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A SYMPATRIC CRYPTIC SPECIES OF MAMMAL: A NEW SPECIES OF *RHOGEESSA* (CHIROPTERA: VESPERTILIONIDAE)

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Abstract.—A new species of bat from the genus *Rhogeessa* is described, which would not have been recognized as distinct if the karyotypes had not been available. The discovery of this species clearly documents that it is possible for two sympatric species of mammals to be so similar in external and cranial morphology that without chromosomal, genic, or some other data, a researcher would never realize a local sample contained more than a single biological species. [Cryptic species; karyotypes; morphometrics; Vespertilionidae; *Rhogeessa*.]

In examinations involving defense of theses and dissertations, I have often heard the question asked, "How do you know the sample of animals that you studied was not composed of two morphologically cryptic species?" The question is a critical one, because the implications of data collected in many studies could be quite different if more than a single species were included in a sample. However, I am not aware of an example from the class Mammalia in which two sympatric species cannot be distinguished by classical methods utilizing morphology. The following description of a new species is from a sample containing two species that would not have been recognized as distinct from each other if chromosomal data had not been available. This example serves as a warning that two cryptic species of mammals may exist sympatrically, yet be indistinguishable by classical methods of identifying congeneric taxa.

In the course of chromosomal studies on New World bats, it has become apparent, for the reasons listed below, that there is an undescribed species in the *tumida-parvula* complex of the genus *Rhogeessa*. The purpose of this paper is to describe this species and to point out the implication of its discovery.

Rhogeessa genowaysi, new species

Holotype.—Adult female, skin and skull number 36139 of The Museum, Texas Tech University; from Mexico; Chiapas; 23.6 mi by road (Mex. Hwy 200) northwest of Huixtla; obtained on 20 May 1981 by David Webster, Laurie Robbins, and Lynn Robbins; original number Lynn W. Robbins 10592; karyotype number TK 20584.

Geographic distribution.—Known only from two localities on the Pacific lowlands of southern Chiapas (Fig. 1). Baker and Patton (1967) listed their five specimens as collected from "km 184 on Hwy 200 E Huixtla." Examination of my field notes reveals that this locality is NW (not east) of Huixtla and the two localities are at most a few kilometers apart.

Description.—The skull of *Rhogeessa genowaysi* is shown in Figure 2. This species is unique when compared to most described mammalian species because, if it were not for karyotypic data, *R. genowaysi* probably never would have been distinguished from the more widely distributed *R. tumida*. Therefore, the means of distinguishing *R. genowaysi* from *R. tumida* is, of necessity, chromosomal and genic. *Rhogeessa genowaysi* has a diploid number (2N) of 42 (Fig. 3A), whereas *R. parvula* has a 2N = 44 (Fig. 3B) and *R. tumida* has chromosomal races with 2Ns of 30, 32, 34, and 52 (Figs. 1 and 3C, 3D, and 3E; Baker and Patton, 1967; Bickham and Baker, 1977; Honeycutt et al., 1980). *Rhogeessa genowaysi* is sympatric with the 2N = 34 form of *R. tumida* and, at the type locality, 30 individuals of *Rhogeessa* that were collected with mist-nets were karyotyped (11 were *R. genowaysi* and 19 were *R. tumida*).

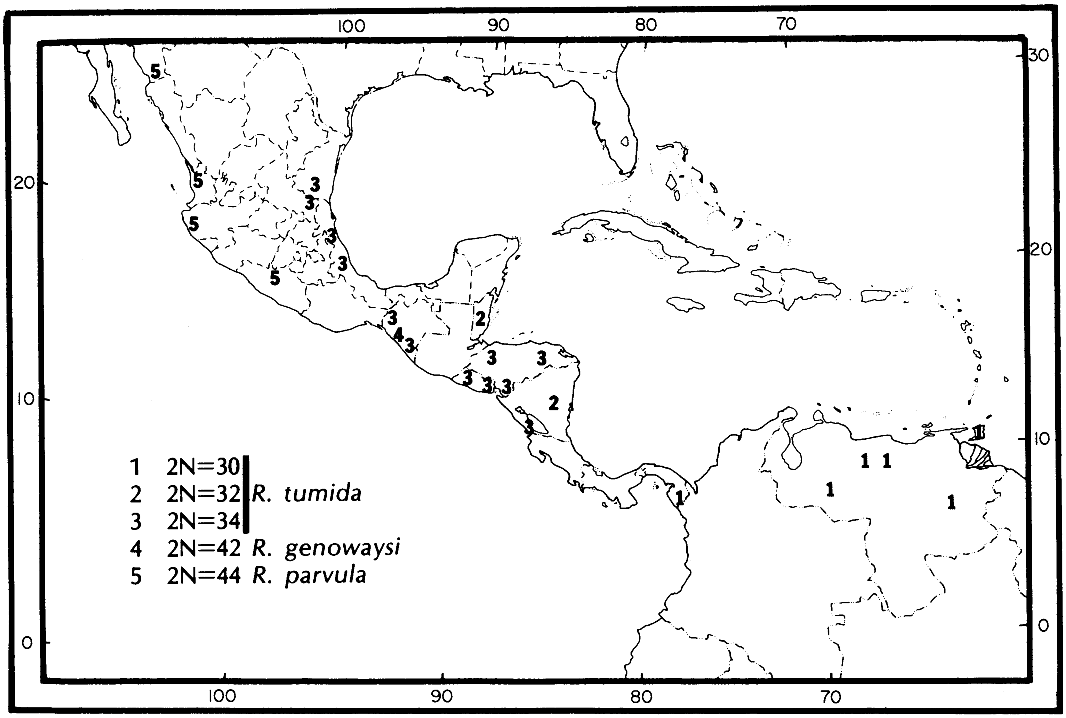

FIG. 1. Geographic distribution of chromosomal morphs of the *Rhogeessa tumida–parvula* complex. At the type locality of *R. genowaysi*, the 2N = 34 *R. tumida* was also present. Not shown is the 2N = 52 form collected in Suriname which is beyond the limits of this map.

No individuals with intermediate karyotypes have been found. *Rhogeessa genowaysi* also differed from *R. parvula* (2N = 44, Fig. 3B) in karyotype as *R. parvula* is distinguished from *R. genowaysi* in diploid number as well as in the placement of centromeres and size of the biarmed elements. The similarity of diploid numbers between *R. genowaysi* and *R. parvula*, however, still raises the possibility that the two taxa may be conspecific.

An electrophoretic comparison of two

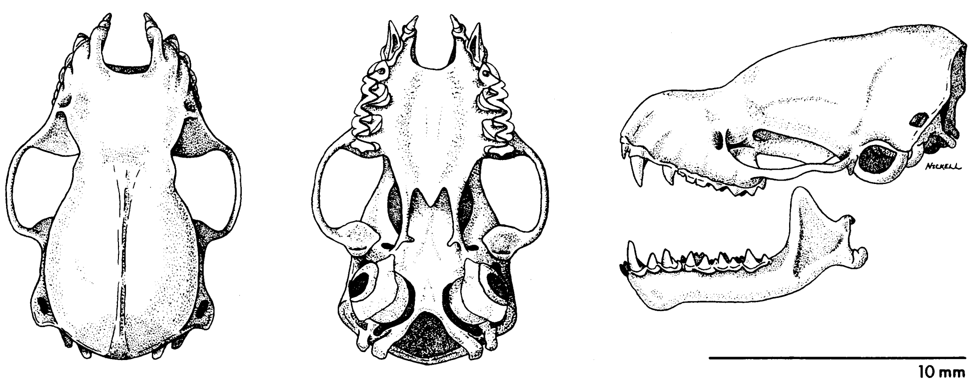

FIG. 2. Dorsal, ventral and lateral views of the cranium, and lateral view of the lower jaw of *Rhogeessa genowaysi*.

TABLE 1. Measurements (mm) of *Rhogeessa genowaysi* and *R. tumida,* and *F* values from two-way ANOVA (species × sex).

Specimen	Sex	Measurements[a]								
		FA	GLS	CBL	ZB	MB	IOB	MAXT	MAND	EAR
R. genowaysi										
TTU 36169[b]	F	29.4	13.4	12.8	8.9	7.4	3.5	4.9	9.2	12
TTU 36170	M	28.5	12.1	11.4	7.6	6.5	3.0	4.2	9.1	12
TTU 36171	F	30.5	13.2	12.7	8.7	7.3	3.3	4.7	9.1	11
UA 15338	M	29.3	13.5	12.5	—	7.3	3.4	5.3	9.2	10
UA 15339	F	29.1	13.5	12.6	8.7	6.8	3.2	5.3	9.4	11
UA 15340	M	29.5	12.9	12.2	—	7.1	3.4	4.7	9.3	11
UA 15739	F	27.8	13.6	12.7	8.6	7.0	3.2	4.8	9.5	11
UA 15740	M	29.4	13.2	12.2	8.5	6.8	3.2	4.5	9.3	11
TTU 29101	F	28.2	13.9	12.9	9.1	7.4	3.5	4.7	9.5	—
TTU 29103	F	29.9	13.6	12.8	9.1	7.3	3.3	4.9	9.2	—
TTU 29104	F	28.7	12.9	11.9	—	6.6	3.3	4.6	8.9	—
TTU 29106	M	30.5	12.6	12.0	—	6.8	3.1	4.3	8.6	—
TTU 29108	F	30.4	13.5	12.5	8.5	7.3	3.3	4.6	9.3	—
R. tumida										
TTU 36160	F	27.8	12.5	12.0	8.4	7.0	3.2	4.4	8.8	—
TTU 36166	F	28.5	13.0	12.1	—	6.9	3.4	4.6	9.1	14
TTU 29098	F	28.1	12.6	11.9	8.3	6.8	3.3	4.5	8.9	—
TTU 29100	F	30.0	12.9	12.2	8.4	7.2	3.1	4.7	9.1	—
TTU 29102	F	30.3	13.1	12.2	—	6.9	3.0	4.5	8.8	—
TTU 29105	M	28.2	13.8	12.6	9.1	7.6	3.4	4.8	9.3	—
TTU 29109	F	29.7	12.2	11.9	8.2	6.9	3.2	4.5	8.8	—
TTU 36162	M	28.6	12.7	12.2	8.2	7.1	3.3	4.5	8.9	13
TAM 35147	M	28.6	13.3	12.6	8.8	7.4	3.4	4.6	9.1	—
TAM 35145	M	29.9	12.8	12.1	8.4	6.9	3.1	4.5	8.8	—
TTU 36163	F	27.9	12.6	12.1	8.3	6.8	3.1	4.4	9.1	13
TTU 36164	F	29.6	12.9	12.0	7.7	6.7	3.0	4.5	9.1	11
TTU 36161	F	29.1	12.6	11.9	7.7	6.9	3.2	4.3	9.0	13
TTU 36165	M	28.4	12.4	11.9	—	6.8	3.1	4.5	9.1	13
F values[c]										
Model		0.64	5.16**	6.80**	5.77**	1.93	1.86	2.71	3.13*	5.39*
Species		1.49	7.08*	6.44*	4.35	0.27	2.44	5.20	7.00*	11.07**
Sex		0.01	0.79	1.61	0.01	0.02	0.00	0.36	0.27	1.50
Species × sex		0.41	7.63*	12.36**	12.96**	5.49	3.13	2.55	2.12	3.60

[a] FA = forearm; GLS = greatest length of skull; CBL = condylobasal length; ZB = zygomatic breadth; MB = mastoid breadth; IOB = interorbital breadth; MAXT = maxillary toothrow length; MAND = mandibular length; EAR = ear length.
[b] Holotype of *R. genowaysi.*
[c] Two-way analysis of variance: *, $P < 0.05$; **, $P < 0.01$.

specimens of *R. genowaysi* with two specimens of *R. parvula* revealed that within this limited sample these two taxa are fixed for alternative alleles at 6 (peptidase-2, leucine-aminopeptidase, glutamate oxalate transaminase-1, α-glycerophosphate dehydrogenase, isocitrate dehydrogenase-2, and malate dehydrogenase) of the 20 presumed loci examined. Additionally, the two specimens of *R. genowaysi* had fixed allozymic differences distinguishing it from individuals of the 2N = 30, 32, 34, and 52 cytotypes of *R. tumida.* Genically, *R. genowaysi* appears to be more closely related to the 2N = 34 cytotype with which it is sympatric.

Measurements.—Standard measurements for the holotype were recorded in the field as 76-28-7-12 (in millimeters). Forearm and cranial measurements for the holotype and 12 adult individuals of *R. genowaysi* are given in Table 1. Additional measurements for species of *Rhogeessa* are given by Goodwin (1958) and LaVal (1973). Table 1 also lists measurements for 14 adult specimens of *R. tumida* collected at the *R. geno-*

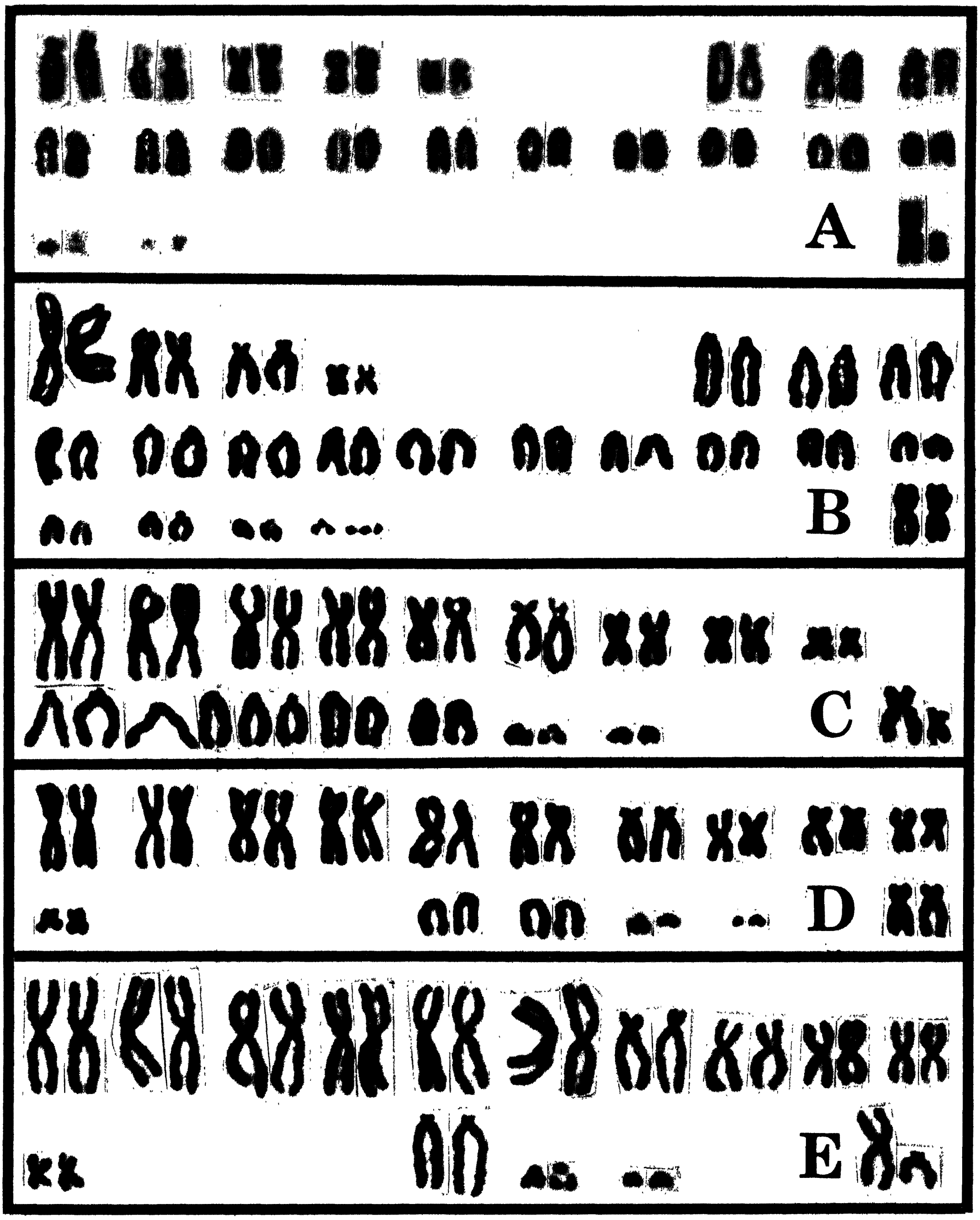

FIG. 3. (A) Standard karyotype of a male topotype of *Rhogeessa genowaysi*. (TTU 29106). (B) Standard karyotype of a female *Rhogeessa parvula* from 4 km N Ouichimichis, Nayarit (voucher specimen in the Collection of Mammals, University of Arizona). (C) Standard karyotype of a male *Rhogeessa tumida* (2N = 34) from 5 mi N and 1 mi W San Juan del Sur, Nicaragua (TTU 13321). (D) Standard karyotype of a female *Rhogeessa tumida* (2N = 32) from 4.5 km NW Rama, Nicaragua (TTU 13313). (E) Standard karyotype of *Rhogeessa tumida* (2N = 30) from Maracas, Trinidad (TTU 24129).

waysi type locality. A two-way analysis of variance (ANOVA) indicates that three of the seven cranial characters vary significantly between the two species (Table 1). However, a discriminant function based on the 27 animals of known sex incorrectly classifies three of the specimens, even though sex is used as a discriminant variable along with the seven cranial characters. For the individuals listed in Table 1, *R. genowaysi* has shorter ears than *R. tumida* ($F = 11.07$, $P < 0.01$). Examination of about 40 other *R. tumida* in the Texas Tech University collections indicates that this relationship generally holds, although there is some overlap in the 11 to 12 mm range. I did not include ear length in the discriminant analysis, as this would have resulted in an unacceptably small sample (relative to the number of variables) of *R. genowaysi.*

The significant interactive effect in three of the characters suggests differences in degree or direction of sexual variation in the two species. Separate one-way ANOVAs indicate that *R. tumida* does not vary significantly between sexes in any of the measured characters, but that in *R. genowaysi* females are larger in greatest length of skull, condylobasal length, and zygomatic breadth (F values of 6.57, 7.59 and 8.22, respectively; $P < 0.05$ in each case). Thus, the primary manner in which these two species differ morphometrically is in the extent of secondary sexual variation.

Ecology.—Specimens of *R. genowaysi* have been taken under the canopy of mature second growth lowland tropical forest. This locality is a few meters above sea level.

Etymology.—The specific name *genowaysi* is a patronym for my close friend, Hugh H. Genoways, in recognition of his outstanding contributions to systematic mammalogy.

DISCUSSION

The ultimate test of specific distinctness is sympatric distribution without hybridization. *Rhogeessa genowaysi* passes such a test, for there are no intermediate karyotypes in the 30 individuals (11 *genowaysi* and 19 *tumida*) collected at the type locality. Therefore, it seems safe to assume specific status for the two sympatric cytotypes even though I failed to find any cranial or other morphological features that completely distinguish the two. Undoubtedly, the most significant aspect of *R. genowaysi* is the demonstration by its discovery that two sympatric species of mammals can be so similar in external and cranial morphology that—without chromosomal, genic, or some other data—a researcher would never realize that a local sample contained more than a single biological species (see LaVal, 1973:35). No matter how rare morphologically cryptic species are among mammals, these data serve as a caveat indicating that such a possibility is a reality. Only after many additional chromosomal, electrophoretic, and other types of studies are conducted on substantial samples from single localities will there be sufficient data to determine if the situation described for *R. tumida* and *R. genowaysi* is an isolated example or if it is only the "tip of the iceberg."

For higher vertebrates, cryptic species may be a significant problem. Studies on such groups as birds (Stein, 1958, 1963; Johnson, 1980), frogs (Bogart and Wasserman, 1972; Miyamoto, 1983), and *Rhogeessa* document that cryptic species exist in a diversity of taxonomic groups. What is not clear from the available literature is the frequency of the phenomenon.

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