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Short communication

A new subspecies of the little desert bat (*Rhogeessa minutilla*) from a Venezuelan semiarid enclave

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The genus *Rhogeessa* includes seven recognized species of insectivorous bats belonging to the family Vespertilionidae (WILSON and REEDER 1993). The only two representations of this genus in Venezuela, seem to have allopatric distributions (LAVAL 1973), *Rhogeessa minutilla* and *R. tumida* (HANDLEY 1976; SORIANO and OCHOA 1997).

The little desert bat, *Rhogeessa minutilla* shows a discontinuous pattern of distribution in the coastal region of Venezuela and Colombia, occurring in Margarita island, where the species was described by MILLER (1897); however, their main distribution range is the northwestern part of Venezuela and Península de la Guajira in Colombia (LAVAL 1973). This species was also referred to as a desert dweller because it is common in lowland thorn shrubs and semiarid environments (LAVAL 1973; LINARES 1998). On the other hand, *R. tumida* has a wider range and continuous distribution, which includes the majority of humid forests in northern Venezuela (HANDLEY 1976; LAVAL 1973; LINARES 1998). The main features that allow to differentiate *R. minutilla* from *R. tumida*, are: smaller on the average, much more intensive yellow color of fur and paler membranes, proportionately smaller post orbital width, longer tragus and tibia, and smaller difference between third metacarpal and forearm (LAVAL 1973).

An isolated population of *Rhogeessa* was detected by us in the semiarid enclave of Lagunillas of the Venezuelan Andes, in the middle Chama river basin in the State of Mérida, which was referred to as *R. minutilla* (SOSA et al. 1996). However, specimens of this population show intermediate features between *R. minutilla* and *R. tumida*. Thus, the pattern of coloration resembles that of *R. minutilla*; while body mass and measurements are larger, and could match with *R. tumida*. Because of its isolated condition, it can be hypothesized that this population may be an undescribed subspecies.

In this study we employed cluster analysis techniques with the aim of obtaining objective and statistically supported conclusions about the taxonomic status of this Andean population.

Material examined: For the analysis, 46 adult specimens of *Rhogeessa* were selected following the ANTHONY (1988) age criteria. Twenty came from the semiarid en-

clave of Lagunillas, in the Venezuelan Andes. The other twenty-six specimens were identified as the species: *R. minutilla* (16 specimens) and *R. tumida* (10 specimens), according to the locality where they were collected within the range of this species in Venezuela. All specimens were housed in the Colección de Vertebrados de la Universidad de Los Andes (CVULA) and the Museo de la Estación Biológica de Rancho Grande (EBRG).

Specimens examined: *Rhogeessa* (Andean population). Estado Mérida: Laguna de Caparú, 3 km SE San Juan de Lagunillas (CVULA: I-2825, I-2826, I-2831, I-2948, I-2949, I-3232 to I-3233, I-3256, I-3321, I-3322, I-3376 to 3379, I-3388 to 3389, I-3421, I-3455, I-3479, I-3480). *Rhogeessa minutilla*. Estado Falcón: Capatárida, 40 m (EBRG: 13271, 13290), Sta. Rosa, 6 km SSW de Capatárida, (EBRG: 13280, 13281, 13283). Estado Lara: Matatere, 18 km de Bobare (EBRG: 3341), El Paují, 8 km de Bobare (EBRG: 3346, 3347), 10 km N de El Tocuyo, Caserío Boro, 537 m (EBRG: 13294, 13299, 13300, 13309). Estado Nueva Esparta: Playa Punta Arenas, cerca de Boca de Pozo, Península de Macanao (EBRG: 3321, 3327). Estado Zulia: 114 km N + 28 km W de Maracaibo (Cojoro), 15 m. (EBRG: 13287, 13289). *Rhogeessa tumida*. Estado Apure: Hato Cariben, 60 km NE de Pto. Páez, 76 m (EBRG: 13313). Estado Barinas: Unidad II, Parcela 23, Reserva Forestal de Ticoporo, 30 km E de El Cantón (EBRG: 5926). Estado Carabobo: Hacienda Saint Jean, 13 km SW Borburata, 120 m (EBRG: 8147). Estado Miranda: 5 km E Río Chico (cerca Puerto Tuy), 0 m (EBRG: 13314). Estado Monagas: Mata de Bejuco, 54 km SE de Maturín, 18 m (EBRG: 13317), El Merey, cerca Chaguaramas, 45 km SSW de Temblador, Distrito Sotillo, 30 m (EBRG: 16831). Estado Yaracuy: 19 km NW de Urama (EBRG: 13311, 13312), 8 km N + 18 km W de San Felipe (cerca Minas de Aroa), 400 m (EBRG: 13315). Estado Zulia: 48 km WNW Encontrados, El Rosario, 54 m (EBRG: 13316).

Measurements: For each selected specimen the following eight cranial measurements were taken: greatest length of skull, including incisors (GLS); postorbital width (POW); mastoid width (MW); width across upper second molars (M2-M2); width across upper canines (C1-C1); second molar width (M2); maxillary toothrow (MAX) and mandible length (MAND). All cranial measurements were taken with a Mitutoyo digital caliper, with an accuracy of 0.05 mm; with the exception of MAX which was taken by a graduated scale on the ocular lens of a stereoscopic microscope (Leica model Wild M8), with an accuracy of 0.05 mm. Additionally, we took three skeletal measurements: forearm (FA), third metacarpal (3MC) and tibia (TIB).

Data treatments: With the aim of determining the taxonomic affinities between the two nominal species and the representatives of the Andean population, we carried out a cluster analysis with the eleven cranial and skeletal measurements listed above, by mean of Ward's method and Relative Euclidean Distance, using the program PC-ORD, version 4.0 (MCCUNE and MEFFORD 1999). The means of the variables of the two closest populations were compared by *t*-test. In addition, we carried out a discriminant analysis, using the program STATISTICA (ANONYMOUS 1994) to determine which variables allow to discriminate between these two populations.

The cluster analysis shows a very clear differentiation among populations (Fig. 1), in which the sample of *R. tumida* (T) deviates from the other two while *R. minutilla* (M) and the Andean population (A), show the closest relation. Although this analysis allows to assign the Andean population to the *R. minutilla* species, two separated clusters for each can be recognized. As consequence, the Andean population could be considered as a different subspecies.

Comparisons by use of *t*-test of the mean values of variables showed that the Andean population exhibits significantly greater values than *R. minutilla* in GLS, POW, MW, MAX, C1-C1, M2-M2, M2, MAND and FA; the TIB value was significantly lower and 3MC was nonsignificant (Tab. 1). Our data indicate that specimens of the Andean population have longer and broader skulls,

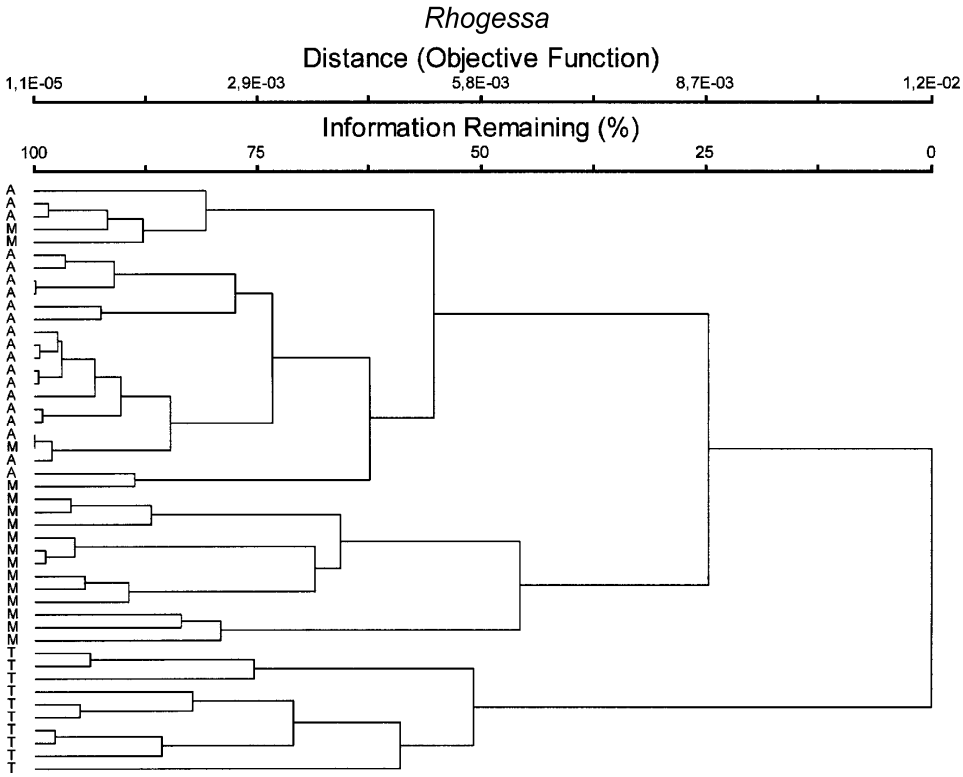

Fig. 1. Results of the cluster analysis for the three *Rhogeessa* populations: *R. tumida* (T), *R. minutilla* (M), and Andean population (A).

Table 1. Comparison of the characters used in the study between the Andean and *Rhogeessa minutilla* populations. Numbers are the mean and 95% confidence interval in parentheses.
(***) = p < 0.001; (**) = p < 0.01; (*) = p < 0.05; NS = non significant

Character	Andean population	*Rhogeessa minutilla*	Significance
GLS	12.98 (0.39)	12.65 (0.66)	**
POW	3.20 (0.18)	3.10 (0.17)	**
MW	6.85 (0.25)	6.52 (0.40)	***
MAX	4.72 (0.24)	4.60 (0.25)	**
C1-C1	3.76 (0.15)	3.63 (0.34)	**
M2-M2	5.30 (0.24)	5.06 (0.34)	***
M2	1.29 (0.09)	1.23 (0.08)	***
MAND	5.21 (0.21)	5.03 (0.40)	**
FA	28.36 (1.28)	27.61 (1.59)	**
TIB	10.70 (0.53)	11.26 (1.35)	**
3MC	27.05 (1.29)	26.81 (2.03)	NS

as well as a longer maxillary and mandibulary length, and broader M2 than *R. minutilla* populations. In addition, FA is longer than in *R. minutilla*, while TIB is shorter in the Andean population.

Results from discriminant-function analysis show a Wilks' Lambda of 0.1615, approx. F (11.25) = 11.33, p < 0.00001, and the mean of canonical variables of 2.47 for *R. minutilla*, and –1.98 for the Andean population, in-

dicating a very good separation between both populations. Tibia shows the highest discriminant power (Standardized Coefficient = –0.800, p = 0.027), and M2 (Standardized Coefficient = –0.534, p = 0.043).

According to the present results, we can conclude that the Andean population from the semiarid enclave of Lagunillas represents at least an undescribed subspecies of *R. minutilla*. Based on the evidence of our analysis, we describe the new Andean form of *Rhogeessa minutilla* as follows:

Rhogeessa minutilla cautiva
subspecies nov.

Holotype: Adult postlactant female, skin, skull, and partial postcranial skeleton, CVULA-I- 3388, from Laguna de Caparú, 3 km SE San Juan de Lagunillas, Mérida state, Venezuela, 900 m elevation; obtained on 15 May 1989 by P. J. Soriano and M. Sosa (field number S-4049). Selected external and cranial measurements (in mm), and weight (in g) of holotype are: length of head and body (tail included), 75; length of tail, 32; length of hind foot, 4; length of ear, 14; length of forearm (dry), 28.00; length of tibia, 10.60; greatest length of skull, 13.03; postorbital width, 3.15; mastoid width, 7.00; maxillary length, 4.79; length across canines, 3.80; mandibulary length, 5.16; length across second upper molar, 5.27; second upper molar width, 1.30; weight, 4.3 g.

Paratypes: Nineteen adult specimens from the same locality consisting of 9 males and 10 females: CVULA- I – 2825, 2826, 2831, 2948, 2949, 3232, 3233, 3256, 3321, 3322, 3376–3379, 3389, 3421, 3455, 3479, 3480. Mean and range (in parentheses) of selected external and cranial measurements (in mm), and weight (in g) of paratypes are: length of head and body (tail included), 73.37 (70–77); length of tail, 31.11 (28–34); length of hind foot, 4.68 (4–7); length of ear, 12.84 (11–14); length of forearm (dry), 28.28 (26.65–29.55); length of tibia, 10.66 (10.30–11.30); greatest length of skull, 12.94 (12.45–13.27); postorbital width, 3.20 (3.01–3.34); mastoid width, 6.81 (3.53–7.0); maxillary length, 4.71 (4.37–4.95); length across canines, 3.74 (360–3.89); length across second upper molar, 5.29 (5.11–9.58); mandibular length, 5.20 (5.0–5.42); second upper molar width, 1.28 (1.19–1.36); weight, 3.43 (2.7–4.3).

Diagnosis: This new subspecies is characterized by having the longest and broadest rostrum known for the species, as is indicated by its higher values of GLS, MAX, MAND, and POW, MW, C1-C1, M2, and M2-M2, respectively. Likewise, it has a shorter tibia and longer forearm than the coastal population of *R. minutilla*.

Comparisons: *Rhogeessa m. cautiva* is distinguished from *R. m. minutilla* by a longer skull and maxillary tooth row, broader palate, and shorter tibia.

Distribution: This endemic subspecies inhabits the Lagunillas semiarid enclave located in the middle basin of the Chama river and the Nuestra Señora river basin, Mérida state, Venezuela. According to speculations of local geomorphologists this semiarid environment could have been isolated for at least the last 10 000 years (E. La Marca and R. Andressen, pers. com.).

Habitat and ecology: This isolated population seems to be restricted to the Lagunillas enclave, which shows a xerophitic vegetation called thorn shrub, ranged between 500 and 2000 m elevation, with mean temperature and annual precipitation of 21 °C and 575 mm, respectively (Ataroff and Sarmiento 2003; Sarmiento et al. 1971). *Rhogeessa m. cautiva* seems to use as refuges the cavities inside dead branches of the columnar cactus *Subpilocereus repandus* (M. E. Naranjo, pers. obs.). This population shows a bimodal polyestrous reproductive pattern with two reproductive peaks throughout the year (Sosa et al. 1996). Likewise, 85% of the diet of this bat is composed of insects belonging to the orders Diptera, Hymenoptera, Lepidoptera and Coleoptera (Sosa et al. 1996).

Etymology: The epithet *cautiva*, is a Spanish word coming from the Latin *captivus*, meaning for captive or prisoner, used in reference to the isolate condition of this population. The subspecific name is a noun, singular and of feminine gender, in apposition to the generic name, which has the same grammatical gender.

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