MAMMALIAN SPECIES No. 536, pp. 1–4, 3 figs.

Proechimys iheringi.

By L. M. Pessôa and S. F. Reis

Published 27 December 1996 by the American Society of Mammalogists

***Proechimys* J. A. Allen, 1899**

Proechimys J. A. Allen, 1899:264. Type species *Echimys trinitatis* J. A. Allen and Chapman, 1893:223, by original designation.

Trinomys Thomas, 1921:140. Type species *Echimys albispinus* I. Geoffroy St.-Hilaire, 1838:886, by original designation. Named as a subgenus.

CONTEXT AND CONTENT. Order Rodentia, Suborder Hystricomorpha, Family Echimyidae, Subfamily Eumysopinae, Genus *Proechimys,* with two subgenera, *Trinomys* and *Proechimys.* The subgenus *Trinomys* contains five species, (Moojen, 1948; Pessôa et al., 1992), *P. dimidiatus, P. iheringi, P. setosus, P. albispinus,* and *P. moojeni.* A key to species appears in Pessôa and Reis (1993*b*).

***Proechimys iheringi* (Thomas), 1911**

Spiny Rat

Proechimys iheringi Thomas, 1911:252. Type locality Island of São Sebastião, off São Paulo, Brazil.

CONTEXT AND CONTENT. As above. Seven subspecies of *Proechimys* (*Trinomys*) *iheringi* are currently recognized (Moojen, 1948; Pessôa and Reis, 1993*a*); all are endemic to eastern Brazil.

P. i. bonafidei Moojen, 1948:378. Type locality Fazenda Boa Fé, *Teresópolis,* Rio de Janeiro, Brazil.

P. i. denigratus Moojen, 1948:381. Type locality Mata do Ribeirão da Fortuna, 40 kilometers west of Ilheus, *Itabuna,* Bahia, Brazil.

P. i. eliasi Pessôa and Reis, 1993*a*:183. Type locality Restinga de Maricá, (22°31′S, 47°17′W), Município de Maricá, Rio de Janeiro, Brazil.

P. i. gratiosus Moojen, 1948:379. Type locality Floresta da Caixa Dagua, *Santa Teresa,* Espírito Santo, Brazil.

P. i. iheringi Thomas, 1911:252, see above.

P. i. panema Moojen, 1948:380. Type locality Campinho, *Colatina,* Espírito Santo, Brazil.

P. i. paratus Moojen, 1948:382. Type locality Floresta da Capela de São Braz, *Santa Teresa,* Espírito Santo, Brazil.

A key to the subspecies follows (modified from Pessôa and Reis, 1993*a*).

1. Premaxillary and maxillary parts of the incisive foramen septum in direct contact 2
   Premaxillary and maxillary parts of the incisive foramen septum not in direct contact 4
2. Maxillary portion of the septum thin and delicate . . . . *P. i. bonafidei*
   Maxillary portion of the septum well developed and stout 3
3. Postorbital process of zygoma small and formed by both jugal and squamosal . . . . *P. i. iheringi*
   Postorbital process of zygoma moderately developed and formed by squamosal only . . . . *P. i. paratus*
4. Vomer visible ventrally between the premaxillary and maxillary portions of the septum 5
   Vomer not visible ventrally between the premaxillary and maxillary portions of the septum 6
5. Postorbital process of zygoma spiniform; subapical zone of middorsal guard hairs cinnamon colored . . *P. i. denigratus*
   Postorbital process of zygoma only moderately developed; subapical zone of middorsal guard hairs not cinnamon . . . . *P. i. eliasi*
6. Premaxillary portion extending beyond the first half of the incisive foramen; middorsal guard hairs colored ochraceous-buff . . . . *P. i. gratiosus*
   Premaxillary portion not reaching the first half of the incisive foramen; middorsal guard hairs cinnamon . . . . *P. i. panema*

DIAGNOSIS. *Proechimys iheringi* is a member of subgenus *Trinomys,* which can be distinguished from subgenus *Proechimys* primarily by length of the main fold in the cheekteeth, which is shallow and does not reach the opposite wall of the cheekteeth in *Proechimys,* but is deep and extends across the crown of the cheekteeth in *Trinomys. P. iheringi* can be distinguished from other species in subgenus *Trinomys* by wide and stiff guard hairs; differentiated light-colored guard hairs on outer sides of thighs and rump; tail with white tip, developed as a white brush in some subspecies; jugals broad dorso-ventrally; and incisive foramen elongate (Moojen, 1948; for a key to species in the subgenus *Trinomys,* see Pessôa and Reis, 1993*b*).

The subspecies of *P. iheringi* can be distinguished by cranial anatomy (see key), as well as by pelage characteristics (Moojen, 1948; Pessôa and Reis, 1993*a*). The guard hairs on the dorsal region are wider in *P. i. eliasi* ($\bar{X} = 1.1$ mm) than in *P. i. iheringi* (0.6 mm), *P. i. bonafidei* (0.8 mm), *P. i. gratiosus* (0.6 mm), and *P. i. panema* (0.8 mm). Guard hairs in *P. i. eliasi* are about the same width as in *P. i. denigratus* ($\bar{X} = 1.1$ mm), whereas *P. i. paratus* has the widest guard hairs (1.3 mm).

Proechimys i. bonafidei occurs sympatrically with *P. dimidiatus* in Teresópolis, Rio de Janeiro (Davis, 1945, 1947; Moojen, 1948; Pessôa and Reis, 1992*a*), and *P. i. iheringi* may also overlap the distribution of *P. dimidiatus* elsewhere in the state of Rio de Janeiro (Moojen, 1948). Both subspecies of *P. iheringi* can be distinguished from *P. dimidiatus* by qualitative and quantitative cranial characters (Pessôa and Reis, 1992*a*). For example, the maxillary part of the vomerine sheath is thin and delicate in *P. i. bonafidei,* narrow and short in *P. i. iheringi,* and wide and strong in *P. dimidiatus.* The incisive foramen is constricted posteriorly in both subspecies of *P. iheringi,* but wide posteriorly in *P. dimidiatus.* In *P. i. bonafidei,* the postorbital process of zygoma is formed mainly by the squamosal and in *P. i. iheringi,* both jugal and squamosal contribute equally to the formation of the zygomatic pro-

FIG. 1. *Proechimys iheringi eliasi* from Restinga de Maricá, Rio de Janeiro, Brazil.

cess; in *P. dimidiatus*, the postorbital process is formed only by the squamosal.

Proechimys i. bonafidei and *P. i. iheringi* can also be distinguished from *P. dimidiatus* on the basis of metric cranial traits, with the most important characters separating the three taxa being toothrow length, interorbital constriction, skull depth, and incisive foramen length (Pessôa and Reis, 1992*a*). *P. i. iheringi* and *P. dimidiatus* also differ in bacular morphology. In the former, the lateral indentation is near the proximal end of the shaft, but in *P. dimidiatus*, it is near mid-shaft. The proximal and distal ends are evenly rounded in *P. dimidiatus*, whereas in *P. i. iheringi* the distal end is concave (Pessôa and Reis, 1992*a*, 1992*b*).

GENERAL CHARACTERS. *Proechimys iheringi* is a large spiny rat, with wide, stiff guard hairs (Moojen, 1948; Pessôa and Reis, 1993*a*; Fig. 1). The color of upper parts and sides is a combination of blackish from the tips of guard hairs and cinnamon from the subapical zones of over hair; a darker band occurs along mid-dorsal line; pale guard hairs are conspicuous on outer sides of thighs and rump; usually a rufous tint occurs on neck and post-auricular region; underparts and inner sides of legs are white; feet are dorsally white; hind feet are slightly darker on outer sides; and tail has a white tip that is developed into a white brush (penicillate) in *P. i. denigratus* and *P. i. eliasi* (Moojen, 1948; Pessôa and Reis, 1993*a*).

Mean external measurements (in mm, ranges in parentheses) of 24 males and 25 females, respectively, are: length of head and body, 201 (185–220), 205 (180–228); length of tail, 191 (170–242), 190 (153–225); and length of hind foot, 49 (43–54), 48 (45–55; Moojen, 1948). Length of tail relative to head and body length varies from 87% in *P. i. iheringi* to 120% in *P. i. elasi* (Pessôa and Reis, 1993*a*).

The skull is elongate and smooth with jugals that are wide dorso-ventrally and an elongate incisive foramen (Fig. 2). Mean cranial measurements (in mm, ranges in parentheses) of 54 specimens of *P. iheringi* (sexes combined) are: length of skull, 51.7 (46.2–56.5); basilar length, 35.9 (32.0–39.5); palatal length, 17.0 (14.4–19.1); length of toothrow, 8.3 (7.9–8.6); length of diastema, 10.8 (9.9–12.6); rostral length, 22.2 (20.6–25.3); nasal length, 18.5 (16.7–20.6); width of inteorbital constriction, 11.8 (9.7–14.4); rostral breadth, 7.3 (6.0–8.0); depth of skull, 13.4 (11.9–14.5); rostral depth, 10.3 (8.7–11.7); maxillary breadth, 8.7 (7.4–10.0); zygomatic breadth, 25.7 (23.5–27.9); length of bulla, 10.0 (8.3–11.6); post-palatal length, 24.1 (21.6–26.6); incisive foramen length, 4.7 (3.5–5.7); and mandibular length, 25.9 (22.3–29.0). Cranial measurements for each subspecies of *P. iheringi* can be found in Pessôa and Reis (1994). Sexual dimorphism seems to be negligible in cranial measurements (Pessôa and Reis, 1991), and the pattern of variation in overall cranial dimensions in geographic space is complex (Pessôa and Reis, 1994).

DISTRIBUTION. According to Moojen (1948), *P. iheringi* occurs from the state of Bahia to the state of São Paulo in eastern Brazil (Fig. 3). Although *P. i. iheringi* is known from several localities in the mainland and offshore islands of the states of São Paulo and Rio de Janeiro (Cerqueira et al., 1990; Pessôa and Reis, 1993*a*; Yonenaga-Yassuda et al., 1985), the remaining subspecies are known only from the type locality (Moojen, 1948; Pessôa and Reis, 1993*a*), with the following exceptions. The report by Pessôa et al. (1993) provided new records for *P. i. paratus* and *P. i. gratiosus* from the state of Espírito Santo where these forms were first described. New records for *P. i. denigratus* are Conceição do Mato Dentro in the state of Minas Gerais and Linhares in the state of Espírito Santo, which are located 411 km and 459 km, respectively, south of Itabuna, Bahia, the type locality of *P. i. denigratus*. The third record is Barra de São Cristovão, Sergipe, located 400 km north of Itabuna. This last record extends the distribution of *P. iheringi* to the state of Sergipe in northeastern Brazil. Elevational range varies from sea level to 850 m. No fossils of *P. iheringi* are known.

FORM AND FUNCTION. The dentition is characterized by orthodont incisors. The dental formula is i 1/1, c 0/0, p 1/1, m 3/3, total 20 (Lawlor, 1979). Upper molariform teeth usually have one to five counterfolds, with number varying with subspecies; lower premolars always have two counterfolds, and lower molars always have one or two counterfolds (Moojen, 1948).

The baculum in *P. iheringi* is elongate and narrow, with a straight shaft, no apical wings, and no median depression (Pessôa and Reis, 1992*b*). Bacular morphology appears to vary among the subspecies, although not all have been described (Pessôa and Reis, 1992*a*, 1992*b*, 1993*a*). The shaft shows an indentation near the distal end in *P. i. gratiosus*, whereas in *P. i. eliasi* and *P. i. iheringi*, the indentation is near the proximal end. In *P. i. gratiosus*, the shaft broadens near the proximal end and is tapered at the tip. The proximal end is paddle-shaped in *P. i. eliasi* and *P. i. iheringi*, but the distal end is tapered in the former and broadened laterally in the latter.

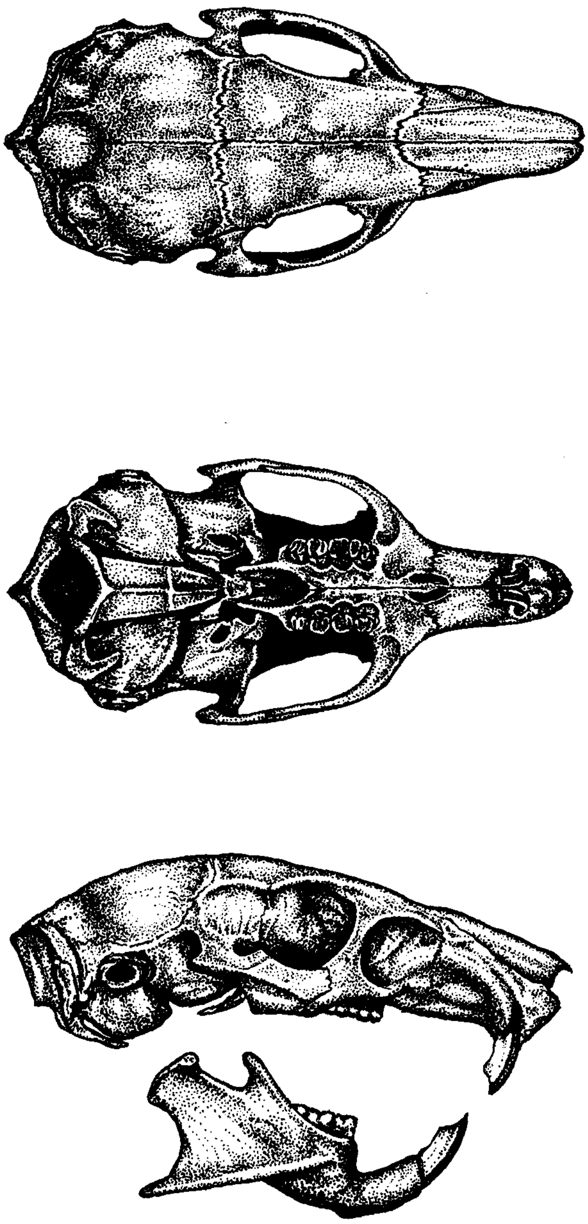

FIG. 2. Dorsal, ventral, and lateral views of cranium, and lateral view of the lower jaw of *Proechimys iheringi iheringi* (male, MN 25705, Museu Nacional, Universidade Federal do Rio de Janeiro). Greatest length of cranium is 51.48 mm.

ONTOGENY AND REPRODUCTION. No data are available for development in *P. iheringi*, and information on reproduction is limited. Three female *P. i. bonafidei* (Teresópolis, Rio de Janeiro) collected in April (two) and September (one) were pregnant with two, one, and two embryos, respectively. A *P. i. denigratus* (Itabuna, Bahia) collected on 9 January, gave birth to two young on 26 January. A *P. i. iheringi* collected in Juréia (state of São Paulo) in December carried one embryo, whereas a female of *P. i. eliasi*

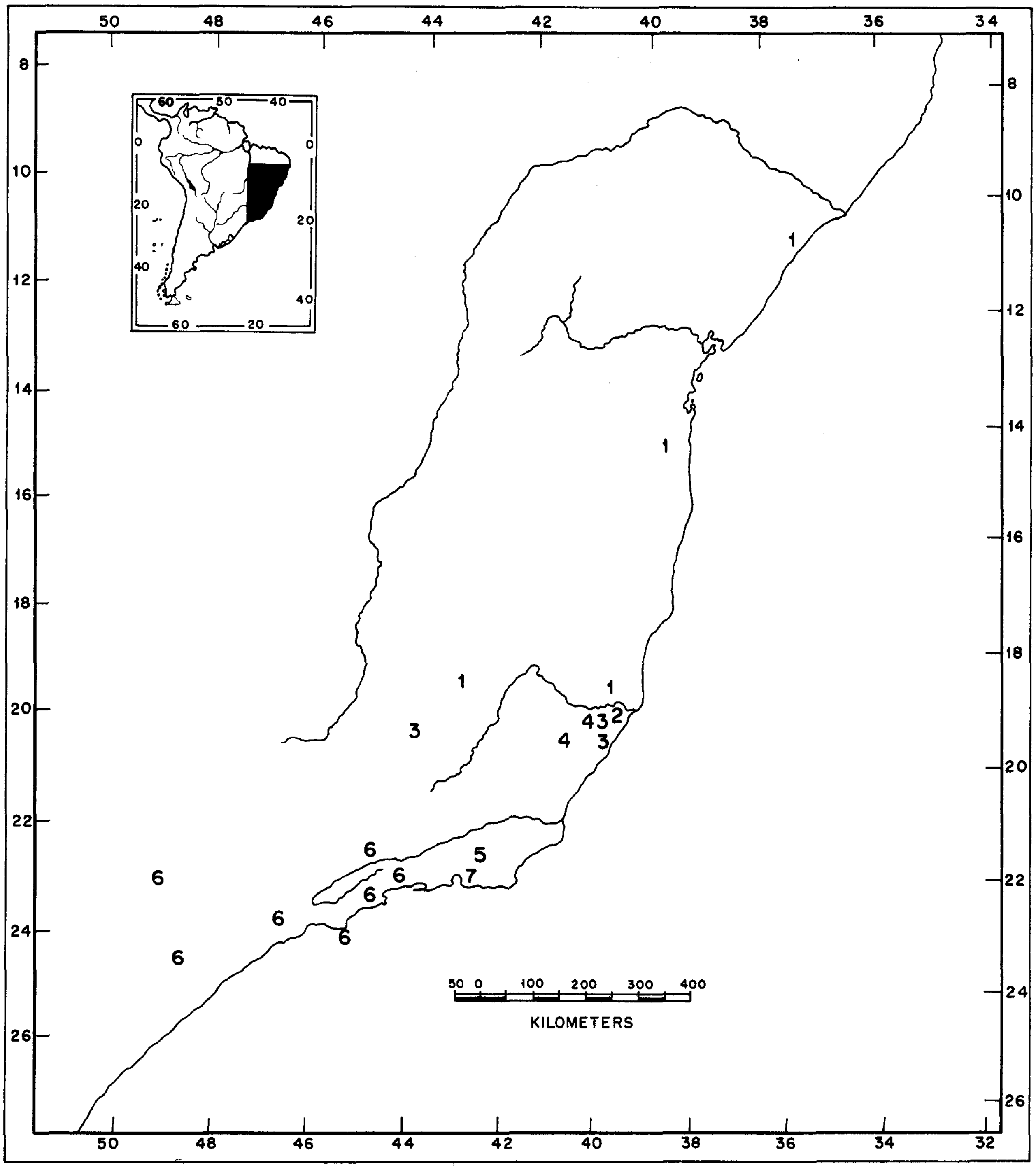

FIG. 3. Distribution of *Proechimys iheringi* (modified from Moojen, 1948 and Pessôa et al., 1993): 1, *P. i. denigratus*; 2, *P. i. panema*; 3, *P. i. paratus*; 4, *P. i. gratiosus*; 5, *P. i. bonafidei*; 6, *P. i. iheringi*; 7, *P. i. eliasi*.

(Barra de Maricá, state of Rio de Janeiro) gave birth to three young in captivity (J. A. de Oliveira, pers. comm.).

ECOLOGY AND BEHAVIOR. Most subspecies of *P. iheringi* occur in moist climax forest habitats, although *P. i. denigratus* has been collected in drier forests with a high percentage of deciduous trees in Itabuna, Bahia (Moojen, 1948). Moojen (1948) remarks nevertheless that all animals in these areas were collected near water. Another subspecies, *P. i. eliasi* (Pessôa and Reis, 1993*a*) inhabits the coastal sand dunes in the restinga da Barra de Maricá in the state of Rio de Janeiro. The vegetation in this habitat is dominated by plants in the families Myrtaceae, Erythoxilaceae, Bromeliaceae, Cactaceae, and Mimosaceae (Cerqueira et al., 1990).

There is little information about behavior of this species. Individual *P. i. iheringi*, *P. i. bonafidei*, and *P. i. eliasi* maintained in the laboratory produced high-pitched sounds that differed among subspecies (J. A. de Oliveira, pers. comm.).

GENETICS. Diploid number in *P. i. iheringi* from several inland populations in the state of São Paulo varies from 60 to 65, depending on the number of B chromosomes (Yonenaga-Yassuda et al., 1985). A karyotype similar in morphology to those reported by Yonenaga-Yassuda et al. (1985) is known to occur in Ilha Grande, an island off the coast of the state of Rio de Janeiro, although no B chromosomes were observed (2n = 60; FN = 116; O. B. Ribeiro, pers. comm.). *P. i. bonafidei* and *P. i. eliasi* from their type localities in the state of Rio de Janeiro yielded chromosomes identical in conventional staining, although varying in number, 2n = 56 (FN

= 108) and 2n = 58 (FN = 112), respectively (O. B. Ribeiro, pers. comm.).

Modeling studies of phenotypic cranial evolution in *P. iheringi* suggest that differences among populations and subspecies are due to selection and not to random genetic drift (Reis et al., 1992). Assuming a model of truncation selection, the minimum intensities of selection necessary to account for the observed cranial differentiation were found to be low, with selective mortality per generation on the order of 10^{-3} (Reis et al., 1992).

REMARKS. In addition to postulating a formal subspecific classification for *P. iheringi,* Moojen (1948) also suggested that *P. i. iheringi* and *P. i. paratus* might be recognizable at the species level. Recent studies (Pessôa and Reis, 1991, 1994) show that *P. i. iheringi* and *P. i. paratus* are craniometrically differentiated from a third cluster of populations that include *P. i. denigratus, P. i. panema, P. i. gratiosus, P. i. bonafidei,* and *P. i. eliasi,* lending support to Moojen's (1948) conjecture.

Our work was supported by funds from Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro (E-29/170.339/90), Fundação de Amparo à Pesquisa do Estado de São Paulo (88/2237-4, 89/0772-1, 89/3405-0, 93/), and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq: 400052/91-1; 301386/92-7). We are indebted to Dr. Alfred L. Gardner and an anonymous reviewer for comments that improved the manuscript. We are thankful to M. F. Pessôa for the drawings of the skull and the map. Work by LMP and SFR is partially supported by Research Fellowships from CNPq.

LITERATURE CITED

Allen, J. A. 1899. The generic names *Echimys* and *Loncheres.* Bulletin of the American Museum of Natural History, 12:257–264.

Allen, J. A., and F. M. Chapman. 1893. On a collection of mammals from the island of Trinidad, with descriptions of new species. Bulletin American of the Museum of Natural History, 5:203–225.

Cerqueira, R., F. A. S. Fernandez, and M. F. S. Quintela. 1990. Mamíferos da restinga de Barra de Maricá, Rio de Janeiro. Papéis Avulsos de Zoologia, 37:141–157.

Davis, E. D. 1945. The annual cycle of plants, mosquitoes, birds, and mammals in two Brazilian forests. Ecological Monographs, 15:244–295.

———. 1947. Notes on the life histories of some Brazilian mammals. Boletim do Museu Nacional, 76:1–8.

Geoffroy Saint-Hilaire, I. 1838. Notice sur les rongeurs épineux désignés par les auteurs sous les noms d'Echimys, Loncheres, Heteromys et Nelomys. Comptes Rendues Academie Science Paris, 6:884–888.

Lawlor, T. E. 1979. Handbook to the orders and families of living mammals. Second ed. Mad River Press, Eureka, 327 pp.

Moojen, J. 1948. Speciation in Brazilian spiny rats (Genus *Proechimys,* Family Echimyidae). University of Kansas Publications, Museum of Natural History, 1:301–406.

Pessôa, L. M., and S. F. Reis. 1991. Cranial infraspecific differentiation in *Proechimys iheringi* Thomas (Rodentia: Echimyidae). Zeitschrift für Säugetierkunde, 56:34–40.

———. 1992*a.* An analysis of morphological discrimination between *Proechimys dimidiatus* and *Proechimys iheringi* (Rodentia: Echimyidae). Zoologischer Anzeiger, 228:189–200.

———. 1992*b.* Bacular variation in the subgenus *Trinomys,* genus *Proechimys* (Rodentia: Echimyidae). Zeitschrift für Säugetierkunde, 57:100–102.

———. 1993*a.* A new subspecies of *Proechimys iheringi* Thomas (Rodentia: Echimyidae) from the state of Rio de Janeiro, Brazil. Zeitschrift für Säugetierkunde, 58:181–190.

———. 1993*b.* Proechimys dimidiatus. Mammalian Species, 441:1–3.

———. 1994. Systematic implications of craniometric variation in *Proechimys iheringi* Thomas (Rodentia: Echimyidae). Zoologischer Anzeiger, 232:181–200.

Pessôa, L. M., J. A. de Oliveira, and S. F. Reis. 1992. A new species of spiny rat genus *Proechimys,* subgenus *Trinomys* (Rodentia: Echimyidae). Zeitschrift für Säugetierkunde, 57: 39–46.

Pessôa, L. M., S. F. Reis, M. Passamani, and S. Mendes. 1993. Notes on the distribution of *Proechimys iheringi denigratus, Proechimys iheringi paratus* and *Proechimys iheringi gratiosus* in eastern Brazil (Rodentia: Echimyidae). Zoologischer Anzeiger, 231:21–23.

Reis, S. F., L. M. Pessôa, and B. Bordin. 1992. Cranial phenotypic evolution in *Proechimys iheringi* Thomas (Rodentia: Echimyidae). Zoologica Scripta, 21:201–204.

Thomas, O. 1911. New rodents from South America. Annals and Magazine of Natural History, 8:252–253.

———. 1921. On the spiny rats of the *Proechimys* group from Southeastern Brazil. Annals and Magazine of Natural History, 8:140–143.

Yonenaga-Yassuda, Y., M. J. de Souza, S. Kasahara, M. L'Abbate, and H. T. Chu. 1985. Supernumerary system in *Proechimys iheringi iheringi* (Rodentia, Echimyidae), from the state of São Paulo, Brazil. Caryologia, 38:179–194.

Editors of this account were Alicia V. Linzey, Cynthia E. Rebar, Karl F. Koopman, and Elaine Anderson. Managing editor was Alicia V. Linzey.

L. M. Pessôa and S. F. Reis, Departamento de Zoologia, IB, Universidade Federal do Rio de Janeiro, Cidade Universitária, Ilha do Fundão, 21941-590 Rio de Janeiro, RJ, Brazil and Departamento de Parasitologia, IB, Universidade Estadual de Campinas, C.P. 6109, 13083-970 Campinas, SP, Brazil.