

A NEW SPECIES OF THE GENUS *RHOGEESSA*, WITH COMMENTS ON GEOGRAPHIC DISTRIBUTION AND SPECIATION IN THE GENUS

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ABSTRACT. — A new species of *Rhogeessa* is described from southern Suriname. The new species is characterized by a karyotype that possesses a diploid number of 52 and a fundamental number of 52 and by its relatively large overall size compared to other South American *Rhogeessa*. Ten species are now recognized within the genus. Seven of these species, including the one described herein, are members of *R. tumida* complex. Two of these species — *R. io* and *R. minutilla* — also occur in South America and the remaining four species are confined to Mexico and Central America.

Key words: *Rhogeessa*, Suriname, karyology, systematics, Mammalia

Bats of the genus *Rhogeessa* have presented evolutionary biologists and systematists with a unique suite of features. Several cryptic or sibling species are identified by karyotypic variation (Baker, 1984; Baker et al., 1985) and this complex has been used as an empirical basis for a speciation model (speciation by monobrachial fusions, Baker and Bickham, 1986). Some species show little or no morphological distinctiveness (Baker, 1984). For the two most widely distributed species recognized by morphological differences (*R. tumida* and *R. parvula*), the range of geographic variation in morphology within both species is greater than any morphological features that distinguish the two (LaVal, 1973). Although, several species have been recognized based on karyotypes, the morphological features are still problematic when used to identify taxa. One of the karyotypic forms (Honeycutt et al., 1980) from Suriname has been identified as a previously undescribed species (Ruedas and Bickham, 1992) and this paper presents a formal description of that taxon.

Before a formal description can be made, some clarification of species boundaries and characteristics is needed to permit the required comparisons. This undescribed species is a member of the *R. tumida* complex in South America.

The first point to consider is that other specimens of the *R. tumida* complex that have been karyotyped from South America have a diploid number of 30. Specimens with this karyotype have been G-banded and cladistically analyzed (Baker et al., 1985) using *Myotis* and *Eptesicus*

as outgroups (Bickham, 1979a, 1979b). The results of this analysis indicated that the $2N = 30$ cytotype from South America and $2N = 32$ cytotype from Nicaragua represent sister clades identified by three unique centric fusions (5/1, 10/4, and 11/7 using the standardized G-Band karyotype for vespertilionid bats, Bickham, 1979a).

Based on the potential complex meiotic figures that would result from hybrids between either the $2N = 30$ or the $2N = 32$ (Nicaraguan) cytotypes and any other cytotype found north of South America, it is probable that the $2N = 30$ and 32 (Nicaraguan form) have speciated from more northern taxa by monobrachial fusions (Baker and Bickham, 1986). The senior synonym for the $2N = 30$ and 32 (Nicaraguan form) cytotypes is *R. io* Thomas, 1903, with a type locality of Valencia, Carabobo, Venezuela. At this time it seems appropriate to consider the $2N = 30$ cytotype and the $2N = 32$ (Nicaraguan form) as conspecific because there is no evidence of an isolating mechanism in the chromosomal or other data. Therefore, the range of *R. io* should be recognized as the Atlantic versant of Nicaragua south through Panama, and South America including specimens of *R. tumida* recorded by LaVal (1973) for Colombia, Venezuela, Trinidad, Guyana, and Mato Grosso, Brazil. The situation surrounding the Ecuador specimens is unclear (LaVal, 1973; Goodwin, 1958).

LaVal examined and figured bacula (1973, Fig. 2, p. 9) for several representatives of the *R. tumida* com-

plex. Three specimens (from Veracruz, Tamaulipas, and Chiapas) are from the range of the $2N = 34$ cytotypes (*tumida*, sensu stricto) and these three are more similar to each other than to any of the remaining bacula that are figured. Three other specimens, the eastern variant of Nicaragua, Colombia, and Venezuela, are from our proposed range for *R. io* and these three have unique bacular morphology unlike that seen in *tumida* (sensu stricto) and these three are more like each other than any is like representatives of *tumida* (sensu stricto). To our eye the baculum of the specimen from Puna Island, Ecuador, most closely resembles the bacula of *R. minutilla*. It is interesting to note that *R. minutilla* is a coastal and island form in the xeric regions of Venezuela and Colombia and the Puna Island locality matches well this ecological situation. Therefore, we are uncomfortable assigning the Ecuador specimens to a specific taxon and more study is needed. Chromosomal data from both *R. minutilla* and the Ecuador population should be valuable in establishing these relationships.

We think that there are ten species in the genus *Rhogeessa* that should be recognized. *Rhogeessa alleni* and *R. gracilis* are the outliers relative to the other species and *R. mira* may well be as distant to the remaining taxa as are *R. alleni* and *R. gracilis* (LaVal, 1973). The

relationship of *alleni*, *gracilis*, and *mira* to each other and to members of the *R. tumida* complex merits further study. Within what we will call the *R. tumida* complex there are seven species. *Rhogeessa tumida* is distributed along the Atlantic versant of Mexico southward to Honduras where it is found on both the Pacific and Atlantic versants. *Rhogeessa parvula* is distributed in Mexico from Sonora to Guerrero and Oaxaca. *Rhogeessa genowaysi* is known from a restricted area in Chiapas, Mexico. The distribution of *Rhogeessa io* is as described above. The $2N = 32B$ form described by Baker et al. (1985) from Belize has been shown to occur in Belize, northern Guatemala, and throughout the Yucatan Peninsula by Audet et al. (1993). The senior synonym applied to this taxon was *Rhogeessa aeneus* Goodwin, 1958 (Audet et al., 1993). *Rhogeessa minutilla* is found along the north coast of South America on Margarita Island, Venezuela, and Colombia. The species we are describing herein is from northeastern South America. The geographic relationship of these taxa can be seen in Figure 1 and Baker (1984).

An overview of the geographic distribution of the *tumida* complex indicates that areas of sympatry are uncommon and parapatry may be the common relationship at species boundaries. Our working hypothesis is that

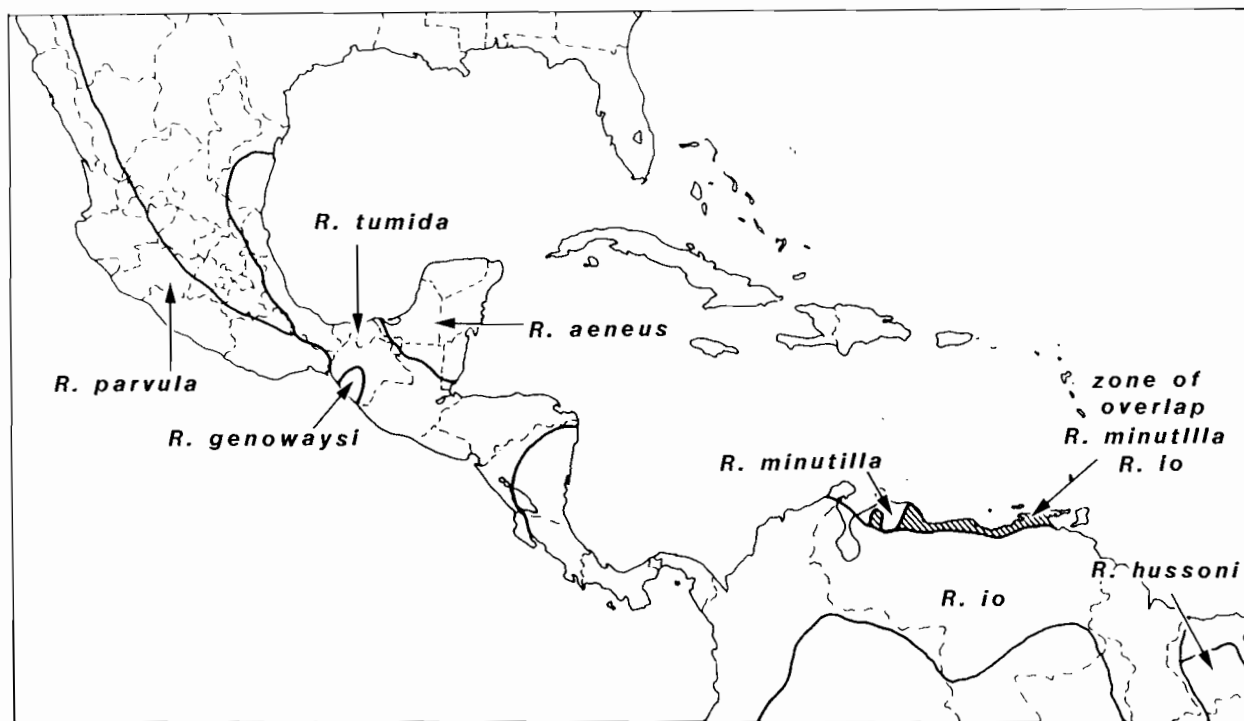


Fig. 1. Approximate geographic distribution of the seven species in the *Rhogeessa tumida* - complex. Exact geographic boundaries and areas of potential sympatry between species are yet to be fully studied. Records from Brazil and Ecuador are not shown (see text and LaVal, 1973).

this pattern is the result of speciation of a once wide spread single species and the relationships among species will in most cases reflect geographic associations. When the geographic distribution of the *R. tumida* complex is contrasted with that observed for the other vespertilionid genera such as *Myotis*, *Lasiurus*, and *Eptesicus*, the pattern seen in *Rhogeessa* appears exceptional. In the former three genera, sympatry among species is common and examples of parapatry are not well documented.

The new taxon described below is from Suriname in northeastern South America and the species of *Rhogeessa* that are in a geographic position to hybridize with the new species are *R. io* defined above and *R. minutilla* from along the coast of Venezuela and Colombia.

Rhogeessa hussoni, new species

Holotype.—Adult female, skin and skull, Carnegie Museum of Natural History no. 63934, from Suriname: Nickerie District; Sipaliwini Airstrip; obtained on 18 August 1979 by Jane A. Groen and Stephen L. Williams; original no. Jane A. Groen 1058; special no. TK 10150.

Distribution.—Northeastern South America (Fig. 1). Known with certainty from only two localities, one in extreme southwestern Suriname in Nickerie District and the other from the state of Bahia in northeastern Brazil. However, the specimen from Alto Parnaíba, Maranhão, Brazil, reported by Goodwin (1958) and LaVal (1973) may best be assigned to this species. It is a skin only in the Field Museum with a length of forearm of 29.5 (Goodwin, 1958) which is larger than any *R. minutilla* (Ruedas and Bickham, 1992) and at the upper end of the variation of *R. io*. On the other hand, measurements for specimens from southern Guyana (LaVal, 1973) are relatively small and we continue to assign them to *R. io* until more information, particularly karyotypes, are available from this area.

Selected measurements.—The following external measurements (in millimeters) of the holotype follow those of Ruedas and Bickham (1992): length of forearm, 30.2; metacarpal of digit 3, 29.0; first (proximal) phalanx of digit 4, 27.8; first phalanx of digit 4, 9.3; metacarpal of digit 5, 28.2; first phalanx of digit 5, 7.3.

Cranial measurements (in millimeters) of the holotype (Fig. 2) and a subadult female from Bahia, Brazil (CM 100,000), after Ruedas and Bickham (1992) are as follows: breadth of braincase, 5.7, 5.5; condylobasal length, 10.0, 9.1; depth of braincase, 4.7, 4.6; greatest length of skull, 13.2, 12.8; mastoid breadth, 7.1, 6.8; length of mandibular tooththrow, 5.2, 5.2; length of maxil-

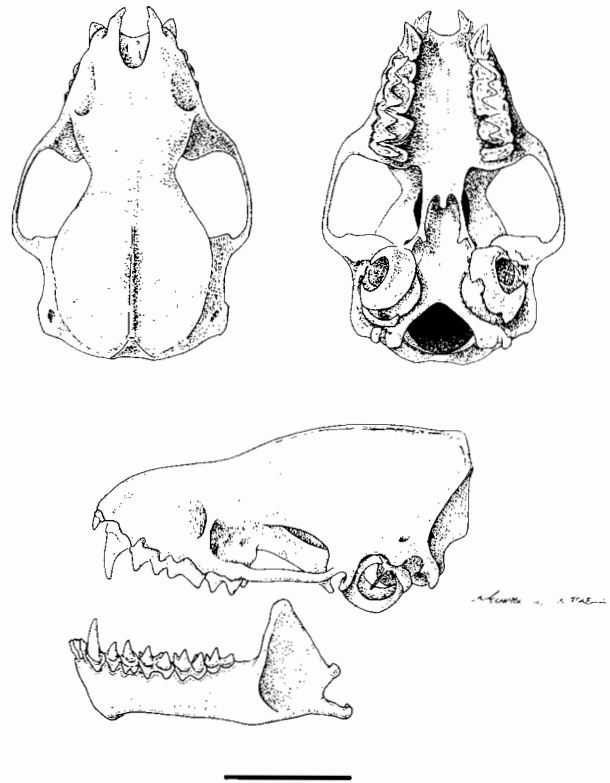


Fig. 2. Dorsal, ventral, and lateral views of the cranium and lateral view of the mandible of the female holotype of *Rhogeessa hussoni* from Suriname (CM 63934). Bar equals 5 mm.

lary tooththrow, 4.7, 4.5; postorbital breadth, 3.2, 3.2; postpalatal length, 4.7, -; width across upper canines, 3.8, 3.7; width across upper molars, 5.6, 5.5; zygomatic breadth, 8.9, -.

Diagnosis.—Diploid number equals 52 (Fig. 3) with a fundamental number of 52. Size relatively large compared to other South American species of the genus *Rhogeessa* with a proportionally short mandibular tooththrow.

Comparisons.—*Rhogeessa hussoni* is distinguished by having a diploid number 52 from other members of the genus for which the karyotype is known, including *Rhogeessa genowaysi* $2N=42$, *R. parvula* $2N=44$, *R. io* $2N=30,32$, *R. tumida* $2N=34$, and *R. aeneus* $2N=32$.

LaVal (1973) cites several characters by which *Rhogeessa minutilla* and *R. tumida* [= *io*] can be distinguished in northwestern Venezuela. The holotype of *R. hussoni* fits several of the characters of *R. io* more closely than *R. minutilla*. Among these characters are lack of a "helmet" on the cranium, postorbital breadth of 3.2, teeth unworn, and the third metacarpal more than 1 mm shorter than the forearm.



Fig. 3. Representative karyotype of the female holotype of *Rhogeessa hussoni* from Suriname (CM 63934). The first pair of biarmed chromosomes are assumed to be the X-chromosomes. This figure is reprinted from Honeycutt et al., 1980.

Overall size is large compared to the other two South American species of the genus, *R. minutilla* and *R. io*, except that the length of the mandibular tooththrow is proportionally and actually shorter than in these two species. The external measurements of the holotype exceed the range of variation in a series of nine *R. minutilla* and 10 *R. io* [under the name *tumida*] (Ruedas and Bickham, 1992) in four of the eight measurements studied including (range for *R. minutilla* followed by *R. io*) metacarpal of digit 3 (25.7-28.0; 26.2-28.4), second phalanx of digit 3 (8.7-10.2; 8.8-10.0), metacarpal digit 4 (25.1-27.6; 25.9-27.4), and metacarpal of digit 5 (26.0-27.9; 26.3-27.8). The cranial measurements of the holotype exceed the range of variation of these same series in five of the 11 measurements studied including condylobasal length (8.7-9.8; 8.5-9.1), greatest length of skull (11.8-12.9; 11.7-12.6), postpalatal length (4.1-4.4; 4.0-4.4), width across upper canines (3.3-3.7; 3.4-3.6), and width across upper molars (5.0-5.5; 5.0-5.4). On the other hand, the length of the mandibular tooththrow of the holotype is 5.2 which is under the range of variation in these samples (5.3-6.0; 5.4-5.7) presented by Ruedas and Bickham (1992).

The specimen examined from Brazil is a subadult female with the phalangeal epiphyses still clearly open. There is not a karyotype available for this specimen, but we have assigned it to *R. hussoni* because of its short mandibular tooththrow which is fully erupted.

Remarks.—Diploid numbers reported for the *Rhogeessa tumida* complex are 30, 32, 34, 42, 44, and 52 (Bickham and Baker, 1977; Baker, 1984; Honeycutt et al., 1980). When described, five of these values (30, 32, 34, 42, and 52) were reported for what at that time was recog-

nized as a single species, *R. tumida*. Part of the variation within *tumida* was removed when Baker (1984) described the $2N = 42$ form as *R. genowaysi*. The justification for specific distinctiveness of the $2N = 42$ form was the sympatric occurrence of the $2N = 42$ and the $2N = 34$ forms. The $2N = 34$ cytotype is widely distributed and includes the type locality of *tumida*, whereas the $2N = 42$ cytotype is restricted to a small geographic region in Chiapas, Mexico. Without chromosomal data, the existence of *R. genowaysi* would not have been detected, as exhaustive examinations of the two have failed to provide morphological features or measurements to distinguish between them (J. K. Jones, Jr., and D. C. Carter, pers. comm.).

The description of the $2N = 52$ cytotype herein, does not have the clear cut situation established by sympatric occurrence. However, several aspects of the karyotypic data from South American taxa indicate it is appropriate to describe *R. hussoni* at the specific level.

Over one hundred species of vespertilionid bats have been karyotyped (McBee et al., 1986) and certain patterns are evident. For this family the primitive karyotype is proposed to be $2N = 44$ with a G-band karyotype like that found in most *Myotis* (Bickham, 1979a, 1979b). For species with a higher diploid number like *Eptesicus fuscus*, centric fissions are proposed to have occurred. Such a series of fissions are required to derive the proposed karyotype primitive for *Rhogeessa* (Baker et al., 1985). Baker et al. (1985) proposed that two biarmed autosomes (the 16/17 and the 20/18) and a biarmed X were present in the karyotype primitive for *Rhogeessa*. They proposed that the 20/18 was a synapomorphy for the genus, however, the 16/17 was primitive for all vespertilionids. Because we have karyotyped only a female for *R. hussoni* and no G-bands have been produced we are forced to estimate the evolution of the karyotype from nondifferentially stained chromosomes. We suspect that the large biarmed element in *R. hussoni* is the X and the two other smaller biarmed elements are likely autosomes. If one of the smaller elements is the 20/18 then other events are required to derive the *R. hussoni* karyotype from that proposed as primitive for *Rhogeessa*. These events are likely the fission of the 16/17 or 20/18 and the fragmentation of one other acrocentric to elevate the karyotype to a $2N = 52$. Perhaps, both the 20/18 and the 16/17 are fissioned and the two other biarmed autosomes are from pericentric inversions. Unfortunately, all of this is speculation, but, it is clear that several events are required to produce the *R. hussoni* karyotype

from that proposed as primitive for *Rhogeessa* and several events are required to relate the *R. hussoni* karyotype to that known for any described for an extant species. Therefore, the most conservative course of action is to describe *R. hussoni* as a distinct species. In fact, if we were to describe *R. hussoni* as a subspecies based on the available chromosomal data, we would not know in which recognized species to place it.

Etymology.—It is our pleasure to name this species in honor of the late Dr. A. M. Husson, the former Curator of Mammals of the Rijksmuseum van Natuurlijke Historie in Leiden, The Netherlands, in recognition of his major contributions to the study of South American mammals through his monographs on the bats of Suriname (1962) and the mammals of Suriname (1978).

Specimens examined (2).—Suriname: Nickerie District; Sipaliwini Airstrip 1 (CM). Brazil: Bahia; Fazenda Sao Raimundo, Juazeiro da Bahia, 1 (CM).

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