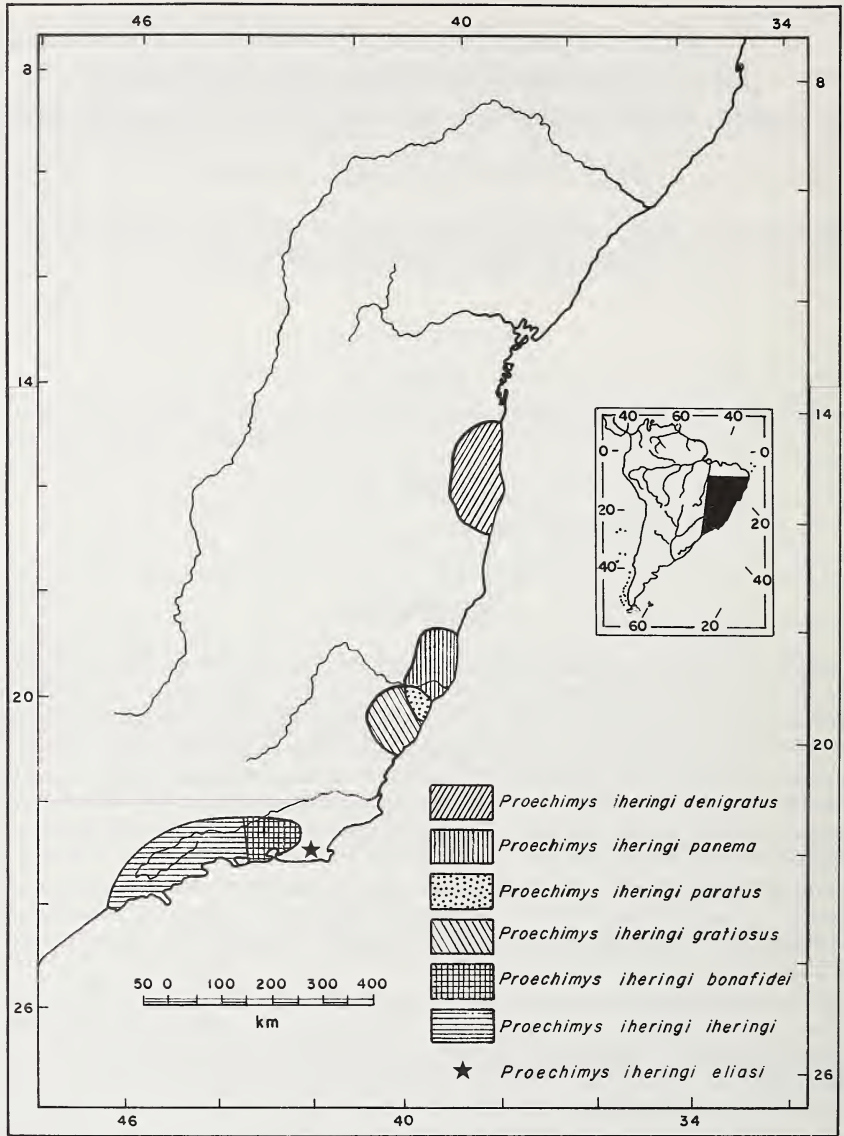


Fig. 1. Ranges for the subspecies of *Proechimys iheringi* according to MOOJEN (1948). The star denotes the type locality of *Proechimys iheringi eliasi*

Zoologia da Universidade de São Paulo (MZUSP). The following population samples were examined (Fig. 1): *P. i. denigratus* (Itabuna, State of Bahia [n = 8], MN 10474, 10476, 10477, 10515, 10517, 10519, 10521, 10528), *P. i. panema* (Campinho, State of Espírito Santo [n = 5], MN 8284–8288); *P. i. paratus* (Capela de São Braz, State of Espírito Santo [n = 4], MN 4012, 4023, 5455, 5458); *P. i. gratosus* (Santa Teresa, State of Espírito Santo [n = 12], MN 4010, 4018, 4024, 4055, 5430, 5468, 5656, 5674, 5757, 5759, 5767, 5772); *P. i. bonafidei* (Teresópolis, State of Rio de Janeiro [n = 10], MN 6179, 6181–6183, 6187, 6780, 6782, 6784, 6786, 6787); *P. i. iheringi* (Island of São Sebastião, State of São Paulo [n = 6], MZUSP 218, 221, 222, 2095, 2145, 2146).

Results

Proechimys iberingi eliasi, new subspecies

Holotype: An adult male (MN 30524), dry skin, skull, and postcranial skeleton. Collected by L. M. PESSÔA, J. A. DE OLIVEIRA and S. F. DOS REIS on 28 July 1991 at Restinga da Barra de Maricá, Maricá, Rio de Janeiro, Brazil.

Type locality: Restinga da Barra de Maricá (22° 31' S, 47° 17' W), Município de Maricá, Rio de Janeiro, Brazil.

Other specimens: Eight specimens, all from Maricá (MN 26811, 26826, 26827, 26859, 28806, 28815, 28932, 30523).

Distribution: Known only from the type locality.

Diagnosis: The following combination of characteristics sets *Proechimys iberingi eliasi* apart from any other subspecies of *P. iberingi*: aristiforms wide and stiff, general color of upper parts blackish due to the lack of cinnamon ground color from subapical zone of setiforms; tail with whitish brush; bullae large and well inflated, nasals long; septum of incisive foramen complete and formed almost exclusively by premaxillae; maxillary portion of the septum short, vomer visible ventrally between premaxillary and maxillary portions of the septum.

Description

Pelage: General color on upper parts blackish and underparts white (Fig. 2). Aristiforms on middorsal region: gray basally, gradually blackening toward tip; total length (mean = 21.2 mm); maximum width (mean = 1.1). Aristiforms on outer thighs: gray basally, blackening distally with Ochraceous-Tawny tip; total length (mean = 17.6); maximum



Fig. 2. Type specimen of *Proechimys iberingi eliasi* (MN 30524), photographed alive

width (mean = 0.7). Setiforms on middorsal region: gray basally, gradually blackening toward tip; total length (mean = 15.7); maximum width (mean = 0.1). Setiforms on outer thighs gray basally, gradually blackening toward tip, but interrupted by a Cinnamon-Buff subapical zone; total length (mean = 14.0); maximum width (mean = 0.1).

Skull: Slender, nasals long, bullae large and well-inflated; jugals dorsoventrally wide with transverse ridge conspicuous; post-orbital process of zygoma conspicuous, formed almost exclusively by jugal; mesopterygoid fossa extending forward as far as the posterior plane of second molars; posterior palatine foramina at anterior plane of first molars (Fig. 3); incisive foramen elongate and narrow; vomerine septum complete and formed almost exclusively by premaxillae; maxillary part of vomerine sheath short; vomer visible ventrally, included between the premaxillary and maxillary portions of the vomerine septum (Fig. 4).



Fig. 3. Lateral, dorsal, and ventral views of the skull of the holotype of *Proechimys iberingi eliasi* (MN 30524)



Fig. 4 (left). Ventral view of the incisive foramen of the holotype of *Proechimys iberingi eliasi* (MN 30524). Premaxillae (pm), maxillae (m), and vomer (v) are indicated. – Fig. 5 (right). Upper left molariform teeth of the holotype of *Proechimys iberingi eliasi* (MN 30524)

Teeth: Upper premolar with one or two counterfolds, upper molars with two counterfolds; lower premolar with two counterfolds and lower molars with one counterfold (Fig. 5).

Baculum: Elongate and narrow with a straight shaft. Shaft with a slight dorsoventral curvature and a tapered lateral indentation in the proximal third. Proximal end paddle-shaped. Distal end has no apical wings or median depression (Fig. 6).

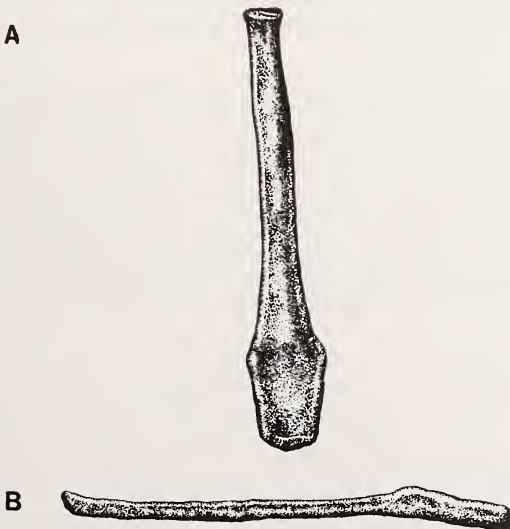


Fig. 6. Ventral (A) and lateral (B) views of the baculum of the type of *Proechimys iberingi eliasi* (MN 30524). The distal part is to the top (ventral view) and to the left (lateral view)

Table 1. Sample sizes (N), means (\bar{X}), standard deviations (\pm SD), and minimal (Min.) and maximal (Max.) values for seventeen cranial measurements (in mm) in seven subspecies of *Proechimys iberti*

Characters	<i>P. i. denigratus</i>				<i>P. i. panama</i>				<i>P. i. paratus</i>				<i>P. i. gratusus</i>			
	N	\bar{X}	\pm SD	Min. Max.	N	\bar{X}	\pm SD	Min. Max.	N	\bar{X}	\pm SD	Min. Max.	N	\bar{X}	\pm SD	Min. Max.
Skull length	8	48.8	\pm 2.05	46.2 52.2	5	51.1	\pm 1.00	49.8 52.3	4	52.5	\pm 2.18	50.3 55.5	12	50.4	\pm 1.75	47.1 52.4
Basilar length	8	33.7	\pm 1.42	32.0 36.5	5	35.4	\pm 1.32	33.7 37.0	4	36.7	\pm 1.81	34.8 38.8	12	35.3	\pm 1.04	33.8 37.0
Palatal length	8	16.0	\pm 1.05	14.4 17.2	5	16.7	\pm 0.59	16.0 17.5	4	17.7	\pm 1.15	16.5 19.2	12	16.4	\pm 0.67	15.2 17.9
Toothrow length	8	7.9	\pm 0.25	7.5 8.2	5	8.0	\pm 0.27	7.6 8.3	4	8.5	\pm 0.09	8.4 8.6	12	8.3	\pm 0.58	7.6 9.8
Diastrama	8	9.9	\pm 0.70	8.9 11.1	5	10.7	\pm 0.41	10.1 11.3	4	10.8	\pm 0.50	10.5 11.5	12	10.5	\pm 0.53	9.9 11.8
Rostral length	8	20.6	\pm 1.16	18.5 22.5	5	21.6	\pm 0.66	20.9 22.7	4	22.8	\pm 0.83	21.7 23.7	12	21.6	\pm 1.28	20.0 23.3
Nasal length	8	16.7	\pm 0.86	15.1 17.9	5	17.9	\pm 0.94	17.0 19.3	4	19.1	\pm 0.62	18.4 19.9	12	17.7	\pm 0.82	16.4 18.9
Interorbital constriction	8	10.7	\pm 0.58	9.7 11.4	5	12.4	\pm 0.82	11.3 13.4	4	11.7	\pm 0.93	10.4 12.4	12	11.6	\pm 0.40	10.8 12.4
Rostral breadth	8	7.6	\pm 0.31	7.1 8.2	5	6.9	\pm 0.59	6.1 7.8	4	6.6	\pm 0.49	6.0 7.2	12	7.8	\pm 0.46	7.1 8.6
Skull depth	8	12.8	\pm 0.47	11.9 13.4	5	13.5	\pm 0.19	13.2 13.7	4	13.2	\pm 0.65	12.7 14.1	12	13.3	\pm 0.53	12.4 14.3
Rostral depth	8	9.3	\pm 0.44	8.7 9.9	5	10.0	\pm 0.59	9.7 11.1	4	10.6	\pm 0.40	10.3 11.1	12	10.3	\pm 0.37	9.6 11.2
Maxillary breadth	8	8.5	\pm 0.53	7.6 9.2	5	8.6	\pm 0.66	7.8 9.3	4	8.3	\pm 0.53	7.7 9.0	12	8.5	\pm 0.53	7.7 9.4
Zygomatic breadth	8	24.9	\pm 1.01	23.5 26.8	5	26.3	\pm 1.37	24.7 28.0	4	25.5	\pm 0.54	25.2 26.3	12	25.5	\pm 0.75	24.3 26.7
Bulla length	8	9.8	\pm 0.45	9.0 10.4	5	9.7	\pm 0.51	9.3 10.5	4	10.6	\pm 0.46	9.9 10.8	12	9.4	\pm 0.60	8.5 10.3
Post-palatal length	8	23.4	\pm 1.60	21.6 26.6	5	23.6	\pm 1.51	21.8 25.5	4	24.2	\pm 1.08	23.5 25.8	12	23.7	\pm 0.79	22.5 24.9
Incisive foramen length	8	5.0	\pm 0.43	4.2 5.7	5	4.7	\pm 0.43	4.3 5.2	4	4.4	\pm 0.16	4.3 4.6	12	5.0	\pm 0.22	4.7 5.3
Mandibular length	8	24.4	\pm 1.23	22.3 25.7	5	25.6	\pm 1.15	24.8 27.7	4	26.6	\pm 0.75	26.0 27.6	12	25.6	\pm 0.95	23.7 27.1

Characters	<i>P. i. bonifidei</i>				<i>P. i. iberti</i>				<i>P. i. eliasi</i>			
	N	\bar{X}	\pm SD	Min. Max.	N	\bar{X}	\pm SD	Min. Max.	N	\bar{X}	\pm SD	Min. Max.
Skull length	10	53.0	\pm 2.45	49.3 56.1	6	54.8	\pm 0.90	53.9 56.5	9	51.4	\pm 1.86	48.8 55.4
Basilar length	10	37.0	\pm 1.46	35.0 39.0	6	38.3	\pm 0.81	37.4 39.5	9	35.1	\pm 1.62	32.4 37.6
Palatal length	10	16.7	\pm 0.98	15.3 18.2	6	18.6	\pm 0.47	17.7 19.1	9	16.9	\pm 0.70	15.6 18.3
Toothrow length	10	8.8	\pm 0.44	8.1 9.6	6	8.4	\pm 0.19	8.2 8.6	9	8.4	\pm 0.36	8.0 9.1
Diastrama	10	10.9	\pm 0.57	10.0 11.8	6	12.2	\pm 0.43	11.5 12.6	9	10.5	\pm 0.48	9.7 11.5
Rostral length	10	23.3	\pm 1.24	21.4 25.0	6	23.5	\pm 0.90	22.9 25.3	9	22.1	\pm 1.04	20.8 24.2
Nasal length	10	19.1	\pm 1.14	17.2 21.0	6	20.2	\pm 0.29	19.7 20.6	9	18.6	\pm 0.99	16.5 19.8
Interorbital constriction	10	12.2	\pm 0.55	11.5 13.1	6	12.6	\pm 0.92	11.9 14.4	9	11.7	\pm 0.38	11.2 12.1
Rostral breadth	10	7.8	\pm 0.73	6.5 8.8	6	7.6	\pm 0.27	7.3 8.0	9	7.0	\pm 0.47	6.4 8.0
Skull depth	10	14.1	\pm 0.35	13.5 14.8	6	14.0	\pm 0.37	13.6 14.5	9	13.2	\pm 0.23	12.9 13.6
Rostral depth	10	10.9	\pm 0.51	10.1 11.7	6	10.8	\pm 0.42	10.2 11.4	9	10.2	\pm 0.49	9.8 11.2
Maxillary breadth	10	8.9	\pm 0.39	8.2 9.3	6	9.5	\pm 0.50	8.8 10.0	9	8.3	\pm 0.55	7.4 9.2
Zygomatic breadth	10	25.8	\pm 1.06	24.2 27.9	6	26.2	\pm 0.89	25.3 27.7	9	25.5	\pm 0.61	24.7 26.5
Bulla length	10	9.5	\pm 0.59	8.3 10.6	6	10.3	\pm 0.95	9.2 11.6	9	10.8	\pm 0.30	10.2 11.2
Post-palatal length	10	25.0	\pm 1.07	23.2 26.5	6	25.2	\pm 0.39	24.6 25.7	9	23.7	\pm 0.87	22.4 25.3
Incisive foramen length	10	5.2	\pm 0.27	4.7 5.7	6	4.1	\pm 0.43	3.5 4.7	9	5.0	\pm 0.30	4.7 5.6
Mandibular length	10	26.7	\pm 0.91	25.2 28.2	6	26.8	\pm 1.15	25.9 29.0	9	25.9	\pm 0.69	25.0 27.2



Fig. 7. Habitat of *Proechimys iberingi eliasi* at the Restinga da Barra de Maricá, State of Rio de Janeiro, Brazil

Measurements: Measurements (in mm) of the holotype are as follows: total length 410; tail 225; hindfoot 50; ear 25; skull length 55.4; basilar length 37.6; palatal length 18.3; toothrow length 8.3; diastema 11.5; rostral length 24.2; nasal length 19.8; interorbital constriction 12.1; rostral breadth 8.0; skull depth 13.1; rostral depth 11.2; maxillary breadth 7.6; zygomatic breadth 26.0; bulla length 11.2; post-palatal length 25.3; incisive foramen length 4.7; mandibular length 26.2. Means and ranges of all specimens examined are listed in Table 1.

Habitat: The coastal sand plains of the Restinga da Barra de Maricá in the State of Rio de Janeiro, are characterized by a mosaic of plant communities (CERQUEIRA et al. 1990). The major vegetational types can be described as meadows, scrublands, and forested slopes. Plant types in the meadows include species of the families Poaceae, Cyperaceae, Typhaceae, and Melastomataceae. The scrubs are dominated by families Myrtaceae, Erythoxylaceae, Bromeliaceae, Cactaceae, and Mimosaceae, with trees usually no higher than 4 m tall. The forested slopes have taller trees reaching 10 to 15 m, although plant species characteristic of the meadows and scrubs such as bromeliads are also present. According to CERQUEIRA et al. (1990), *P. i. eliasi* occurs primarily in the scrubs shown in Figure 7.

Etymology: The epithet *eliasi* honors the memory of Prof. ELIAS PACHECO COELHO whose pioneer work made possible the training of young zoology students at the Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.

Discussion

The taxonomy of *P. iberingi* was established by MOOJEN (1948), who described the subspecies as part of a broader study of the Brazilian forms of spiny rats of the subgenera

Proechimys and *Trinomys*. For each subspecies, MOOJEN (1948) described the color and thickness of aristiform and setiform hairs, and provided descriptions of several qualitative aspects of skull morphology, which included (1) the size and shape of the bullae, (2) degree of development of ridges and depth of jugal bone, (3) degree of development of post-orbital process of zygoma, (4) shape and anatomy of the incisive foramen, and (5) placement of posterior palatine foramina. MOOJEN (1948) also detailed variation in the number of counterfolds in upper and lower molariform teeth.

Although MOOJEN (1948) described variation in the characters listed above, he found diagnostic features to define the geographic units of *P. iberingi* primarily among tail length relative to body size, thickness of aristiforms and color patterns of setiform hairs, morphology of incisive foramen, and pattern of counterfold in molariform teeth. These traits have also proven useful to characterize and distinguish *P. i. eliasi* from the other subspecies of *P. iberingi*. The tail is longer than head and body in *P. i. eliasi* and *P. i. denigratus*, shorter than head and body in *P. i. iberingi*, *P. i. bonafidei*, and *P. i. paratus* and is about the same length as head and body in *P. i. gratosus* and *P. i. panema*. *Proechimys i. eliasi* and *P. i. denigratus* share a whitish brush in the tail tip.

The aristiforms on the dorsal region are wider in *P. i. eliasi* (1.1 mm) than in *P. i. iberingi* (0.6 mm), *P. i. bonafidei* (0.8 mm), *P. i. gratosus* (0.6 mm), and *P. i. panema* (0.8 mm). The aristiforms in *P. i. eliasi* have about the same width as in *P. i. denigratus* (1.1 mm), whereas *P. i. paratus* has the widest aristiforms (1.3 mm). The color pattern of setiform hairs also differs noticeably in *P. i. eliasi*. In all subspecies of *P. iberingi* described by MOOJEN (1948), the setiform hairs on middorsal region are interrupted by a Cinnamon or Ochraceous subapical zone. Such Cinnamon or Ochraceous subapical zone is lacking in *P. i. eliasi* and imparts a dark color pattern to the dorsum, which makes the pelage of the new subspecies very distinctive from the other subspecies of *P. iberingi*.

MOOJEN (1948) recognized the shape and dimensions of the incisive foramen as diagnostic characters to define taxa at specific and infraspecific levels in the subgenus *Trinomys* (reviewed in PESSÔA [1992]). The incisive foramen is elongate and always constricted posteriorly in *P. iberingi*, although the morphology of the septum that crosses the incisive foramen provides diagnostic features for the recognition of the subspecies. The septum is formed by processes of premaxillary and maxillary bones. The premaxillary portion is usually well developed, whereas the length and width of the maxillary portion vary considerably. The premaxillary and maxillary parts can be either in direct contact or separate. The former condition was described as complete and the latter as incomplete by MOOJEN (1948). Finally, the vomer may be exposed ventrally between the premaxillary and maxillary portions of the septum. All such conditions can be seen in the subspecies of *P. iberingi*. The septum is complete and formed by premaxillary and maxillary portions in *P. i. paratus*, *P. i. iberingi*, and *P. i. bonafidei*. The maxillary portion is well developed in *P. i. paratus* and in *P. i. iberingi*, and is thin and delicate in *P. i. bonafidei*. The septum in *P. i. gratosus* and *P. i. panema* is formed by premaxillary and maxillary portions, but it is incomplete since the maxillary portion is reduced to a small process. In *P. i. eliasi* and *P. i. denigratus* the septum is also complete, but the vomer is visible ventrally between the premaxillary and maxillary portions.

MOOJEN (1948) evaluated the usefulness of the number and pattern of folds in the molariform teeth, and was able to demonstrate that the length of the main fold is a most trenchant character to define the morphological limits of subgeneric variation in *Proechimys*. The analysis of variation in the number of counterfolds at the specific and subspecific levels is hampered, however, as folds can become obliterated or coalesce with increasing age (MOOJEN 1948). Variation in the number of counterfolds thus has to be addressed with caution given the caveat of age-related modification. Inspection of MOOJEN'S (1948) description of the number of folds in subspecies of *P. iberingi* indicates moderate variation, primarily due to coalescence of folds. Nevertheless the presence of two

folds is relatively common in *P. i. gratosus*, *P. i. panema*, *P. i. paratus*, *P. i. bonafidei*, and *P. i. eliasi*. On the other hand, *P. i. iberingi* can have up to four folds, whereas in *P. i. denigratus* the number of folds can be reduced to one.

The degree of development as well as the bones that contribute to the formation of the post-orbital process of zygoma were described by MOOJEN (1948), but not featured in the subspecific diagnoses of *P. iberingi*. This structure nevertheless does contribute to characterize the subspecies and is considered here. The post-orbital process of zygoma is small and formed only by the squamosum in *P. i. gratosus* and *P. i. panema*, mostly by the squamosum in *P. i. bonafidei* and by both jugae and squamosum in *P. i. iberingi*. In *P. i. eliasi* and *P. i. denigratus* the post-orbital process is formed almost exclusively by the jugae, although is only moderately developed in the former and spiniform in the latter. In *P. i. paratus* the post-orbital process is moderately developed and formed by the squamosum only.

Variation in cranial dimensions in all subspecies of *P. iberingi* is summarized in Table 1. *Proechimys i. eliasi*, *P. i. panema*, and *P. i. gratosus* are similar in average skull size. *Proechimys i. eliasi* is smaller in average skull size than the other subspecies of *P. iberingi*, with the exception of *P. i. denigratus*. In contrast, *P. i. eliasi* has the largest mean value for bulla length. The larger size of the bulla of the new subspecies can be appreciated by a comparison with mean bullae and skull length values for *P. i. bonafidei* and *P. i. iberingi*. These two subspecies are geographically the closest to *P. i. eliasi* and, while they have average skulls larger than *P. i. eliasi*, their mean values for bulla length are smaller. *Proechimys i. denigratus* is the only other subspecies whose bulla is equally large relative to cranial size.

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Zusammenfassung

Eine neue Unterart von Proechimys iberingi (Rodentia: Echimyidae) aus dem Bundesstaat Rio de Janeiro, Brasilien

Aus den sandigen Küstenebenen des Bundesstaates Rio de Janeiro (Brasilien) wird eine neue Unterart von *Proechimys iberingi* beschrieben. Sie ist durch eine Kombination von Merkmalen gekennzeichnet, unter denen das Fehlen einer zimtfarbenen Zone im subapikalen Bereich des Haarkleides, ein mehr als körperlanger Schwanz mit einem terminalen weißen Pinsel, große Ohrblasen im Schädel und morphologische Details des Septums zwischen den Foramina incisiva besonders charakteristisch sind.

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