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Diaemus youngi.

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Diaemus Miller, 1906

Diaemus Miller, 1906:84. Type species *Desmodus youngi* Jentink.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Phyllostomidae, Subfamily Desmodontinae (Koopman, 1993). The genus *Diaemus* is monotypic.

Diaemus youngi (Jentink, 1893)

White-winged Vampire Bat

Desmodus youngi Jentink, 1893:282. Type locality "upper Canje Creek, a tributary of the Berbice River, British Guiana" (=Guyana).

Diaemus youngi cypselinus Thomas, 1928:288. Type locality "Peru, Loreto; Pebas."

CONTEXT AND CONTENT. Context as noted above. *Diaemus* is regarded as a valid genus along with *Desmodus* and *Diphylla*. No subspecies are recognized (Koopman, 1988, 1993).

DIAGNOSIS. *Diaemus* resembles *Desmodus* and *Diphylla* (Fig. 1), but is recognizable from other genera of vampire bats by characters which include ear length and shape, thumb size, and wing tip coloration, as well as presence, absence, and shape of the metacarpal pads and calcar. The ears of *Diaemus* (and *Desmodus*) are longer than broad, whereas in *Diphylla* the reverse is true. In *Desmodus*, a well developed fold of skin connects the ear to the upper part of the head and the outer margin of the ear terminates in a larger and much more rounded wart above the eye than in *Diaemus* (Jentink, 1893). The tragus of *Diaemus* is hairy on the anterior surface and the outer margin is not toothed as in *Desmodus* (Jentink, 1893). Compared to *Desmodus*, the thumb of *Diaemus* (and *Diphylla*) is relatively short (approximately one eighth the length of the third digit). In *Desmodus*, the thumb is approximately one fifth of the length of the third digit. In *Diaemus*, there is a single pad under the metacarpals. In *Diphylla*, the metacarpal pads are absent and in *Desmodus*, there are two pads under each metacarpal. The calcar is absent in *Diaemus*, greatly reduced in *Desmodus*, and small (approximately 3 mm) and digitiform in *Diphylla* (Koopman, 1988). *Diaemus* is the only vampire genus with white tipped wings. The coronoid process of the mandible is high in *Diaemus* (Fig. 2) and rises above the condyle. In *Diphylla*, the coronoid process is very low but rises above the condyle, whereas in *Desmodus* the coronoid process is high and on a level with the condyle. The dental formula of *Diaemus* is i 1/2, c 1/1, p 1/2, m 2/1, total 22, but the posterior upper molar is vestigial and often lost in old individuals. The dental formulae of *Diphylla* and *Desmodus* are i 2/2, c 1/1, p 1/2, m 2/2, total 26 and i 1/2, c 1/1, p 1/2, m 1/1, total 20, respectively. In *Diphylla*, the lower incisors are larger and form a more or less continuous cutting edge. The lower incisors of *Diaemus* tend to be rather irregular and variable in both kind and degree of lobation. The lower incisors of *Desmodus* are strongly bilobate and in *Diphylla*, the median incisor has four beadlike lobes, and the lateral incisor has seven. The anterior upper molar has a prominent medial cusp in *Diaemus*, which is absent in *Desmodus* and *Diphylla* (de la Torre, 1956; Goodwin and Greenhall, 1961; Husson, 1962; Koopman, 1988; Fig. 2).

GENERAL CHARACTERS. *Diaemus youngi* is a medium-sized, robust, close-furred bat. The ears are moderately long and separate. The lower lip is grooved vertically, the muzzle is short, and the circumnarial ridge suggests a noseleaf without a secondary noseleaf. The eyes are large and shiny. The forearm is sparsely haired. The calcar is absent and there is no evident tail. The interfemoral membrane is narrow and sparsely haired. Pelage color is usually glossy clay, light brown, or dark cinnamon brown. Borders and edges of the wings are white, and the membrane between the second and third fingers is largely white.

Mean external measurements (mm) of 11 males and four females from Venezuela followed by ± *SD*, are (values for males listed first): length of head and body, 83.36 ± 5.35, 84 ± 2.94; length of foot, 17.91 ± 1.3, 19.5 ± 1.29; length of ear, 18.18 ± 1.33, 18.75 ± 0.5; and length of forearm, 51.65 ± 1.39, 53.48 ± 1.24 (Eisenberg, 1989). Cranial measurements of five males and five females from Venezuela and Trinidad are (values for males listed first): greatest length of skull, 24.6 ± 0.8, 24.8 ± 0.8; zygomatic breath, 13.8 ± 0.5, 13.9 ± 0.2; postorbital constriction, 6.1 ± 0.17, 6.2 ± 0.2; breath of braincase, 13.0 ± 0.3, 13.0 ± 0.3; and length of maxillary toothrow, 3.3 ± 0.12, 3.5 ± 0.2 (Goodwin and Greenhall, 1961; Swanepoel and Genoways, 1979). Body masses (g) for 10 males and five females from Trinidad are 31.7–41.3 and 37.5–48.1, respectively, and include two gravid individuals (46.2 and 48.1—Goodwin and Greenhall, 1961). Additional measurements appear in Bhatnagar (1988), Goodwin and Greenhall (1961), Hall (1981), Handley (1976), Hussen (1962), Koopman (1988), Lay (1963), Ray et al. (1988), Redford and Eisenberg (1992), Swanepoel and Genoways (1979), and Villa-R. (1967). Photographs of live animals appear in Greenhall (1988), Nowak (1991), and Uieda (1993, 1994).

DISTRIBUTION. *Diaemus youngi* is rare or uncommon throughout most of its geographic range. In North America, the white-winged vampire bat has been recorded from southern Tamaulipas in northeastern Mexico, south through eastern Mexico to

FIG. 1. *Diaemus youngi* from Tamualipas, Mexico. Photograph by Bruce Hayward.

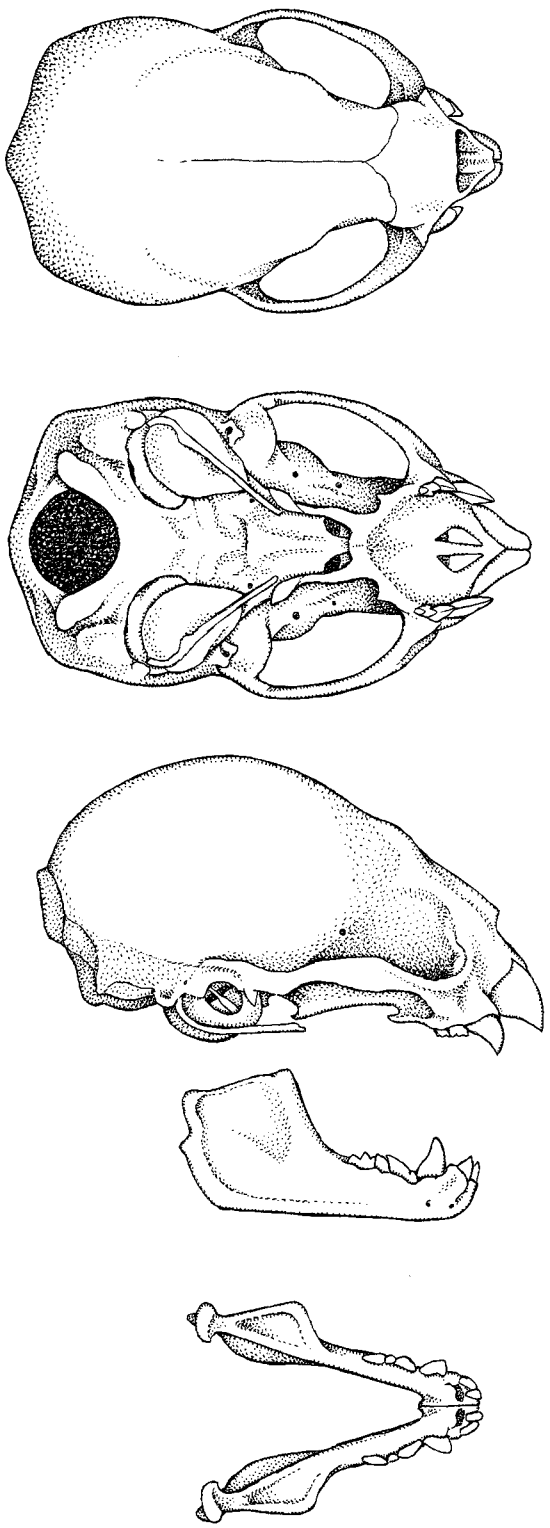

FIG. 2. Lateral, ventral, and dorsal views of cranium and occlusal and ventral views of mandible of *Diaemus youngi*. Greatest length of cranium is 24.9 mm.

Central America and Panama (Hall, 1981; Reddell, 1981; Fig. 3). In South America, its range extends across the Amazon basin and the Guianas south to northern Argentina and southwestern Brazil (Barquez, 1984; Delpietro et al., 1973; Linares, 1987; Osgood, 1912; Sanborn, 1949). It does not occur west of the Andes south of Colombia (Koopman, 1988). In the West Indies, it is found on the islands of Margarita and Trinidad (Goodwin and Greenhall, 1961). There is no fossil record for *Diaemus youngi* (Ray et al., 1988).

FORM AND FUNCTION. In *Diaemus youngi*, both sexes possess cup-shaped oral scent glands (Fig. 4) located bilaterally inside the mouth. These glands are not obvious until the bat is disturbed, at which time the glands are directed forward and emit an offensive odor. The following amino acids are present in these glands: aspartate, glutamate, alanine, norvaline, and (doubtfully) lysine. The function of the glands is unknown, but it may be an anti-predator mechanism (Goodwin and Greenhall, 1961; Greenhall, 1988) or involved in territory marking and individual recognition (Schutt, 1995). An individual taken in July from Margarita Island, Venezuela, had quiescent glands while those of other specimens, collected the same month on the nearby mainland, were active (Smith and Genoways, 1974).

Teeth in *Diaemus youngi* are similar to *Desmodus* but with lower incisors curving inward. The median incisors and canines are pointed and have long cutting edges utilized for shaving hair and feathers, and for piercing skin for feeding. The cheek teeth are non-occlusive and without grinding surfaces (Miller, 1907). The teeth of *Desmodus* are kept sharp by thegosis, a process in which individual cutting edges of a tooth cross with the cutting edges of other teeth. This tooth sharpening mechanism appears similar in *Diaemus youngi* (Greenhall, 1972). It was initially reported that, unlike most mammalian teeth, those of vampire bats lack enamel (Greenhall, 1988). Another report, however, indicated that all three genera of vampires possess teeth with fully developed enamel (Bhatnagar and Wimsatt, 1989).

Because of their unique blood feeding habits, vampire bats face the problem of inactivating the hemostatic mechanism of their host. Limited information on white-winged vampire bats indicates that their saliva (like *Desmodus*) possesses a plasminogen activator (an enzymatic substance which causes rapid lysis of blood clots), a platelet aggregation inhibitor, and several anticoagulants (Cartwright and Hawkey, 1968; Hawkey, 1988). Whereas desmokinase (the plasminogen activator from *Desmodus* saliva) shows considerable specificity for mammalian blood, the substance extracted from *Diaemus youngi* saliva also could activate avian plasminogen (Hawkey, 1988). The stomach of *Diaemus youngi* is elongated but is less tubular and more conical in shape than the intestiniform stomach of *Desmodus* (Forman et al., 1979).

In the post-cranial skeleton, the sternum has a manubrium, six sternebrae and a xiphoid process. The first costal cartilage is large and wide and the second attaches at the sternal angle. The costal cartilages are parallel to each other and about as long as the wings of the manubrium. The humerus is robust with a prominent pectoral ridge. The ulna is fused distally with the radius. The pelvic spine is long and diverging at the cranial tip. The inferior ischial rami are thick (Bhatnagar, 1988). The femur is robust and thicker relative to its length than in most species of bats. It was proposed that sturdy hindlimb bones reflect the increased compressive forces under which vampire bat hindlimb bones are loaded during quadrupedal locomotion (Howell and Pylka, 1977). The lateral and medial surfaces of the tibia are grooved and the anterior surface is rounded (but less so than in *Desmodus*). The tibia is T-shaped in cross section. The fibula is complete, thin cranially, and laterally compressed (Bhatnagar, 1988; Koopman, 1988). The sturdy hind limb bones of *Diaemus youngi* and *Desmodus* appear to be adaptations for complex quadrupedal locomotion. The shorter thumb, however, resembles that of *Diphylla*, and may be one of several factors which prevent *Diaemus youngi* from exhibiting the agile ambulatory acrobatics of *Desmodus* (Schutt et al., 1993).

The thumb and hindlimb digits of white-winged vampire bats do not have the digital locking mechanism seen in most bats (Schutt, 1992, 1993). As in *Desmodus* and *Diphylla*, there are two digital flexor tendon retinacula, the inner surfaces of which are devoid of plicae. Additionally, digital flexor tendon surfaces are smooth and lack scales or foliations. Absence of the passive digital lock in vampire bat ancestors may have been one of a number of factors that 'preadapted' these bats to the highly specialized quadrupedal locomotion required for blood feeding (Schutt, 1993).

Vampire bats have very high indices of encephalization (approximately 240), which are comparable to the family Pteropodidae. Six specimens of *Diaemus youngi* from Venezuela, with body masses ranging from 31.6–38.0 g, had brain masses which ranged from 910–1,020 mg. In comparison, 12 specimens of *Desmodus* from

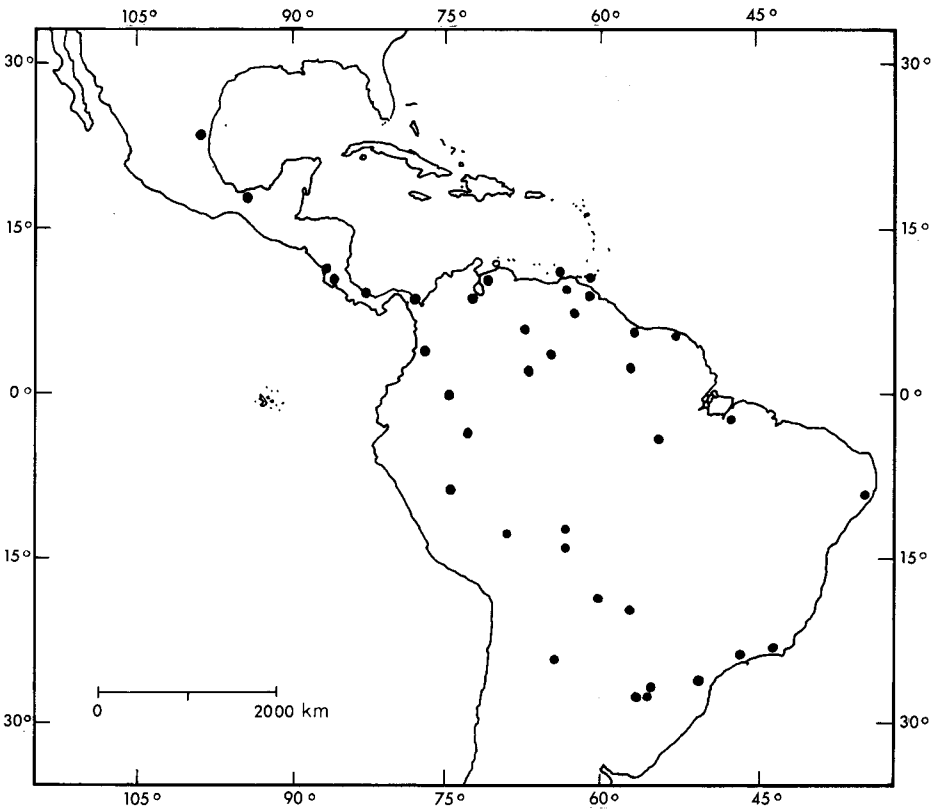

FIG. 3. Geographic distribution of *Diaemus youngi*. See text for collecting localities and marginal records.

Venezuela and Mexico had body masses ranging between 21.1–35.6 g, and brain masses of 660–930 mg (Pirlot and Stephen, 1970). One explanation for higher indices of encephalization in *Diaemus* and *Desmodus* (compared to *Leptonycteris*, *Artibeus jamaicensis* and *Carollia*) may be the specialized feeding habits of vampire bats. These bats utilize complicated behavior (including highly variable quadrupedal locomotion and stealth) when approaching prey.

The cerebral hemispheres in *Diaemus youngi* are less elongate but are well convoluted and deeply sulcated compared to *Desmodus*. Pseudo-temporal lobes are angular as in *Desmodus* and the inferior coliculi are not dorsally exposed. The cerebellum has a low medial crest and secondary foliations along the lateral edges of the vermiform body. The internal morphology of *Diaemus youngi* is similar to *Desmodus*. The interhemispheric sulcus descends to a well-formed cingulate sulcus, and descends farther and flares laterally just above the corpus callosum to form a callosal sulcus. The cingulate lobes of the cerebrum protrude ventrally into the interhemispheric sulcus. The lateral olfactory tracts are located on the ventral surface of the brain (McDaniel, 1976). The lateral thalamic nuclei project dorsally to the level of the habenular nuclei whereas the lateral geniculate bodies are large and deep. The thalamus is wide and shallow. The amygdaloid nuclei are large and the anterior ends are not as distant from each other in *Diaemus youngi* as in *Desmodus*. The pons is deep and narrow, with flat floor and the sides rise steeply to the level of the cerebellar peduncles (McDaniel, 1976).

FIG. 4. Oral scent glands of *Diaemus youngi* from Campinas, State of São Paulo, Brazil. Photograph by Wilson Uieda.

Vampire bat eyes are relatively large when compared to those of other microchiropterans of similar body mass and approach eye size found in frugivorous species. Peculiar retinal folds were observed in both eyes of a single *Diaemus youngi*. These folds may represent an infolded retina rather than retinal detachment, resembling superficially the undulating appearance in the megachiropteran retina (Bhatnagar, 1988), although this observation is based on one specimen.

Diaemus youngi probably relies strongly on olfaction and chemoreception given that it possesses highly developed vomeronasal organs. In white-winged vampire bats, the entire receptor-free epithelium bears cilia, whereas there are mixed nonciliated and ciliated cells in *Desmodus* and only a few ciliated cells in *Diphylla*. This suggests that the vomeronasal organ is more efficient for chemoreception in *Diaemus youngi* compared to the other two vampires (Bhatnagar, 1988).

Audition seems to be the most important sensory modality in vampire bats, but there is little knowledge of their hearing ability (Schmidt, 1988*b*). Compared to other microchiropterans, the auditory ossicles are small in *Diaemus youngi*, but the middle ear muscles are large. Paauw's cartilage is present and the stapedial artery is persistent (Hinchcliffe and Pye, 1969). The cochlea is conical and mean cochlear height is 2.43 mm (Pye, 1967). There is a thickening of the basilar membrane, especially at the base (Bhatnagar, 1988; Pye, 1967). *Diaemus youngi* produced frequency modulated pulses of short duration (0.8 to 1.6 msec) and the strongest component was 66 kilocycles per second, falling off at 40 kilocycles per second (Pye, 1967). In a recent study, captive white-winged vampire bats were recorded during aggression/dominance interactions, grooming, and feeding (Faure et al., 1995). They emit-

ted calls that were linear or hyperbolic downward sweeps containing 2–4 harmonics, usually with maximal energy located in the fundamental (although a number of unusual call "types" were recorded). In addition to containing audible frequencies, social signals were rich in ultrasound (bandwidth range=37.4–71.6 kHz). Social calls were extremely variable in duration (range=2.7–42.7 msec) and frequency (peak frequency range=16–33.9 kHz; lowest frequency=7.4–21.1 kHz; highest frequency=50.6–90.6 kHz).

Diaemus youngi possesses both overhair and underhair. Scale forms are short, repand to sinuate and coronal, with minor marginal irregularities. Melanin granules are dispersed generally through all portions of the filament and there are prominent basal bulbs. Scales are medium and entire coronal and medullae never are present (Benedict, 1957).

A study on temperature regulation in Neotropical bats determined that vampire bats are not as effective as nectar, fruit, and meat-eating bats at thermoregulation (McNab, 1969). Within the vampire bats, *Diaemus youngi* and *Diphylla* maintain lower body temperatures than does *Desmodus*. The reason for this difference is not known.

Sperm morphology in *Diaemus youngi* is similar to that of *Desmodus*, but very different from that of *Diphylla* (Forman and Genoways, 1979). Testes in *Diaemus youngi* average 3.4 by 2.0 mm and the epididymis is large and leaf-like (Bhatnagar, 1988). Mean measurements (μm) with ±*SD* characterizing spermatozoa are: length of head, 5.61 ± 0.2; acrosome length, 3.20 ± 0.17; nuclear length, 4.50 ± 0.14; midpiece length, 12.51 ± 0.3; and width of head, 3.11 ± 0.3 (Forman and Genoways, 1979).

ECOLOGY. *Diaemus youngi* is monotocous and polyestrous; otherwise its breeding habits are unknown (Carter, 1970; Schmidt, 1988). On 22 October, in southern Trinidad, white-winged vampire bats found in a hollow immortelle tree (*Erythrina micropteryx*), consisted of four breeding males, one immature male, one lactating female, and one non-gravid female. Two lactating females, each with a single juvenile male, were taken on 23 August in northern Trinidad; one of the young was estimated about two weeks of age, the other about two months (Goodwin and Greenhall, 1961).

Diaemus youngi exhibits flexibility with regard to foraging sites and roost preference. It appears to prefer moist, open areas but also forages in dry deciduous forests as well as in multistratal evergreen forest (Eisenberg, 1989). *Diaemus youngi* is both a cave and tree dwelling species in Trinidad, roosting in colonies of up to 30 individuals (Goodwin and Greenhall, 1961). In well lighted caves, *Diaemus youngi* was found sharing roosts with *Saccopteryx bilineata* and *Desmodus rotundus*. In the lowlands of southeastern Mexico, white-winged vampire bats have been collected in Cocona Cavern near Teapa, Tabasco, along with great numbers of *Desmodus* (Villa-R., 1967). *Diaemus youngi* populations roosting in caves in Mexico have been characterized as fragile (Arita, 1993). In Panama, *Diaemus youngi* is a rare, forest-dwelling bat (Handley, 1966). On Margarita Island, Venezuela, it was numerous, especially in the forest around Cerro Copey, and commonly attacked cattle. Seven bats were collected in a hollow tree, at the base of which were pools of typical, tarry vampire excrement (Musso, 1962). In Venezuela, *Diaemus youngi* and *Desmodus* had separate habitats: *Diaemus youngi* lived around human dwellings and *Desmodus* preferred forests (Pirlot, 1964). Specimens also were collected by mist netting in scattered localities (<500 m elevation) in the following habitats: yards, pastures, orchards, and forests (evergreen, thorn forests, dry forest, very dry and moist) (Handley, 1976). In a karst region of southeastern Brazil, white-winged vampire bats were found in caves in association with eight other species of bats including *Peropteryx macrotis, Chrotopterus auritus, Anoura caudifer, Carollia perspicilata, Sturnira lilium, Artibeus lituratus, Vampyrops lineatus,* and *Desmodus* (Trajano, 1984). In the Utinga forest, near Belem, Brazil, 0.003 white-winged vampire bats were caught per net hour in nets set at ground level (Handley, 1967). They were also present in remnant Atlantic rain forest near Pernambuco, Brazil (Mares et al., 1981) and in French Guiana (Brosset and Charles-Dominique, 1990). In Peru, *Diaemus youngi* is confined to the lowlands (Eisenberg, 1989). In eastern Peru, it shared large cave roosts with *C. perspicilata, C. auritus, Desmodus rotundus, Glossophaga soricina, Lonchophylla handleyi, Micronycteris minuta, Phyllostomus hastatus, Pteronotus parnellii, P. personatus* and *V. infuscus* (Graham, 1988). Near the Panguana Biological Station in Amazonian Peru, both *Diaemus youngi* and *Diphylla ecaudata* were collected near huts and surrounding gardens at the forest edge (Hutterer et al., 1995).

Ectoparasites found on *Diaemus youngi* include two families of mites, (Macronyssidae and Thrombiculidae) and bat flies (family Streblidae). Species of mites of the family Macronyssidae include *Nycteronyssus desmodus* (which is species specific), *Radfordiella desmodi,* and *R. oudemansi.* Thrombiculids included *Euschoengastia colombiae,* and *Perissopalla exhumatus.* Bat flies included *Strebla diaemi, Trichobius dugesii, T. parasiticus,* and an undescribed species of *Trichobius* (Anciaux de Favroux, 1971; Goodwin and Greenhall, 1961; Mendez, 1988; Saunders and Yunker, 1973). The thrombiculids *Euschoengastia colombiae* and *Perissopalla exhumatus* are not primarily associated with *Diaemus youngi,* whereas the streblid fly *Strebla diaemi,* a species known from Panama and Venezuela, is species specific (Mendez, 1988).

Diaemus youngi is also host to a diverse endoparasite fauna, although knowledge of such parasites is fragmentary (Mendez, 1988). The presence of an undescribed filarial nematode (family Filariidae) in the olfactory mucosa of white-winged vampire bats from Trinidad suggested that either ticks, mosquitoes, or other blood sucking arthropods may act as the intermediate host and vector of this nematode (Lichtenfels et al., 1981). The protozoan parasites *Trypanosoma cruzi marikellei* (order Kinetoplastida: family Trypanosomidae) which infests *Diaemus youngi* in Colombia, appears to be non-pathogenic to man and laboratory animals. It is regarded as subspecifically distinct from the human pathogen *T. cruzi cruzi,* the cause of Chagas' disease (Constantine, 1988). Rabies virus and rabies related viruses are classified in the genus *Lyssavirus.* The virus has been reported from all three genera of vampires, but the only reports of rabies transmission by *Diaemus youngi* have been from Trinidad (Constantine, 1988; Goodwin and Greenhall, 1961).

BEHAVIOR. White-winged vampire bats are swift and deliberate fliers. Under appropriate lighting conditions their white wing tips can be seen clearly (Goodwin and Greenhall, 1961; Musso, 1962).

Although avian blood is the preferred diet of *Diaemus youngi,* it will take mammalian blood (Gardner, 1977; Goodwin and Greenhall, 1961; Nowak, 1991; Schutt, 1995). In Trinidad, it preyed upon poultry, pigeons, goats and occasionally cattle. When poultry, pigeons, and goats were attacked, cattle and equines in the area were excluded from predation. During field observations of white-winged vampire bats in Brazil, there was a negative correlation between frequency of observed feeding behavior and environmental factors such as wind (over 27 km/h), rain, and the presence of intense moonlight (Uieda, 1992).

In Trinidad, although cattle were attacked in the wild, captive *Diaemus youngi* refused to feed upon non-citrated bovine blood (Goodwin and Greenhall, 1961; Greenhall, 1988). Of 23 newly caught adult white-winged vampire bats examined, 13 fed upon mammalian blood (cattle, pig, and some unidentifiable samples). Of the remaining 10 bats, eight fed upon avian blood in combination with mammalian blood and two fed exclusively on avian blood (Greenhall, 1970, 1988). In other studies, captive specimens of *Diaemus youngi* have been maintained successfully on a diet of defibrinated bovine blood supplemented weekly with fresh chicken blood (Muradali et al., 1993; Schutt, 1995).

Experiments were conducted in Trinidad on captive white-winged vampire bats to determine which native birds were available prior to introduction of domestic fowl (see Buchanan, in Greenhall, 1988). Live birds included representatives of Columbidae, Psittacidae, Picidae, Dendrocalaptidae, Pipridae, Tyrannidae, Mimidae, Turdidae, Icteridae, Thraupidae, and Fringillidae. Range of masses of these birds was from 15 to 200 g. *Diaemus youngi* successfully attacked and fed upon individuals of all families. In each case, feeding continued until the bird's death. A 7-g trochilid was not attacked, resembling the behavior of *Desmodus* toward *Mus* sp. and *Microtus* sp., and other mammals smaller than themselves (Greenhall, 1988). Feeding behavior of captive *Diaemus youngi* was observed on domestic pigeons, collared doves, and half-grown chickens. Perch diameter of less than 2 cm and prey masses were proposed as factors limiting attacks on smaller birds (Uieda et al., 1992).

In Tamaulipas, Mexico, a white-winged vampire bat was captured while feeding on a chicken (Villa-R., 1967) and its feeding behavior on free-ranging poultry has been observed in Brazil (Sa-

zima and Uieda, 1980; Uieda, 1992, 1993, 1994) and Trinidad (Greenhall, 1988). After landing on a branch, *Diaemus youngi* typically moved to the underside, holding on with thumbs and toes. When preying upon chickens or guinea fowl, bites usually were made on the tarsi, toes and cloaca (turkeys were bitten on the bare skin of the lower breast). Occasionally, feeding was interrupted when the bat groomed itself or when the prey became momentarily disturbed. During these latter instances, *Diaemus youngi* usually retreated to the undersurface of the branch and aligned itself with it. This behavior may be defensive, with the branch shielding the bat against pecking by the bird. In other instances when the bird became disturbed, the white-winged vampire bat crawled onto its prey and hid under its wing and belly. There have been no reports of attacks on ground-sleeping birds (Greenhall, 1988).

Two displays by a feeding bat toward another flying individual were observed. In both instances, the feeding bat stretched its neck, bared its teeth and uttered high-pitched cries. Apparently these demonstrations were effective, since no bat was observed landing near a defended prey (Greenhall, 1988).

In captivity, *Diaemus youngi* was extremely vocal and made a variety of hisses, screams and chirps (Goodwin and Greenhall, 1961; Muradali et al., 1993; Schutt, 1995). Mated pairs cleaned and groomed one another. One pair appeared quite disturbed when separated (Goodwin and Greenhall, 1961). In Brazil, two adult females were kept in captivity and fed live chickens (Uieda and de Araújo, 1987). One of the bats gave birth after 217 days of captivity. Captive specimens of *Diaemus youngi* were observed feeding on adult chickens (*Gallus gallus*) perched on branches (Muradali et al., 1993; Schutt, 1995).

Before bites were made, the potential bite area was always licked for periods lasting from 10 seconds to two minutes. It is not known if white-winged vampire bat saliva contains anesthetic or enzymatic components to aid in bite preparation or if licking softens the keratinized reticulate scales that cover the surface of the digit. Additionally, most bites were made on the posteriorally directed hallux (digit I). Feeding from this digit may keep the bat concealed under its prey to a greater degree than would occur if an anteriorly directed digit (digits I–IV) was fed upon (Schutt, 1995).

A force platform and high speed photography were used to measure differences in quadrupedal locomotor performance (e.g. flight initiation) between captive specimens of *Diaemus youngi* and *Desmodus* (Schutt et al., 1993). These differences are thought to be related to principle prey selection. Whereas the terrestrially feeding *Desmodus* employed flight initiating jumps from a horizontal surface, *Diaemus youngi*, which feeds arboreally, did not jump from the ground to initiate flight.

GENETICS. The karyotype of *Diaemus youngi* has a diploid number of 32 and a fundamental number of 60. Except for one pair of medium subtelocentric chromosomes, all autosomes are either metacentric or submetacentric. The X-chromosome is a large submetacentric and the Y-chromosome, a minute acrocentric (Baker et al., 1988; Forman et al., 1968). The smallest pair of autosomes has a nucleolar organizer region on the longest arm near the centromere. C-band positive regions occur at the centromeres of some telomeres. Analysis of C- and G-band variation suggest that among vampire bats the karyotype of *Diaemus youngi* is least modified from the proposed primitive karyotype for the family Phyllostomidae and that *Desmodus* and *Diphylla* form a clade relative to *Diaemus* (Bass, 1978). However, this relationship is not supported by data from studies using molecular techniques. Data from starch gel electrophoresis and albumin immunology indicate a closer relationship between *Diaemus youngi* and *Desmodus* relative to *Diphylla* (Baker et al., 1988; Honeycutt 1981). These latter studies support morphological evidence which indicated that *Diaemus youngi* and *Desmodus* form a clade relative to *Diphylla* (Cadena, 1977; Koopman, 1988; Miller, 1907; Schutt, 1995; Slaughter, 1970).

REMARKS. *Diaemus youngi* was included within *Desmodus* by Handley (1976), Koopman (1978), and Honacki et al. (1982), but Koopman (1988) later concluded that the two vampires are generically distinct (Koopman, 1993). A partial bibliography of literature on the three species of vampire bats, with 626 references was compiled by Linhart (1970).

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We wish to dedicate this review of *Diaemus youngi* to Aurelio Malaga Alba of the Pan American Health Organization and Colin C. Sanborn of the Field Museum of Natural History.

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